Note:
Before using this information and the product it supports, be sure to read the general information under “Notices” on page 917.
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About this document

This document tells you how to diagnose and report problems occurring in the IBM® z/OS TCP/IP. Additional information is provided for diagnosing problems with selected applications that are part of z/OS Communications Server.

The information in this document includes descriptions of support for both IPv4 and IPv6 networking protocols. Unless explicitly noted, descriptions of IP protocol support concern IPv4. IPv6 support is qualified within the text.

Use this document to perform the following tasks:

• Diagnose and solve problems in a z/OS Communications Server installation.
• Describe problems to the IBM Software Support Center and document the problems appropriately.

This document refers to Communications Server data sets by their default SMP/E distribution library name. Your installation might, however, have different names for these data sets where allowed by SMP/E, your installation personnel, or administration staff. For instance, this document refers to samples in SEZAINST library as simply in SEZAINST. Your installation might choose a data set name of SYS1.SEZAINST, CS390.SEZAINST or other high-level qualifiers for the data set name.

Who should read this document

System programmers can use this document to diagnose problems with TCP/IP or to diagnose problems with z/OS Communications Server components.

How this document is organized

z/OS Communications Server: IP Diagnosis Guide is divided into the following parts:

Part 1, “General diagnosis information,” on page 1 describes how to diagnose a problem suspected to be caused by z/OS Communications Server, select diagnostic tools, and apply diagnostic techniques.

Part 2, “Traces and control blocks,” on page 41 describes selected procedures for TCP/IP Services component trace, packet trace, Socket API trace, and the subcommands (installation, entering, and execution).


Appendixes in part 4 provide extra information for this document.

How to use this document

To use this document, you should be familiar with z/OS TCP/IP Services and the TCP/IP suite of protocols.

This book contains various traces and code examples. In many cases, these examples contain non-release specific information; they are included for illustrative purposes. Actual examples and traces depend on your environment.

How to contact IBM service

For immediate assistance, visit this website: http://www.software.ibm.com/support

Most problems can be resolved at this website, where you can submit questions and problem reports electronically, and access a variety of diagnosis information.
For telephone assistance in problem diagnosis and resolution (in the United States or Puerto Rico), call the IBM Software Support Center anytime (1-800-IBM-SERV). You will receive a return call within 8 business hours (Monday – Friday, 8:00 a.m. – 5:00 p.m., local customer time).

Outside the United States or Puerto Rico, contact your local IBM representative or your authorized IBM supplier.

If you would like to provide feedback on this publication, see “Communicating your comments to IBM” on page 939.

Conventions and terminology that are used in this information

Commands in this information that can be used in both TSO and z/OS UNIX environments use the following conventions:

• When describing how to use the command in a TSO environment, the command is presented in uppercase (for example, NETSTAT).
• When describing how to use the command in a z/OS UNIX environment, the command is presented in bold lowercase (for example, netstat).
• When referring to the command in a general way in text, the command is presented with an initial capital letter (for example, Netstat).

All the exit routines described in this information are installation-wide exit routines. The installation-wide exit routines also called installation-wide exits, exit routines, and exits throughout this information.

The TPF logon manager, although included with VTAM®, is an application program; therefore, the logon manager is documented separately from VTAM.

Samples used in this information might not be updated for each release. Evaluate a sample carefully before applying it to your system.

Note: In this information, you might see the following Shared Memory Communications over Remote Direct Memory Access (SMC-R) terminology:

• RoCE Express®, which is a generic term representing IBM 10 GbE RoCE Express, IBM 10 GbE RoCE Express2, and IBM 25 GbE RoCE Express2 feature capabilities. When this term is used in this information, the processing being described applies to both features. If processing is applicable to only one feature, the full terminology, for instance, IBM 10 GbE RoCE Express will be used.

• RoCE Express2, which is a generic term representing an IBM RoCE Express2® feature that might operate in either 10 GbE or 25 GbE link speed. When this term is used in this information, the processing being described applies to either link speed. If processing is applicable to only one link speed, the full terminology, for instance, IBM 25 GbE RoCE Express2 will be used.

• RDMA network interface card (RNIC), which is used to refer to the IBM® 10 GbE RoCE Express, IBM® 10 GbE RoCE Express2, or IBM 25 GbE RoCE Express2 feature.

• Shared RoCE environment, which means that the "RoCE Express" feature can be used concurrently, or shared, by multiple operating system instances. The feature is considered to operate in a shared RoCE environment even if you use it with a single operating system instance.

Clarification of notes

Information traditionally qualified as Notes is further qualified as follows:

Attention
Indicate the possibility of damage

Guideline
Customary way to perform a procedure

Note
Supplemental detail
How to read a syntax diagram

This syntax information applies to all commands and statements that do not have their own syntax described elsewhere.

The syntax diagram shows you how to specify a command so that the operating system can correctly interpret what you type. Read the syntax diagram from left to right and from top to bottom, following the horizontal line (the main path).

Symbols and punctuation

The following symbols are used in syntax diagrams:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>►►</td>
<td>Marks the beginning of the command syntax.</td>
</tr>
<tr>
<td>►</td>
<td>Indicates that the command syntax is continued.</td>
</tr>
<tr>
<td></td>
<td>Marks the beginning and end of a fragment or part of the command syntax.</td>
</tr>
<tr>
<td>◄◄</td>
<td>Marks the end of the command syntax.</td>
</tr>
</tbody>
</table>

You must include all punctuation such as colons, semicolons, commas, quotation marks, and minus signs that are shown in the syntax diagram.

Commands

Commands that can be used in both TSO and z/OS UNIX environments use the following conventions in syntax diagrams:

- When describing how to use the command in a TSO environment, the command is presented in uppercase (for example, NETSTAT).
- When describing how to use the command in a z/OS UNIX environment, the command is presented in bold lowercase (for example, netstat).

Parameters

The following types of parameters are used in syntax diagrams.
Required parameters are displayed on the main path.

Optional parameters are displayed below the main path.

Default parameters are displayed above the main path.

Parameters are classified as keywords or variables. For the TSO and MVS™ console commands, the keywords are not case sensitive. You can code them in uppercase or lowercase. If the keyword appears in the syntax diagram in both uppercase and lowercase, the uppercase portion is the abbreviation for the keyword (for example, OPERand).

For the z/OS UNIX commands, the keywords must be entered in the case indicated in the syntax diagram.

Variables are italicized, appear in lowercase letters, and represent names or values you supply. For example, a data set is a variable.

Syntax examples

In the following example, the PUt subcommand is a keyword. The required variable parameter is `local_file`, and the optional variable parameter is `foreign_file`. Replace the variable parameters with your own values.

```
PUt local_file foreign_file
```

Longer than one line

If a diagram is longer than one line, the first line ends with a single arrowhead and the second line begins with a single arrowhead.

```
The first line of a syntax diagram that is longer than one line

The continuation of the subcommands, parameters, or both
```

Required operands

Required operands and values appear on the main path line. You must code required operands and values.

```
REQUIREOPERAND
```

Optional values

Optional operands and values appear below the main path line. You do not have to code optional operands and values.

```
OPERAND
```
Selecting more than one operand

An arrow returning to the left above a group of operands or values means more than one can be selected, or a single one can be repeated.

![Diagram showing multiple operands and values]

Nonalphanumeric characters

If a diagram shows a character that is not alphanumeric (such as parentheses, periods, commas, and equal signs), you must code the character as part of the syntax. In this example, you must code OPERAND=(001,0.001).

\[
\text{OPERAND} = (001, 0.001)
\]

Blank spaces in syntax diagrams

If a diagram shows a blank space, you must code the blank space as part of the syntax. In this example, you must code OPERAND=(001 FIXED).

\[
\text{OPERAND} = (001 \text{ FIXED})
\]

Default operands

Default operands and values appear above the main path line. TCP/IP uses the default if you omit the operand entirely.

![Diagram showing a default operand]

Variables

A word in all lowercase italics is a variable. Where you see a variable in the syntax, you must replace it with one of its allowable names or values, as defined in the text.

\[
\text{variable}
\]

Syntax fragments

Some diagrams contain syntax fragments, which serve to break up diagrams that are too long, too complex, or too repetitious. Syntax fragment names are in mixed case and are shown in the diagram and in the heading of the fragment. The fragment is placed below the main diagram.
Prerequisite and related information

z/OS Communications Server function is described in the z/OS Communications Server library. Descriptions of those documents are listed in “Bibliography” on page 921, in the back of this document.

Required information

Before using this product, you should be familiar with TCP/IP, VTAM, MVS, and UNIX System Services.

Softcopy information

Softcopy publications are available in the following collection.

<table>
<thead>
<tr>
<th>Titles</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Z Redbooks</td>
<td>The IBM Z™ subject areas range from e-business application development and enablement to hardware, networking, Linux, solutions, security, parallel sysplex, and many others. For more information about the Redbooks® publications, see <a href="http://www.redbooks.ibm.com/">http://www.redbooks.ibm.com/</a> and <a href="http://www.ibm.com/systems/z/os/zos/zfavorites/">http://www.ibm.com/systems/z/os/zos/zfavorites/</a>.</td>
</tr>
</tbody>
</table>

Other documents

This information explains how z/OS references information in other documents.

When possible, this information uses cross-document links that go directly to the topic in reference using shortened versions of the document title. For complete titles and order numbers of the documents for all products that are part of z/OS, see z/OS Information Roadmap (SA23-2299). The Roadmap describes what level of documents are supplied with each release of z/OS Communications Server, and also describes each z/OS publication.

To find the complete z/OS library, visit the z/OS library in IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

Relevant RFCs are listed in an appendix of the IP documents. Architectural specifications for the SNA protocol are listed in an appendix of the SNA documents.

The following table lists documents that might be helpful to readers.

<table>
<thead>
<tr>
<th>Title</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA Formats</td>
<td>GA27-3136</td>
</tr>
<tr>
<td>Title</td>
<td>Number</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><em>TCP/IP Tutorial and Technical Overview</em></td>
<td>GG24-3376</td>
</tr>
<tr>
<td><em>Understanding LDAP</em></td>
<td>SG24-4986</td>
</tr>
<tr>
<td><em>z/OS Cryptographic Services System SSL Programming</em></td>
<td>SC14-7495</td>
</tr>
<tr>
<td><em>z/OS IBM Tivoli Directory Server Administration and Use for z/OS</em></td>
<td>SC23-6788</td>
</tr>
<tr>
<td><em>z/OS JES2 Initialization and Tuning Guide</em></td>
<td>SA32-0991</td>
</tr>
<tr>
<td><em>z/OS Problem Management</em></td>
<td>SC23-6844</td>
</tr>
<tr>
<td><em>z/OS MVS Diagnosis: Reference</em></td>
<td>GA32-0904</td>
</tr>
<tr>
<td><em>z/OS MVS Diagnosis: Tools and Service Aids</em></td>
<td>GA32-0905</td>
</tr>
<tr>
<td><em>z/OS MVS Using the Subsystem Interface</em></td>
<td>SA38-0679</td>
</tr>
<tr>
<td><em>z/OS Program Directory</em></td>
<td>GI11-9848</td>
</tr>
<tr>
<td><em>z/OS UNIX System Services Command Reference</em></td>
<td>SA23-2280</td>
</tr>
<tr>
<td><em>z/OS UNIX System Services Planning</em></td>
<td>GA32-0884</td>
</tr>
<tr>
<td><em>z/OS UNIX System Services Programming: Assembler Callable Services Reference</em></td>
<td>SA23-2281</td>
</tr>
<tr>
<td><em>z/OS UNIX System Services User's Guide</em></td>
<td>SA23-2279</td>
</tr>
<tr>
<td><em>z/OS XL C/C++ Runtime Library Reference</em></td>
<td>SC14-7314</td>
</tr>
</tbody>
</table>

**Redbooks publications**

The following Redbooks publications might help you as you implement z/OS Communications Server.

<table>
<thead>
<tr>
<th>Title</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>IBM z/OS Communications Server TCP/IP Implementation, Volume 1: Base Functions, Connectivity, and Routing</em></td>
<td>SG24-8096</td>
</tr>
<tr>
<td><em>IBM z/OS Communications Server TCP/IP Implementation, Volume 2: Standard Applications</em></td>
<td>SG24-8097</td>
</tr>
<tr>
<td><em>IBM z/OS Communications Server TCP/IP Implementation, Volume 3: High Availability, Scalability, and Performance</em></td>
<td>SG24-8098</td>
</tr>
<tr>
<td><em>IBM z/OS Communications Server TCP/IP Implementation, Volume 4: Security and Policy-Based Networking</em></td>
<td>SG24-8099</td>
</tr>
<tr>
<td><em>IBM Communication Controller Migration Guide</em></td>
<td>SG24-6298</td>
</tr>
<tr>
<td><em>IP Network Design Guide</em></td>
<td>SG24-2580</td>
</tr>
<tr>
<td><em>Managing OS/390 TCP/IP with SNMP</em></td>
<td>SG24-5866</td>
</tr>
</tbody>
</table>
Where to find related information on the Internet

z/OS
This site provides information about z/OS Communications Server release availability, migration information, downloads, and links to information about z/OS technology
http://www.ibm.com/systems/z/os/zos/

z/OS Internet Library
Use this site to view and download z/OS Communications Server documentation

IBM Communications Server product
The primary home page for information about z/OS Communications Server

z/OS Communications Server product
The page contains z/OS Communications Server product introduction

IBM Communications Server product support
Use this site to submit and track problems and search the z/OS Communications Server knowledge base for Technotes, FAQs, white papers, and other z/OS Communications Server information
http://www.software.ibm.com/support

IBM Communications Server performance information
This site contains links to the most recent Communications Server performance reports
http://www.ibm.com/support/docview.wss?uid=swg27005524

IBM Systems Center publications
Use this site to view and order Redbooks publications, Redpapers, and Technotes
http://www.redbooks.ibm.com/

IBM Systems Center flashes
Search the Technical Sales Library for Techdocs (including Flashes, presentations, Technotes, FAQs, white papers, Customer Support Plans, and Skills Transfer information)
http://www.ibm.com/support/techdocs/atsmastr.nsf
Tivoli® NetView® for z/OS
Use this site to view and download product documentation about Tivoli NetView for z/OS
http://www.ibm.com/support/knowledgecenter/SSZJDU/welcome

RFCs
Search for and view Request for Comments documents in this section of the Internet Engineering Task Force website, with links to the RFC repository and the IETF Working Groups web page
http://www.ietf.org/rfc.html

Internet drafts
View Internet-Drafts, which are working documents of the Internet Engineering Task Force (IETF) and other groups, in this section of the Internet Engineering Task Force website
http://www.ietf.org/ID.html

Information about web addresses can also be found in information APAR II11334.

Note: Any pointers in this publication to websites are provided for convenience only and do not serve as an endorsement of these websites.

DNS websites
For more information about DNS, see the following USENET news groups and mailing addresses:

USENET news groups
comp.protocols.dns.bind

BIND mailing lists
https://lists.isc.org/mailman/listinfo

BIND Users
- Subscribe by sending mail to bind-users-request@isc.org.
- Submit questions or answers to this forum by sending mail to bind-users@isc.org.

BIND 9 Users (This list might not be maintained indefinitely.)
- Subscribe by sending mail to bind9-users-request@isc.org.
- Submit questions or answers to this forum by sending mail to bind9-users@isc.org.

The z/OS Basic Skills Information Center
The z/OS Basic Skills Information Center is a web-based information resource intended to help users learn the basic concepts of z/OS, the operating system that runs most of the IBM mainframe computers in use today. The Information Center is designed to introduce a new generation of Information Technology professionals to basic concepts and help them prepare for a career as a z/OS professional, such as a z/OS systems programmer.

Specifically, the z/OS Basic Skills Information Center is intended to achieve the following objectives:
- Provide basic education and information about z/OS without charge
- Shorten the time it takes for people to become productive on the mainframe
- Make it easier for new people to learn z/OS

To access the z/OS Basic Skills Information Center, open your web browser to the following website, which is available to all users (no login required): https://www.ibm.com/support/knowledgecenter/zosbasics/com.ibm.zos.zbasics/homepage.html?cp=zosbasics
Summary of changes for IP Diagnosis Guide

This document contains terminology, maintenance, and editorial changes, including changes to improve consistency and retrievability. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Changes made in z/OS Communications Server Version 2 Release 3

This document contains information previously presented in z/OS Communications Server: IP Diagnosis Guide, which supported z/OS Version 2 Release 2.

December 2018

Changed information
Technical and terminology changes about Shared Memory Communications

July 2018

Changed information
- Code page enhancements for CSSMTP, see “Bad character translations” on page 826.

March 2018

Changed information
- HiperSockets Converged Interface support, see the following topics:
  - “OPTIONS syntax” on page 91
  - “OPTIONS keywords” on page 96

January 2018

Maintenance and terminology changes are made for z/OS Version 2 Release 3 in January 2018.

September 2017

New information
- Communications Server support for RoCE Express2 feature, see “VTAM message IST2444I seen during PFID activation” on page 761.
- Improved CSSMTP code page compatibility with target servers, see “Bad character translations” on page 826.
- sendmail to CSSMTP bridge, see Chapter 40, “Diagnosing sendmail to CSSMTP bridge problems,” on page 833.

Changed information
- CSSMTP customizable ATSIGN character for mail addresses, see “Bad sequence of commands” on page 826.
- Shared Memory Communications - Direct Memory Access, see the following topics:
  - “OPTIONS keywords” on page 96
  - Chapter 35, “Diagnosing problems with Shared Memory Communications,” on page 757
- z/OS Encryption Readiness Technology, see “Specifying trace options at initialization” on page 56.

Deleted information
• Removal of SMTPD & sendmail, all references to SMTP and sendmail are deleted.
• The following Health Checks are deleted:
  – CSAPP_SMTPD_MAIL_RELAY
  – ZOSMIGV2R2_NEXT_CS_LEGACYDEVICE
  – ZOSMIGV2R2_Next_CS_SENDMAILCLIEN
  – ZOSMIGV2R2_Next_CS_SENDMAILDAEMN
  – ZOSMIGV2R2_Next_CS_SENDMAILMSA
  – ZOSMIGV2R2_Next_CS_SENDMAILMTA
  – ZOSMIGV2R2_Next_CS_SMTPDDAEMON
  – ZOSMIGV2R2_Next_CS_SMTPDMTA
  – ZOSMIGV2R2_Next_CS_TFTP

Changes made in z/OS Communications Server Version 2 Release 2, as updated June 2017

This document contains information previously presented in z/OS Communications Server: IP Diagnosis Guide, which supported z/OS Version 2 Release 2.

New information
• Improved CSSMTP code page compatibility with target servers, see “Bad character translations” on page 826.
• sendmail to CSSMTP bridge, see Chapter 40, “Diagnosing sendmail to CSSMTP bridge problems,” on page 833.

Changes made in z/OS Version 2 Release 2, as updated September 2016

This document contains information previously presented in z/OS Communications Server: IP Diagnosis Guide, GC27-3652-04, which supported z/OS Version 2 Release 2.

Changes made in z/OS Version 2 Release 2

This document contains information previously presented in z/OS Communications Server: IP Diagnosis Guide, GC27-3652-02, which supported z/OS Version 2 Release 1.

New information
• Enhanced IKED scalability, see “Resource constraint problems” on page 327.
• Activate Resolver trace without restarting applications, see the following topics:
  – “CTRACE TRACERES” on page 805
  – “Enabling collection of CTRACE TRACERES records” on page 805
  – “Disabling collection of CTRACE TRACERES records” on page 806
  – “Formatting the CTRACE TRACERES option” on page 806
• CSSMTP migration enablement, see the following topics:
  – Duplicate mail messages
  – Verifying mail workload compatibility with SMTPD
Changed information

- 64-bit enablement of the TCP/IP stack, see the following topics:
  - “Dumps” on page 13
  - “Sample output of the TCP/IP TSDB subcommand” on page 248
  - “Limiting CSM storage utilization” on page 837
- Removed support for the GATEWAY statement in the TCP/IP profile, see the following topics:
  - “Netstat ROUTE/-r” on page 38
  - “Sample output of the TCPIPCS PROFILE subcommand” on page 201
  - “Common configuration mistakes” on page 505
  - “Operation” on page 718
  - “Sources of diagnostic information” on page 720
  - “Session hangs” on page 724
  - “Maximum transmission unit (MTU)” on page 848
  - “IPv4 subnetting” on page 856
  - “Static routing” on page 859
- Reordering of cached Resolver results, see the following topics:
  - “Sample output of the RESOLVER command” on page 266
  - “TRACE RESOLVER” on page 783
  - “Interpreting the Trace Resolver output” on page 788
- Enhanced IKED scalability, see “Obtaining syslog debug information for the IKE daemon” on page 328.
- Activate Resolver trace without restarting applications, see the following topics:
  - “TRACE RESOLVER” on page 783
  - “Interpreting the Trace Resolver output” on page 788
  - “CTRACE - RESOLVER” on page 803
- CSSMTP migration enablement, see Appendix C, “IBM Health Checker for z/OS,” on page 889.

Changes made in z/OS Version 2 Release 1, as updated September 2014

This document contains information previously presented in z/OS Communications Server: IP Diagnosis Guide, GC27-3652-01, which supported z/OS Version 2 Release 1.

Changes made in z/OS Version 2 Release 1, as updated December 2013

This document contains information previously presented in z/OS Communications Server: IP Diagnosis Guide, GC27-3652-00, which supported z/OS Version 2 Release 1.

Changed information

- Network security enhancements for SNMP, see the following topics:
  - “No response from the SNMP agent” on page 561
  - “SNMPv3 AES encryption or decryption failures” on page 562
- TLS security enhancements for policy agent, see “Import requestor connection problems” on page 604.
- AT-TLS enablement for DCAS, see “Analyzing start problems with the DCAS” on page 764.
z/OS Version 2 Release 1 summary of changes

See the Version 2 Release 1 (V2R1) versions of the following publications for all enhancements related to z/OS V2R1:

- z/OS Migration
- z/OS Planning for Installation
- z/OS Summary of Message and Interface Changes
- z/OS Introduction and Release Guide
Part 1. General diagnosis information
Chapter 1. Overview of diagnosis procedure

To diagnose a problem that is suspected to be caused by z/OS Communications Server, first identify the problem, then determine whether it is a problem with TCP/IP. If the problem is related to TCP/IP, gather information about the problem so that you can report the source of the problem to the IBM Software Support Center. With this information, you can work with IBM Software Support Center representatives to solve the problem.

Steps for diagnosing problems

These steps help you identify the source of a problem and obtain a solution.

About this task
Figure 1 on page 4 summarizes the procedure to follow to diagnose a problem. The steps that follow the figure provide more information about this procedure.
Procedure

Perform the following steps to diagnosis a problem:

1. Check sources for diagnostic information.

   Various messages appearing in the console log or in the SYSPRINT or SYSPERROR data sets, together with alerts and diagnostic aids, provide information that helps you to find the source of a problem. You should also check syslogd output, and syslog daemon messages, and be prepared to provide this information to the IBM Software Support Center. If the problem is with TCP/IP, go to Step “3” on page 4; otherwise, go to Step “2” on page 4.

2. Check appropriate books.

   See the diagnosis guide of the hardware device or software application that has the problem.

3. Gather information.

   See Chapter 2, “Selecting tools and service aids,” on page 7, for a detailed explanation of diagnostic procedures and how to collect information relevant to the problem.
4. Try to solve the problem.
   If you cannot solve the problem, go to Step “6” on page 5.

5. The diagnosis task is completed.
   The problem has been solved.

6. Report the problem to the IBM Software Support Center.
   After you have gathered the information that describes the problem, report it to the IBM Software Support Center. If you are an IBMLink user, you can perform your own RETAIN searches to help identify problems. Otherwise, a representative uses your information to build keywords to search the RETAIN database for a solution to the problem.

   The object of this keyword search using RETAIN is to find a solution by matching the problem with a previously reported problem. When IBM develops a solution for a new problem, it is entered into RETAIN with a description of the problem.

7. Work with IBM Support Center representatives.
   If a keyword search matches a previously reported problem, its solution might also correct this problem. If so, go to Step “10” on page 5. If a solution to the problem is not found in the RETAIN database, the IBM Software Support Center representatives continue to work with you to solve the problem. Go to Step “8” on page 5.

8. Create an APAR.
   If the IBM Software Support Center does not find a solution, they create an authorized program analysis report (APAR) in the RETAIN database.

9. A solution is developed by the IBM Software Support Center.
   Using information supplied in the APAR, IBM Software Support Center representatives determine the cause of the problem and develop a solution for it.

10. Apply the solution.
    Apply the corrective procedure supplied by the IBM Software Support Center to correct the problem.

Results
Go to Step “4” on page 5 to verify that the problem is corrected. You know that you are done when the problem is corrected.
Chapter 2. Selecting tools and service aids

This topic introduces the tools and service aids that z/OS Communications Server provides for diagnosis. As used in this document, the term tools includes dumps and traces, while the term service aids includes all other facilities provided for diagnosis.

For example:
- SVC dump and system trace are tools.
- LOGREC data set and IPCS are service aids.

The following information is discussed in this topic:
- “How do I know which tool or service aid to select?” on page 7 lists problem types and matches them with the appropriate tool or service aid. Use this topic to select the tool or service aid you need for a particular problem.
- “Overview of available tools and service aids” on page 13 describes each tool and service aid, including when to use it for diagnosis. Use this topic when you need an overview of tools and service aids, or to find the appropriate time to use a particular tool or service aid.
- “Methods for submitting documentation” on page 18 describes how to send documentation electronically to IBM using FTP or e-mail.
- “Necessary documentation” on page 19 lists the documentation you need to gather before contacting the IBM Software Support Center.

How do I know which tool or service aid to select?

This topic describes the criteria for selecting a tool or service aid.

Your choice depends on one of the following problems or needs:

<table>
<thead>
<tr>
<th>Problem or need</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selecting a dump</td>
<td>“Selecting a dump” on page 8</td>
</tr>
<tr>
<td>Selecting a TCP/IP services component trace</td>
<td>“Selecting a trace” on page 8</td>
</tr>
<tr>
<td>Selecting a service aid</td>
<td>Table 1 on page 7</td>
</tr>
</tbody>
</table>

The tables show the problem, the corresponding tool or service aid, and the topic or document that covers it in more detail. Use these tables to find a tool or service aid quickly.

Tip: The traces given in this document are only examples. Traces in your environment can differ from these examples because of different options selected.

<table>
<thead>
<tr>
<th>Table 1. Selecting a service aid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>If the problem is...</strong></td>
</tr>
</tbody>
</table>
| System or hardware problem: need a starting point for diagnosis or diagnosis requires an overview of system and hardware events in chronological order. | LOGREC data set or EREP  
See z/OS MVS Diagnosis: Tools and Service Aids for detailed information. |
| Information about the contents of load modules and program objects or a problem with modules on the system. | AMBLIST  
See z/OS MVS Diagnosis: Tools and Service Aids for detailed information. |
Table 1. Selecting a service aid (continued)

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use this type of service aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis requires a trap to catch problem data while a program is running. The DISPLAY TCPIP,,STOR command can be used to help set a SLIP trap.</td>
<td>Service Level Indication Processing (SLIP)</td>
</tr>
<tr>
<td></td>
<td>See z/OS MVS System Commands for detailed information.</td>
</tr>
<tr>
<td>Diagnosis requires formatted output of problem data, such as a dump or trace.</td>
<td>IPCS</td>
</tr>
</tbody>
</table>

You can now perform the steps for the decision you have made.

**Selecting a dump**

Base your choice of dumps on the criteria given in Table 2 on page 8.

Table 2. Selecting a dump

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use this type of dump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal end of an authorized program or a problem program.</td>
<td>ABEND dump</td>
</tr>
<tr>
<td></td>
<td>See “Analyzing abends” on page 21 for detailed information.</td>
</tr>
<tr>
<td>TCP/IP server or client address space stops processing or is stopped by the operator because of slowdown or looping condition.</td>
<td>SVC dump</td>
</tr>
<tr>
<td></td>
<td>The SVC dump is created using the DUMP command.</td>
</tr>
<tr>
<td></td>
<td>See “Analyzing loops” on page 22 for detailed information.</td>
</tr>
</tbody>
</table>

You can now perform the steps for the decision you have made.

**Selecting a trace**

Base your choice of traces on the criteria given in Table 3 on page 8.

Table 3. Selecting a trace

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use this type of trace or command</th>
<th>Trace output location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load balancing using the z/OS Load Balancing Advisor</td>
<td>Log file</td>
<td>syslogd</td>
</tr>
<tr>
<td>See Chapter 7, “Diagnosing problems with the z/OS Load Balancing Advisor,” on page 295 for more information.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 3. Selecting a trace (continued)

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use this type of trace or command</th>
<th>Trace output location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network connectivity</td>
<td>Ping, Netstat ARP/-R</td>
<td>Not applicable</td>
</tr>
<tr>
<td>See Chapter 4, “Diagnosing network connectivity problems,” on page 25 for detailed information.</td>
<td>For information about Ping, see “Using the Ping command” on page 34. For information about Netstat ARP/-R, see “Netstat ARP/-R” on page 38.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Packet trace</td>
<td></td>
</tr>
<tr>
<td></td>
<td>See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for detailed information about packet trace.</td>
<td></td>
</tr>
<tr>
<td>Dynamic VIPA or Sysplex Distributor</td>
<td>Component Trace (SYSTCPIP) XCF option</td>
<td>TCP/IP address space or external writer</td>
</tr>
<tr>
<td>TCP/IP socket application</td>
<td>Component Trace (SYSTCPIP) SOCKAPI option</td>
<td>TCP/IP address space or external writer</td>
</tr>
<tr>
<td>See “Socket API traces” on page 70 for detailed information.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPR client</td>
<td>LPR command with the TRACE option</td>
<td>sysout</td>
</tr>
<tr>
<td>See “LPR client traces” on page 396 for detailed information.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPD server</td>
<td>See “LPD server traces” on page 401 for ways to activate traces.</td>
<td>SYSPRINT</td>
</tr>
<tr>
<td>See “LPD server traces” on page 401 for detailed information.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>z/OS UNIX FTP server</td>
<td>z/OS UNIX FTP server trace</td>
<td>Server traces appear on the console if syslogd is not started. If it is started, traces appear in the file designated in the syslog.conf file. See z/OS Communications Server: IP Configuration Guide for detailed information about syslogd.</td>
</tr>
<tr>
<td>z/OS UNIX Telnet</td>
<td>z/OS UNIX Telnet traces</td>
<td>syslogd</td>
</tr>
<tr>
<td>See Chapter 15, “Diagnosing z/OS UNIX Telnet daemon (otelnets) problems,” on page 463, for detailed information.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TN3270E Telnet server</td>
<td>Telnet traces</td>
<td>Telnet address space or external writer</td>
</tr>
<tr>
<td>If the problem is...</td>
<td>Then use this type of trace or command</td>
<td>Trace output location</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Popper</td>
<td>Popper Messages</td>
<td>syslogd</td>
</tr>
<tr>
<td>See Chapter 17, “Diagnosing z/OS UNIX popper problems,” on page 495 for detailed information.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SNALINK LU0</td>
<td>IP Packet Trace</td>
<td>CTRACE managed data set</td>
</tr>
<tr>
<td>See Chapter 18, “Diagnosing SNALINK LU0 problems,” on page 497 for detailed information.</td>
<td>Debug Trace</td>
<td>SNALINK LU0 address space</td>
</tr>
<tr>
<td>SNALINK LU6.2</td>
<td>TRACEDETAIL ALL</td>
<td>SYSPRINT</td>
</tr>
<tr>
<td>See Chapter 19, “Diagnosing SNALINK LU6.2 problems,” on page 503 for detailed information.</td>
<td>IP Packet Trace</td>
<td>CTRACE managed data set</td>
</tr>
<tr>
<td>TCP/IP Internal Trace</td>
<td>CTRACE managed data set</td>
<td></td>
</tr>
<tr>
<td>VTAM Buffer Trace</td>
<td>GTF managed data set, see z/OS Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures for detailed information.</td>
<td></td>
</tr>
<tr>
<td>Dynamic domain name system (DDNS)</td>
<td>Error messages</td>
<td>syslogd</td>
</tr>
<tr>
<td>resolver Trace</td>
<td>Job log output</td>
<td></td>
</tr>
<tr>
<td>TCP/IP component trace</td>
<td>CTRACE managed data set</td>
<td></td>
</tr>
<tr>
<td>z/OS UNIX REXEC</td>
<td>z/OS UNIX REXEC debug trace</td>
<td>syslogd</td>
</tr>
<tr>
<td>See Chapter 21, “Diagnosing z/OS UNIX REXEC, RSH, REXECD, and RSHD problems,” on page 535.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>z/OS UNIX REXECD</td>
<td>z/OS UNIX REXECD debug trace</td>
<td>syslogd</td>
</tr>
<tr>
<td>See Chapter 21, “Diagnosing z/OS UNIX REXEC, RSH, REXECD, and RSHD problems,” on page 535.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>z/OS UNIX RSHD</td>
<td>z/OS UNIX RSHD debug trace</td>
<td>syslogd</td>
</tr>
<tr>
<td>See Chapter 21, “Diagnosing z/OS UNIX REXEC, RSH, REXECD, and RSHD problems,” on page 535.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X Window and Motif</td>
<td>XWTRACE and XWTRACEC (environment variables)</td>
<td>stderr</td>
</tr>
</tbody>
</table>
### Table 3. Selecting a trace (continued)

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use this type of trace or command</th>
<th>Trace output location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SNMP</strong></td>
<td>Manager Traces</td>
<td><strong>Console (snmp) or SYSPRINT (NetView SNMP)</strong></td>
</tr>
<tr>
<td></td>
<td>• SNMP Agent Traces</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TCP/IP Subagent Traces</td>
<td><strong>syslogd</strong></td>
</tr>
<tr>
<td></td>
<td>• OMPROUTE Subagent Traces</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Network SLAPM2 Subagent Traces</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TN3270E Telnet Subagent Traces</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TRAPFWD Traces</td>
<td></td>
</tr>
<tr>
<td><strong>Policy Agent</strong></td>
<td>Log file</td>
<td>See z/OS Communications Server: IP Configuration Guide for detailed information.</td>
</tr>
<tr>
<td><strong>RSVP Agent</strong></td>
<td>Log file</td>
<td>See z/OS Communications Server: IP Configuration Guide for detailed information.</td>
</tr>
<tr>
<td><strong>Traffic Regulator Management Daemon (TRMD)</strong></td>
<td>Log file</td>
<td><strong>syslogd</strong></td>
</tr>
<tr>
<td><strong>IKE daemon</strong></td>
<td>Component trace</td>
<td><strong>CTRACE managed data set</strong></td>
</tr>
<tr>
<td></td>
<td>For detailed information about IKE daemon component trace, see “TCP/IP services component trace for the IKE daemon” on page 329.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Log file</td>
<td><strong>syslogd</strong></td>
</tr>
<tr>
<td></td>
<td>For detailed information about obtaining IKE daemon debug log information, see “Obtaining syslog debug information for the IKE daemon” on page 328.</td>
<td></td>
</tr>
<tr>
<td>If the problem is...</td>
<td>Then use this type of trace or command</td>
<td>Trace output location</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
</tr>
</tbody>
</table>
| Network security services (NSS) server  | Component trace  
For detailed information about network security services (NSS) server component trace, see  
"TCP/IP services component trace for the network security services (NSS) server" on page 356. | CTRACE managed data set               |
| See Chapter 10, “Diagnosing network security services (NSS) server problems,” on page 335. | Log file  
For detailed information about obtaining network security services (NSS) server debug log information, see  
“Obtaining syslog debug information for the network security service server” on page 346. | syslogd                               |
| OMPROUTE                                | Component trace  
For detailed information about OMPROUTE Component Trace, see  
"TCP/IP services component trace for OMPROUTE" on page 712. | CTRACE managed data set               |
| See Chapter 30, “Diagnosing OMPROUTE problems,” on page 687. | OMPROUTE Trace  
For detailed information, see  
"OMPROUTE traces and debug information” on page 701. | stdout                                |
| X.25 NPSI                               | Server activity log  
See Chapter 31, “Diagnosing X.25 NPSI problems,” on page 717 for detailed information. | SYSPRINT                              |
| IMS                                     | IP Packet Trace  
See Chapter 32, “Diagnosing IMS problems,” on page 725 for detailed information. | CTRACE managed data set               |
|                                        | TCP/IP Internal Trace  
See Chapter 32, “Diagnosing IMS problems,” on page 725 for detailed information. | CTRACE managed data set               |
|                                        | IMS Trace  
For more information, see the IMS knowledge center at http://www.ibm.com/support/knowledgecenter/SSEPH2/welcome. |                                       |
| CICS®                                   | CICS external trace data set (auxtrace)  
See Chapter 34, “Diagnosing problems with IP CICS sockets,” on page 751 for detailed information. | For more information, see the CICS knowledge center at http://www.ibm.com/software/htp/cics/library/ |
|                                        | TCP/IP Internal trace  
See Chapter 34, “Diagnosing problems with IP CICS sockets,” on page 751 for detailed information. | CTRACE managed data set               |
Table 3. Selecting a trace (continued)

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use this type of trace or command</th>
<th>Trace output location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Express Logon</td>
<td>Log file</td>
<td>syslogd</td>
</tr>
<tr>
<td>Resolver</td>
<td>Trace Resolver</td>
<td>SYSPRINT or stdout</td>
</tr>
<tr>
<td>See Chapter 37, “Diagnosing resolver problems,” on page 767 for detailed information.</td>
<td>Resolver Internal trace</td>
<td>CTRACE managed data set</td>
</tr>
</tbody>
</table>

You can now perform the steps for the decision you have made.

Selecting a service aid

Base your choice of service aid on the criteria given in Table 1 on page 7.

Overview of available tools and service aids

This topic provides an overview of the tools and service aids in detail. The topics that follow contain a brief description of each tool or service aid, reasons why you would use it, and a reference to the topic or document that covers the tool or service aid in detail. (Most of the detailed information about tools and service aids is in this document.)

A description of tools and service aids are included in the following sections:

- Dumps, see Table 4 on page 14
- Traces, see Table 5 on page 15
- Display commands, see “Display commands” on page 16
- System service aids, see Table 6 on page 17

In the tables that follow, the dumps, traces, or service aids are listed by frequency of use.

**Tip:** The traces given in this document are only examples. Traces in your environment can differ from these examples because of different options selected.

**Dumps**

Table 4 on page 14 describes the types of available dumps.
### Table 4. Description of dumps

<table>
<thead>
<tr>
<th>Type of dump</th>
<th>Description</th>
</tr>
</thead>
</table>
| **ABEND dumps** | Use an ABEND dump when ending an authorized program or a problem program because of an uncorrectable error. These dumps show:  
  - The virtual storage for the program requesting the dump.  
  - System data associated with the program.  

  The system can produce three types of ABEND dumps—SYSABEND, SYSMDUMP, and SYSUDUMP. Each one dumps different areas. Select the dump that gives the areas needed for diagnosing your problem. The IBM-supplied defaults for each dump are:  
  - SYSABEND dumps. The largest of the ABEND dumps, containing a summary dump for the failing program plus many other areas useful for analyzing processing in the failing program.  
  - SYSMDUMP dumps. Contains a summary dump for the failing program, plus some system data for the failing task. In most cases, SYSMDUMP dumps are recommended, because they are the only ABEND dumps that are formatted with IPCS.  
  - SYSUDUMP dumps. The smallest of the ABEND dumps, containing only data and areas about the failing program.  

  See z/OS MVS Diagnosis: Tools and Service Aids for more information about **ABEND**. |
| **SVC dumps** | SVC dumps can be used in two different ways:  
  - Most commonly, a system component requests an SVC dump when an unexpected system error occurs, but the system can continue processing.  
  - An authorized program or the operator can also request an SVC dump when diagnostic data is needed to solve a problem.  

  SVC dumps contain a summary dump, control blocks, and other system code, but the exact areas dumped depend on whether the dump was requested by a macro, command, or SLIP trap. SVC dumps can be analyzed using IPCS.  

  See z/OS MVS Diagnosis: Tools and Service Aids for detailed information.  

  If a console dump or SLIP is requested:  
  - Capture the OMVS and (if applicable) affected application address spaces as well as TCP/IP.  
  - SDATA specification should contain the RGN, TRT, PSA, SUM, CSA and SQA keywords (at minimum). |
### Table 4. Description of dumps (continued)

<table>
<thead>
<tr>
<th>Type of dump</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand-alone dumps</td>
<td>Use a stand-alone dump when: &lt;br&gt;• The system stops processing. &lt;br&gt;• The system enters a wait state with or without a wait state code. &lt;br&gt;• The system enters an instruction loop. &lt;br&gt;• The system is processing slowly. &lt;br&gt;These dumps show central storage and some paged-out virtual storage occupied by the system or stand-alone dump program that failed. Stand-alone dumps can be analyzed using IPCS. &lt;br&gt;See “Analyzing loops” on page 22 for detailed information.</td>
</tr>
</tbody>
</table>

### Traces

Table 5 on page 15 describes the types of available traces.

### Table 5. Description of traces

<table>
<thead>
<tr>
<th>Type of trace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component trace</td>
<td>Use a component trace when you need trace data to report a client/server component problem to the IBM Software Support Center. Component tracing shows processing between the client and server. &lt;br&gt;See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for detailed information.</td>
</tr>
<tr>
<td>Data trace</td>
<td>Use a data trace to trace socket data (transforms) into and out of the physical file structure (PFS). &lt;br&gt;See “Data trace (SYSTCPDA) for TCP/IP stacks” on page 139 for detailed information.</td>
</tr>
<tr>
<td>GTF trace</td>
<td>Use a Generalized Trace Facility (GTF) trace to show system processing through events occurring in the system over time. The installation controls which events are traced. &lt;br&gt;Use GTF when you are familiar enough with the problem to pinpoint the one or two events required to diagnose your system problem. GTF can be run to an external data set. &lt;br&gt;See z/OS MVS Diagnosis: Tools and Service Aids for more information about GTF.</td>
</tr>
<tr>
<td>Master trace</td>
<td>Use the master trace to show the messages to and from the master console. Master trace is useful because it provides a log of the most recently issued messages. These can be more pertinent to your problem than the messages accompanying the dump itself. &lt;br&gt;You can either accept a dump or write this trace to GTF. &lt;br&gt;See z/OS MVS Diagnosis: Tools and Service Aids for detailed information.</td>
</tr>
</tbody>
</table>
### Table 5. Description of traces (continued)

<table>
<thead>
<tr>
<th>Type of trace</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSAENTA trace</td>
<td>Use an OSA-Express network traffic analysis trace to obtain traces of IP packets flowing from and into TCP/IP on a z/OS Communications Server host. The OSAENTA statement lets you copy IP packets as they enter or leave OSA-Express adapter, and then examine the contents of the copied packets. While the packet trace collects data records that flow over the links, the OSAENTA trace collects data records that flow from the network through the OSA adapter. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for detailed information.</td>
</tr>
<tr>
<td>Packet trace</td>
<td>Use a packet trace to obtain traces of IP packets flowing from and into TCP/IP on a z/OS Communications Server host. The PKTTRACE statement lets you copy IP packets as they enter or leave TCP/IP, and then examine the contents of the copied packets. While the component trace function collects event data about TCP/IP internal processing, packet trace collects data records that flow over the links. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for detailed information.</td>
</tr>
<tr>
<td>System trace</td>
<td>Use system trace to see system processing through events occurring in the system over time. System tracing is activated at initialization and, typically, runs continuously. It records many system events, with minimal details about each. The events traced are predetermined, except for branch tracing. You can either take a dump or write this trace to GTF. See z/OS MVS Diagnosis: Tools and Service Aids for detailed information.</td>
</tr>
<tr>
<td>VTAM trace</td>
<td>z/OS Communications Server uses two VTAM components, CSM and MPC. VTAM traces contain entries for many TCP/IP events, especially I/O, and storage requests. See z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps and the VIT for detailed information.</td>
</tr>
<tr>
<td>z/OS UNIX applications</td>
<td>z/OS UNIX applications send debug and trace output to syslogd. For more information about individual components, such as z/OS UNIX FTP or z/OS UNIX SNMP, see those topics in this manual. ITRACE initiated from TCPIP PROFILE processing. See the z/OS Communications Server: IP Configuration Guide for more detailed information about syslogd.</td>
</tr>
</tbody>
</table>

### Display commands

Display commands can be useful tools and service aids. This topic provides a brief description of the DISPLAY TCPIP,,STOR command. For detailed information about this command, see z/OS Communications Server: IP System Administrator’s Commands.
DISPLAY TCPIP,,STOR

Use the DISPLAY TCPIP,,STOR command to display the location and level of a TCP/IP stack module, which verifies that the load module has the appropriate service level.

System service aids

Table 6 on page 17 lists the service aids supported by z/OS Communications Server.

<table>
<thead>
<tr>
<th>Type of service aid</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMBLIST</td>
<td>Use AMBLIST when you need information about the contents of load modules and program objects or you have a problem related to the modules on your system. AMBLIST is a program that provides extensive data about modules in the system, such as a listing of the load modules, map of the CSECTs in a load module or program object, list of modifications in a CSECT, map of modules in the LPA, and a map of the contents of the DAT-on nucleus. See z/OS MVS Diagnosis: Tools and Service Aids for more information about AMBLIST.</td>
</tr>
<tr>
<td>Common storage tracking</td>
<td>Use common storage tracking to collect data about requests to obtain or free storage in CSA, ECSA, SQA, and ESQA. This is useful to identify jobs or address spaces using an excessive amount of common storage or ending without freeing storage. Use Resource Measurement Facility* (RMF*) or the IPCS VERBEXIT VSMDATA subcommand to display common storage tracking data. • See z/OS RMF User's Guide for more information about RMF. • See z/OS MVS Initialization and Tuning Guide for detailed information about requesting common storage tracking. • See the VSM topic in z/OS MVS IPCS User's Guide for information about the IPCS VERBEXIT VSMDATA subcommand.</td>
</tr>
<tr>
<td>Dump suppression</td>
<td>Dump Suppression allows an installation to control dump analysis and elimination (DAE) processing, which suppresses dumps that it considers unnecessary because they duplicate previously taken dumps. DAE suppresses ABEND dumps that would be written to a SYSMDUMP data set (SYSMDUMPs), Transaction dumps (IEATDUMP), and SVC dumps, when the symptom data of a dump duplicates the symptom data of a dump of the same dump type previously taken. DAE uses the ADYSETxx parmlib member to determine the actions DAE is to perform. <strong>Tip:</strong> Consider the SUPPRESSALL statement in ADYSETxx, if dumps are to be considered for suppression. Do this because the Communications Server IP Recovery Routines do not always specify the VRADAE Key in the SDWA(system diagnostic work area) when requesting a dump. See z/OS MVS Initialization and Tuning Guide for more information about requesting dump suppression.</td>
</tr>
</tbody>
</table>
### Table 6. Description of service aids (continued)

<table>
<thead>
<tr>
<th>Type of service aid</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCS</td>
<td>Use IPCS to format and analyze dumps, traces, and other data. IPCS produces reports that can help in diagnosing a problem. Some dumps, such as SNAP, SYSABEND, and SYSUDUMP ABEND dumps, are preformatted and are not formatted using IPCS. See z/OS MVS IPCS User's Guide for detailed information.</td>
</tr>
<tr>
<td>LOGREC data set</td>
<td>Use the LOGREC data set as a starting point for problem determination. The system records hardware errors, selected software errors, and selected system conditions in the LOGREC data set. LOGREC information gives you an idea of where to look for a problem, supplies symptom data about the failure, and shows the order in which the errors occurred. See z/OS MVS Diagnosis: Tools and Service Aids for detailed information.</td>
</tr>
</tbody>
</table>
| SLIP traps          | Use serviceability level indication processing (SLIP) to set a trap to catch problem data. SLIP can intercept program event recording (PER) or error events. When an event that matches a trap occurs, SLIP performs the problem determination action that you specify:  
  • Requesting or suppressing a dump  
  • Writing a trace or a LOGREC data set record  
  • Giving control to a recovery routine  
  • Putting the system in a wait state  
See the SLIP command in z/OS MVS System Commands for detailed information. |

### Methods for submitting documentation

You can send documentation to IBM using the following methods:

- File Transfer Protocol (FTP)
- email
- TCP/IP active storage or the location and level of a TCP/IP stack module.

**Tip:** If you use FTP, compress all dumps and traces with the AMATERSE (MVS terse) program, and send the data in BINARY mode.

**Requirement:** AMATERSE is a prerequisite for PUTDOC.


### Using AMATERSE

AMATERSE is an application that prepares diagnostic materials, such as z/OS dumps and traces, for transmission to IBM and vendor sites. When the materials arrive, AMATERSE also provides a means to create similar data sets to support diagnosis of problems.

If you previously used the TRSMAIN utility, you will see that the following changes were made to prepare AMATERSE for formal inclusion in z/OS:

- AMATERSE is used as the preferred application program name rather than TRSMAIN. TRSMAIN is shipped as an alias entry point to AMATERSE.
• The ddnames INFILE and OUTFILE that were required by the TRSMAIN utility are replaced by SYSUT1 and SYSUT2. When the TRSMAIN entry point of AMATERSE is invoked, ddnames INFILE and OUTFILE remain as the defaults.

• AMATERSE is placed into MIGLIB, a library that is part of the link list. No STEPLIB ddname is needed to invoke AMATERSE.

• You can use AMATERSE, the TRSMAIN utility, and VM terse interchangeably in nearly all cases.

Starting AMATERSE

The following sample JCL can be used to start AMATERSE. Lower case text reflects the data that you must alter.

```
//jobname  JOB ...
//stepname EXEC PGM=AMATERSE,PARM=aaaaa
//SYSPRINT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=12901)
//SYSUT1   DD DISP=bbb,DSN=your.input.dataset.name
//SYSUT2   DD DISP=ccc,DCB=ddd,DSN=your.output.dataset.name
//            SPACE=space_parameters
```

For more information about how to use AMATERSE and any restrictions on its use, see z/OS MVS Diagnosis: Tools and Service Aids.

Using electronic transfer through email attachments

Smaller documents can be sent as attachments to an email message. This can include cut and paste of user output or downloading of the file to a workstation for inclusion. Displayable text can be downloaded by using ASCII transfer; all others should be processed by the AMATERSE utility and transferred in BINARY. Email systems have limits on how much data can be included, so FTP transfers should be used for any significant amounts. (The IBM mail system limit is 10M.)

Necessary documentation

Before you call the IBM Support Center, have the following information available:

**Customer number**

The authorization code that allows you to use the IBM Support Center. Your account name, your TCP/IP license number, and other customer identification should also be available.

**Problem number**

The problem number previously assigned to the problem. If this is your first call about the problem, the support center representative assigns a number to the problem.

**Operating system**

The operating system that controls the execution of programs (such as z/OS), include the release level.

**Language Environment® runtime library**

The release level of the link-edit runtime library is also needed if you are compiling user-written applications written in C or C++.

**Component ID**

A number that is used to search the database for information specific to TCP/IP. If you do not give this number to the support center representative, the amount of time taken to find a solution to your problem increases.

**Release number**

A number that uniquely identifies each TCP/IP release.

Table 7 on page 20 lists the specific information that you should provide to the IBM Support Center.
### Table 7. TCP/IP component name and release level

<table>
<thead>
<tr>
<th>Component name and release level</th>
<th>System maintenance program</th>
<th>Field maintenance identifier/CLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>z/OS Communications Server V2R2</td>
<td>SMP/E</td>
<td>The following identifiers are associated with this stack:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• HIP6220 (Communications Server IP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• JIP622K (Communications Server Security Level 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• JIP622X (Communications Server X11R4 XWindows)</td>
</tr>
</tbody>
</table>

The following are component ID numbers for z/OS Communications Server:

**Licensed IBM program**

z/OS

**Component ID number**

5650-ZOS

A complex problem might require you to talk to several people when you report your problem to the IBM Support Center. Therefore, you should keep all the information that you have gathered readily available. You might want to keep the items that are constantly required, such as the TCP/IP component ID, in a file for easy access.
Chapter 3. Diagnosing abends, loops, and hangs

This topic contains information about abends, loops, and hangs, located in the following subtopics:

- “Analyzing abends” on page 21
- “Analyzing loops” on page 22
- “Steps for analyzing hangs” on page 23

Analyzing abends

An abend is an abnormal end.

Table 8 on page 21 describes the types of abends that can occur.

<table>
<thead>
<tr>
<th>Type of abend</th>
<th>Description</th>
<th>Where to find help</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Abends</td>
<td>User abends are generated by C runtime routines. They usually start with U409x.</td>
<td>See z/OS Communications Server: IP and SNA Codes.</td>
</tr>
<tr>
<td>Platform abends</td>
<td>Abend 3C5 and abend 4C5 are internal abends generated by TCP/IP. Note the reason code stored in register 15 and check the IBM database for known problems.</td>
<td>See z/OS Communications Server: IP and SNA Codes.</td>
</tr>
<tr>
<td>System abends</td>
<td>0C4, 0C1, and 878 are system abends.</td>
<td>See z/OS MVS System Codes.</td>
</tr>
</tbody>
</table>
|                | 0D6/0D4/0C4 abends can occur when an application is removed from VMCF/TNF with the F VMCF/TNF, REMOVE command, or if VMCF is not active when an application or command, which requires it is started or issued. | See z/OS MVS System Codes. Can occur when an application is removed from VMCF/TNF with the F VMCF/TNF, REMOVE command. It can also occur when an application or command, which requires it is started or issued. The following TCP/IP applications and commands will abend if VMCF is not active:  
  - LPD servers  
  - TSO HOMETEST, LPQ, LPR, LPRM, LPRSET, TELNET, and TESTSITE commands |
| CEEDUMPs       | Language Environment produces certain types of abends detected for z/OS UNIX applications such as z/OS UNIX Telnet. CEEDUMPs are usually written to the current working directory in the hierarchical file structure. | See z/OS Language Environment Debugging Guide.                                     |

A dump is usually produced when TCP/IP or a TCP/IP component address space experiences an abend. If an abend occurs and no dump is taken, the dump files or spools might be full or a SYSMDUMP DD statement might not have been specified in the failing procedure. If TCP/IP or a TCP/IP component was not able to complete the dump, gather a console dump of TCP/IP or the failing TCP/IP component, the
external trace data set if available, and system log as soon as possible. Otherwise, you must re-create the
abend or wait for it to occur again.

For more information about debugging the abends and the system abends (for example, abends 0C4,
0C1, and 878), see z/OS Problem Management.

Analyzing loops

The following are some indicators of a loop:

• Slow response time
• No response at all
• Inordinately high processor utilization by TCP/IP

Steps for collecting documentation

If processing stops or TCP/IP does not respond to commands, TCP/IP might be in a loop and you can
collect documentation to help diagnose the problem.

Procedure

Perform the following steps to collect documentation:

1. Get dump output.

   Enabled
   Get an SVC dump of TCP/IP or the looping TCP/IP component by issuing the DUMP command from
   the MVS system console, or press the Program Restart key. See the z/OS MVS Diagnosis: Tools and
   Service Aids for more information about the DUMP command.

   Guidelines: Ensure that the following storage areas are dumped because they might be needed to
diagnose the TCP loop:
   • TCP/IP and VTAM address spaces.
   • SDATA options RGN, CSA, LSQA, NUC, PSA, and LPA.
   • CSM data spaces. Add DSPNAME=(1.CSM*) to the DUMP command to include both of them in the
dump.

   For examples of the DUMP command, see Chapter 5, “TCP/IP services traces and IPCS support,”
on page 43 and Chapter 41, “Diagnosing storage abends and storage growth,” on page 835.

   Disabled
   If the loop is disabled, the MVS system console is not available for input. Try the following steps:
   • Use a PSW RESTART to terminate a looping task. This process creates a LOGREC entry with a
     completion code of X’071’. Use the LOGREC record and the RTM work area to locate the failing
     module. Depending on the PSW bit 32, the last 3 bytes (24-bit mode) or 4 bytes (31-bit mode)
     contain the address being executed at the time of the dump. Scan the dump output to find
     the address given in the PSW. For more information about using PSW RESTART, see z/OS
     Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures.
   • Take a stand-alone dump. See z/OS MVS Diagnosis: Tools and Service Aids for information about
     stand-alone dumps.

2. Get the MVS system console log (SYSLOG), the job log from the started procedure, and the LOGREC
   output.

   The MVS system console log might contain information, such as error messages, that can help you
diagnose the problem. Also, print the LOGREC file.

   Use the LOGDATA option to print the in-core LOGREC buffers. See z/OS MVS Diagnosis: Tools and
   Service Aids or z/OS MVS IPCS Commands for more information about the LOGDATA option.

   Tip: The SYSERROR data set might contain additional information to help you diagnose the problem.
3. Determine whether there are any messages associated with the loop, such as a particular message always preceding the problem, or the same message being issued repeatedly. If so, add the message IDs to your problem documentation.

4. Examine the trace entries using IPCS.

   By examining all of the trace entries in the system trace table, you might be able to determine whether there is a loop. The most obvious loops would be a module or modules getting continual control of the TCP/IP system.

   Use the PSW to determine the names of the modules in the loop. See z/OS MVS IPCS User’s Guide for information about using IPCS.

   In the output shown in Figure 2 on page 23, the CLKC entries indicate an enabled loop. The PSW addresses on the CLKCs identify the looping program. Use the WHERE subcommand to locate the responsible program.

```
02-0029 008E7220   CLKC      078D2600 83A8192C  00001004  00000000
02-0029 008E7220   CLKC      078D2600 83A81934  00001004  00000000
02-0029 008E7220   CLKC      078D2600 83A81930  00001004  00000000
02-0029 008E7220   CLKC      078D2600 83A8192A  00001004  00000000
02-0029 008E7220   CLKC      078D2600 83A81930  00001004  00000000
02-0029 008E7220   CLKC      078D2600 83A81938  00001004  00000000
```

Figure 2. Example of output from the IPCS SYSTRACE command

**Steps for analyzing hangs**

Determine what is hung and what documentation to collect.

**Procedure**

Perform the following steps to analyze and collect documentation:

1. Determine whether all TCP/IP processing stopped or only processing with respect to a single device, or something in between. Also determine what, if any, recovery action was taken by the operator or user at the time the hang was encountered. Some information about the activity that immediately preceded the hang might be available on the system log or in application program transaction logs.

2. Determine whether TCP/IP responds to commands, such as Ping or Netstat HOME/-h. If TCP/IP does not respond to these commands, take an SVC dump of TCP/IP address space and contact the IBM Software Support Center. If TCP/IP does respond to the commands, it is not hung.

3. Determine whether a particular application (such as z/OS UNIX FTP or a user-written application) is hung.

   Take a dump of the OMVS address space, the TCP/IP address space, and the application address space.
Chapter 4. Diagnosing network connectivity problems

This topic describes the diagnosis process for network connectivity problems and contains the following subtopics:

- “Communicating through the correct stack” on page 26
- “Steps for diagnosing problems connecting to a server” on page 26
- “Steps for verifying server operation” on page 27
- “Steps for verifying IP routing to a destination when not using policy-based routing” on page 28
- “Steps for diagnosing problems with IP routing to a destination when using policy-based routing” on page 30
- “Steps for verifying network access” on page 32
- “Tools for diagnosing network connectivity problems” on page 34
- “Documentation for the IBM Support Center” on page 39

Overview

Interconnectivity between network hosts encompasses the physical layer or hardware layer, the protocols such as TCP and IP, the IP security services, and the applications that use the services of TCP and IP. To understand interconnectivity, you should first understand internetworking. For detailed information about internetworking, see Appendix A, “Overview of internetworking,” on page 847.

Isolating network problems is an essential step in successful implementation of a network application. This topic introduces commands and techniques you can use to diagnose network connectivity problems.

The following diagnostic commands are available for either the z/OS UNIX environment or the TSO environment:

- Ping
- Netstat
- Traceroute

Netstat reports are also available from the console environment by invoking the DISPLAY TCPIP,,NETSTAT command. For complete descriptions of these commands and examples of their output, see z/OS Communications Server: IP System Administrator's Commands.

When referring to these commands and their options throughout this section, both the TSO and z/OS UNIX shell command options are listed, separated by a slash. For example, the recommendation to use Netstat to view the stack's HOME list of IP addresses appears as "use Netstat HOME/-h."

MVS-style data sets are written in capital letters (for example, hlq.TCPIP.DATA). Files names in the z/OS UNIX file system are written in lowercase (for example, /etc/hosts).

Table 9 on page 25 lists the name of the commands in each environment.

<table>
<thead>
<tr>
<th>UNIX command</th>
<th>TSO command</th>
<th>Refer to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ping/oping</td>
<td>PING</td>
<td>“Using the Ping command” on page 34</td>
</tr>
<tr>
<td>netstat/onetstat</td>
<td>NETSTAT</td>
<td>“Using the Netstat command” on page 37</td>
</tr>
</tbody>
</table>
Table 9. Diagnostic commands (continued)

<table>
<thead>
<tr>
<th>UNIX command</th>
<th>TSO command</th>
<th>Refer to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>traceroute/otracer</td>
<td>TRACERTE</td>
<td>“Using the Traceroute command” on page 39</td>
</tr>
</tbody>
</table>

Note: Do not use the resolver and domain name server functions, which translate symbolic names to IP addresses, when diagnosing network problems. Use the host IP address instead.

Communicating through the correct stack

If you are running multiple stacks, the first question to ask is whether the application is communicating through the correct stack. To identify the stack an application is using, you can look at the keyword TCPIPjobname in the TCPIP.DATA file. An application can also select a stack using the SETIBMOPT socket API.

You can use the Netstat parameter TCP/-p to specify the TCP/IP stack name for which you want Netstat report output. This lets you determine the characteristics of a particular stack.

Using the information provided by Netstat, you can change, if necessary, the hlq.PROFILE.TCPIP data set or the application configuration file. Alternatively, the application might need to communicate through another stack.

It is also helpful to understand the search order for configuration information used by z/OS Communications Server. See z/OS Communications Server: IP Configuration Reference, “Understanding search orders of configuration information”, for more information.

For more information about running multiple stacks, see z/OS Communications Server: IP Configuration Guide.

Steps for diagnosing problems connecting to a server

Determine the source of the problem in connecting to a server.

Procedure

Perform the following steps:

1. Verify that TCP/IP is running correctly on your host. Use Ping loopback, then Ping one of your home addresses. For information about the Ping command, see z/OS Communications Server: IP System Administrator’s Commands.

2. Verify that the server application is operational. See “Steps for verifying server operation” on page 27 for more information.

3. Verify IP routing to the server or the client. If you are not using policy-based routing, see “Steps for verifying IP routing to a destination when not using policy-based routing” on page 28 for more information. Otherwise, see “Steps for diagnosing problems with IP routing to a destination when using policy-based routing” on page 30 for more information.

4. Use the DISPLAY TCPIP,,NETSTAT,ACCESS,NETWORK command to determine whether network access has been configured on the TCP/IP stack. See z/OS Communications Server: IP System Administrator’s Commands for more information about this command. If network access control is enabled, then the server might not be permitted to send or receive data on a socket. See “Steps for verifying network access” on page 32 to determine whether network access controls are impacting the server application.

5. Verify IP security protection for the server. If IP security is enabled, then IP traffic to or from the server might not be permitted to flow. See “Steps for diagnosing IP security problems” on page 664 to determine whether IP security controls are impacting the server application.
Steps for verifying server operation

Determine whether the server is active and is using the correct port.

**Before you begin**
Identify the job name and port of the server to be verified.

**About this task**
Figure 3 on page 27 shows the decisions involved for verifying server operation.

**Verify Server Operation**

1. **Server Active?**
   - Yes: Go to step 2.
   - No: **Start or Restart Server** and return to step 1.

2. **Correct Port?**
   - Yes: **Done**.
   - No: **Port Reserved?**
     - Yes: **Resolve Port Conflict**.
     - No: **Port In Use?**
       - Yes: **Verify Port Access**.
       - No: **Resolve Port Conflict**.

3. **Port Reserved?**
   - Yes: **Reserved the Port**.
   - No: **Port in Use?**
     - Yes: **Verify Port Access**.
     - No: **Resolve Port Conflict**.

**Procedure**

Perform the following steps to verify server operation:

1. Ensure that the server is started. If not, start the server.
2. Use the Netstat SOCKETS/-s command to determine which port the server is listening on, filtered on the application's job name (-E option for z/OS UNIX, CLIENT keyword for TSO and Operator commands). For example

   ```
   NETSTAT SOCKETS (CLIENT FTP)
   ```

If the server is not listening on the correct port, configure it correctly. For basic information about the Netstat SOCKETS/-s command, see z/OS Communications Server: IP System Administrator's Commands for details. For details on server configuration, see z/OS Communications Server: IP Configuration Reference.
3. Ensure that there is a PORT statement in the TCP/IP profile data set, to reserve the port for the server. If the server is started but not using the correct port, then a PORT statement might be missing. See z/OS Communications Server: IP Configuration Reference for more information about the PORT statement.

4. Use the Netstat SOCKETS/-s command to determine whether a different server is using the port filtered on the port number (-p option for z/OS UNIX, PORT keyword for TSO and Operator commands). Unless the SHAREPORT keyword is specified on the PORT statement, only one server can be listening on a TCP port. See z/OS Communications Server: IP Configuration Reference for more information about the PORT statement.

5. Check the PORT statement for the server to determine whether the SAF keyword has been specified. If so, then port access control is in effect for the port. See z/OS Communications Server: IP Configuration Guide for more information about port access control. Ensure that the user ID associated with the server is permitted to the security resource name represented by the SAF keyword value. See the description of the PORT statement SAF keyword in the z/OS Communications Server: IP Configuration Reference for information about the security resource name. If the SAF keyword was not specified on the PORT statement, and the server belongs to the z/OS Communications Server product, see z/OS Communications Server: IP Configuration Reference for configuration information that is specific to the server.

**Steps for verifying IP routing to a destination when not using policy-based routing**

Verify a route to a particular destination IP address when you are not using policy-based routing (PBR).

**About this task**

Figure 4 on page 29 shows the decisions involved for verifying IP routing to a destination.
Verify IP Routing to a Destination

Figure 4. Overview of verifying IP routing to a destination

**Procedure**

Perform the following steps to verify IP routing to a destination:

1. Use the Ping command to determine whether there is connectivity to the identified IP address. For information about the Ping command, see z/OS Communications Server: IP System Administrator's Commands.

2. If the Ping command fails immediately, there might not be a route to the destination. Use the Netstat ROUTE/-r command to display routes to the network. Verify whether TCP/IP has a route to the destination. For information about the Netstat ROUTE/-r command, see z/OS Communications Server: IP System Administrator's Commands.

   If there is no route, proceed to step “3” on page 29. If a route exists, proceed to step “4” on page 29.

3. If there is no route to the destination, problem resolution depends on whether static or dynamic routing is being used. See z/OS Communications Server: IP Configuration Guide for more information about static and dynamic routing.

4. If a route exists, verify that the route is correct for the destination. If multipath routing is in effect for the destination, use the Ping command to determine whether there is connectivity to the IP address over any route. Invoke the Netstat CONFIG/-f command and check the value in the output report field, MultiPath, to determine whether multipath routing is in effect and what multipath routing is active.
Determine whether there is a gateway identified for the route to the destination. If there is no gateway, then the destination address is presumed to be directly connected. In this case, proceed to step “5” on page 30.

If a gateway is identified for the route, use the Ping command to confirm connectivity to the gateway. Do one of the following:

- If the gateway responds to a Ping, then there is a network problem at the gateway or beyond. Use the Traceroute command with the final destination address to determine at which hop in the route the failure is occurring. For information about using the Traceroute command, see z/OS Communications Server: IP System Administrator's Commands.
- If the gateway does not respond to a Ping, proceed to step “5” on page 30.

5. Determine which network interface is associated with the route to the destination. If the network interface operation has not been verified for this interface, verify it now. See “Steps for verifying network interface operation” on page 31 for more information.

6. Use the DISPLAY TCPIP,,NETSTAT,ACCESS,NETWORK command to see whether network access control is enabled. If it is enabled, see “Steps for verifying network access” on page 32 for more information.

7. Use the Netstat CONFIG/-f command to determine whether IP security is enabled. If the output report field, IpSecurity, contains the value Yes, then IP security is enabled. See “Steps for verifying IP security and defensive filter operation” on page 670 for information about how to verify that IP security is correctly configured. If the problem still exists, see “Documentation for the IBM Support Center” on page 39 to determine what problem documentation you need, and then call the IBM Support Center.

**Steps for diagnosing problems with IP routing to a destination when using policy-based routing**

Verify a route to a particular destination IP address when you are using policy-based routing (PBR).

**Procedure**

Perform the following steps to diagnose problems with IP routing to a destination when you are using policy-based routing:

1. While the application is active and attempting to connect to the destination, use the Netstat ALL/-A report to determine the policy rule that is assigned to the connection and the route table being used to perform a route lookup. For information about the Netstat command, see z/OS Communications Server: IP System Administrator's Commands.

   - If no policy rule is listed and the connection is not expected to use policy-based routing, see “Steps for verifying IP routing to a destination when not using policy-based routing” on page 28.
   - If a policy rule is listed and the connection is expected to use policy-based routing, continue to the following step if one of the following is true:
     - A policy rule is not listed and the connection is expected to use policy-based routing
     - A policy rule is listed and the connection is not expected to use policy-based routing
     - A policy rule is listed, but it is not the expected policy rule
   - Otherwise, continue with step “3” on page 30.

2. For information about how to map a connection to the correct policy rule, see the 'Policy-based routing' section in z/OS Communications Server: IP Configuration Guide.

3. Use pasearch to find the policy rule and the corresponding action. For information about the pasearch command, see “Displaying policy-based networking information” section of z/OS Communications Server: IP System Administrator's Commands. The policy action will list all the possible route tables that can be used for the connection. Perform steps “4” on page 30 through “6” on page 31 on each of the route tables listed in the action.

4. Use the Netstat ROUTE/-r PR command to display routes in the route table. Verify whether TCP/IP has a route to the destination/network in the route table. For information about the Netstat ROUTE/-r command, see z/OS Communications Server: IP System Administrator's Commands.
• If there is no route to the destination/network and no route is expected to be found in the route table, repeat step “4” on page 30 using the next route table in the policy action.

• If there is no route to the destination/network and a route was expected in the route table, see z/OS Communications Server: IP Configuration Guide for information about setting up static and dynamic routing for policy-based routing tables.

• If a route was found, verify that the route is marked active (has the U flag). If the route is not active, see z/OS Communications Server: IP Configuration Guide for information about route states.

• If an active route is found, verify that the route table name matches the route table name displayed on the Netstat ALL/-A report for the connection. If it does not, continue to step “9” on page 31. Otherwise, continue to step “5” on page 31.

5. Determine whether there is a gateway identified for the route to the destination. If there is no gateway, then the destination address is presumed to be directly connected. In this case, proceed to step “6” on page 31. If a gateway is identified for the route, use the Ping command to confirm connectivity to the gateway.

• If the gateway responds to a Ping, then there is a network problem at the gateway or beyond.

• If the gateway does not respond to a Ping, proceed to step “6” on page 31.

6. Determine which network interface is associated with the route to the destination. If the network interface operation has not been verified for this interface, verify it now. See “Steps for verifying network interface operation” on page 31 for more information.

7. Use the DISPLAY TCPIP,,NETSTAT,ACCESS,NETWORK command to determine whether network access control is enabled. If it is enabled, see “Steps for verifying network access” on page 32 for more information.

8. Use the Netstat CONFIG/-f command to determine whether IP security is enabled. If the output report field IpSecurity contains the value Yes, then IP security is enabled. If it is enabled, see “Steps for verifying IP security and defensive filter operation” on page 670 for information about how to verify that IP security is correctly configured.

9. See “Documentation for the IBM Support Center” on page 39 to determine what problem documentation you need, and then call the IBM Support Center.

Steps for verifying network interface operation

Determine whether a particular network interface is ready.

About this task

Figure 5 on page 32 shows the decisions involved for verifying network interface operation.
Verify Network Interface Operation

Procedure

Perform the following steps to verify network interface operation:

1. Use the Netstat DEVLINKS/-d command to check the interface status. If the interface status is Ready, check the physical connectivity from the interface to the network and check for configuration errors in the network. For example, if you are using VLAN, verify that you have configured the proper VLAN IDs throughout the network. If the interface status is not Ready, try to start the interface by using the VARY TCPIP,,START command, and proceed to “2” on page 32.

2. Use the Netstat DEVLINKS/-d command again to determine whether the interface is ready after being started. If the interface is not ready, check the system console for error messages issued from TCP/IP, VTAM, or IOS and respond as suggested in the documentation for the messages that appear.

Steps for verifying network access

Determine whether access to a resource is controlled and whether the server or client application can access the resource.

Before you begin

Identify the IP address, subnet, or prefix for which network access is to be verified.
Verify Network Access

Procedure

Perform the following steps to verify network access:

1. Invoke the DISPLAY TCPIP,,NETSTAT,ACCESS,NETWORK,ipaddress command, specifying the IP address for which access is to be verified. If the command output indicates that network access control is in effect for the IP address, proceed to “2” on page 34.
2. Verify that the server or client application is permitted access to the IP resource. See Chapter 12, “Diagnosing access control problems,” on page 389 for more information about verifying this access.

**Tools for diagnosing network connectivity problems**

This topic describes tools used to diagnose network connection problems.

**Using the Ping command**

The packet Internet groper (Ping) command sends an Internet Control Message Protocol (ICMP/ICMPv6) Echo Request to a host, gateway, or router with the expectation of receiving a reply. You can invoke the Ping function by using the TSO PING command or the z/OS UNIX shell `ping` or `oping` command.

For a complete description of the Ping command and examples of Ping output, see the z/OS Communications Server: IP System Administrator's Commands.

The Ping command does not use the ICMP/ICMPv6 header sequence number field (`icmp_seq` or `icmp6_seq`) to correlate requests with ICMP/ICMPv6 Echo Replies. Instead, it uses the ICMP/ICMPv6 header identifier field (`icmp_id` or `icmp6_id`) plus an 8-byte TOD time stamp field to correlate requests with replies. The TOD time stamp is the first 8-bytes of data after the ICMP/ICMPv6 header. When you specify the Verbose/-v parameter, the ICMP/ICMPv6 header sequence numbers sent in the ICMP/ICMPv6 echo requests are displayed in the verbose report of detailed ICMP/ICMPv6 echo replies. Use these sequence numbers to detect the out-of-order and lost packets, based on missing sequence numbers.

When the PMTU/-P parameter with a value of yes or ignore is specified on the command, Ping will ensure that the outbound echo request packets are not fragmented. As a result, ICMP/ICMPv6 error messages may be received by the Ping command if the echo request packet is too large to be sent out by the stack or, forwarded at some point in the network. In this case, the Ping command uses both the ICMP/ICMPv6 header identifier and sequence number fields to correlate requests with the error messages. For IPv6 Ping requests, the Ping command will also use the 8-byte TOD time stamp returned in the ICMPv6 Packet Too Big error message.

Ping can be used in the following ways:

**Pinging loopback is used to verify the installation of TCP/IP in the z/OS Communications Server environment.**

The Ping loopback is an internal software test. The command examples below use the IPv4 standard loopback address, 127.0.0.1, or the IPv6 standard loopback address, ::1. An IP packet is not sent to a physical device.

```
ping 127.0.0.1
```

For IPv6

```
ping ::1
```

**Ping a home address to verify the information from the Netstat HOME/-h command.**

This is an internal software test. An IP packet is not sent to a physical device.

```
ping 9.67.113.58
```

**Ping a host on a directly attached network to verify the following:**

- If equal-cost multipath routes exist in the IP routing table for outbound IP traffic to reach a remote host, use the Ping INTF/-i option to select a routing interface with the attached equal-cost multipath route. Alternatively, for routing interfaces associated with an IPv6 link-local address, the name of the routing interface can be appended as scope information to the IPv6 link-local address of the remote host. When running multiple TCP/IP stacks on the same MVS image, specify the TCP/-p parameter, along with the scope, to indicate the stack to which the routing interface is configured. Whenever applicable, use either of these options to test connectivity. For more information about...
using scope, see the section on support for scope in z/OS Communications Server: IPv6 Network and Application Design Guide.

- The directly attached network is defined correctly.
- The device is properly connected to the network.
- The device is able to send and receive packets on the network.
- The remote host is able to receive and send packets.

```bash
ping 9.67.43.101 (intf eth1
ping fe80::9:67:43:104%ethipv61 -p tcpip1
```

**Ping a host on a remote network to verify the following:**

- If equal-cost multipath routes exist in the IP routing table for outbound IP traffic to reach the remote host, use the Ping INTF/-i option to select a routing interface with the attached equal-cost multipath route. Whenever applicable, use this option to test connectivity.
- The route to the remote network is defined correctly.
- The router is able to forward packets to the remote network.
- The remote host is able to send and receive packets on the network.
- The remote host has a route back to the local host.

```bash
ping -i eth1 mvs1
```

**Note:** Ping commands to a remote host might fail if there is a firewall between the two systems, even if the host is reachable using other commands.

**Display details of echo replies and obtain summary statistics**

You can use the Ping command with the Verbose/-v parameter to obtain detailed echo replies and summary statistics regarding the round-trip times based on the response times in the received echo replies. The detailed echo replies can be used to identify lost echo reply packets based on their sequence numbers and to identify how many hops the echo requests have traveled based on their values of time-to-live (TTL) or maximum number of hops (hop limits). The Verbose/-v parameter provides the following output information:

- Number of bytes for the ICMP data portion
- Echo reply details (for each echo reply received):
  - from: echo reply sender's IP address
  - seq: ICMP/ICMPv6 sequence number
  - ttl: time-to-live for number of hops (if IPv4)
  - hoplim: maximum hop limit (if IPv6)
  - time: response time
- Ping statistics summary:
  - Packets history:
    - Sent: total number of echo requests sent
    - Received: total number of echo replies received
    - Lost: total number of packets lost plus percentage of packet loss
  - Approximate round-trip times in milliseconds:
    - Minimum: minimum value among all RTTs
    - Maximum: maximum value among all RTTs
    - Average: average RTT among all RTTs
Determine the path MTU size to a host:

Use the Ping PMTU/-P parameter with the values yes or ignore, to prevent fragmentation of the outbound echo request packets and specify what type of path MTU discovery support you want. If the outbound packet needs to be fragmented, Ping will display the host name and IP address of the host where the fragmentation is needed.

**yes**

Specifies that the outbound echo request packets will not be fragmented at the local host or in the network, and that you want to use the MTU value, determined by path MTU discovery for the destination.

- If path MTU discovery is enabled and has already determined an MTU value for the destination, and the length of the Ping echo request packet is larger than this MTU size, then the local TCP/IP stack will not send out the packet. In this case, Ping displays one of the local stack's IP addresses as the address of the host where fragmentation is needed, and the next-hop MTU value displayed by Ping is the current path MTU value to the destination. For Ping commands to IPv4 destinations, the Ping command processing will not cause path MTU discovery support to be triggered for the destination. For IPv4, only TCP processing causes path MTU discovery support to be triggered.

- If path MTU discovery is not enabled, or has not already determined a path MTU value for the destination, and the Ping echo request packet exceeds the configured route MTU selected for this packet, then the local TCP/IP stack will not send out the packet. In this case, Ping will display one of the local stack's IP addresses as the address of the host where fragmentation is needed, and the next-hop MTU value displayed by Ping is that of the route selected for the Ping packet.

- If the Ping request fails because the echo request packet needs to be fragmented at some point in the network, Ping will display the IP address where fragmentation needs to occur and will display the next-hop MTU value, if it was provided.

**ignore**

Specifies that the outbound echo request packets will not be fragmented at the local host or in the network, and that any MTU values determined by path MTU discovery for the destination, will be ignored.

- If path MTU discovery has determined an MTU value for the destination, and the length of the Ping echo request packet is larger than this MTU size, specifying a value of ignore causes the TCP/IP stack to ignore the path MTU value and attempt to send out the packet. As long as the echo request packet length does not exceed the configured route MTU selected for this packet, you can use the ignore value to determine where in the network the original MTU problem occurred. In this case, Ping displays the IP address where fragmentation needs to occur and will display the path MTU value, if it was provided.

- If the Ping echo request packet exceeds the configured route MTU selected for this packet, then the local TCP/IP stack will not send out the packet. In this case, Ping displays one of the local stack's IP addresses as the address of the host where fragmentation is needed, and the next-hop MTU value displayed by Ping is that of the route selected for the Ping packet.

**MULTIPATH PERPACKET considerations:**

When MULTIPATH PERPACKET is in effect, and equal-cost routes are configured to the Ping destination host, the smallest MTU value of all the equal-cost routes is used as the largest packet size which can be sent, even if some of the equal-cost routes could support a larger packet size.
• Specify the NONAME/-n parameter to request that Ping only display the IP address of the host, and not attempt to resolve the IP address to a host name. This saves a name server address-to-name lookup. If this host also returned the next-hop MTU size, the size is also displayed.

• Vary the length of the outbound packet to determine where the packet needs to be fragmented. The Length/-l parameter on the Ping command, specifies the number of data bytes for the echo request.
  – For IPv4 destinations, the total length of the outbound echo request packet includes the length of an IPv4 IP header (20 bytes), the length of an ICMP header (8 bytes), and the data length specified by the Length/-l parameter. Depending on your TCP/IP stack configuration, the TCP/IP stack might add additional IP header options to the IP header created by Ping, before the echo request packet is sent, thereby increasing the size of the packet.
  – For IPv6 destinations, the total length of the outbound echo request packet includes the length of an IPv6 IP header (40 bytes), the length of an ICMPv6 header (8 bytes), and the data length specified by the Length/-l parameter. Depending on your TCP/IP stack configuration, the TCP/IP stack might add additional IPv6 extension headers to the packet created by Ping, before the echo request packet is sent, thereby increasing the size of the packet.

**Correcting timeout problems**

A Ping timeout message can occur for many reasons, and various techniques can be used to identify whether the problem is the local z/OS server or a remote host or router.

Base your actions on the possible reasons for a timeout, as shown in Table 10 on page 37.

<table>
<thead>
<tr>
<th>If the problem is...</th>
<th>Then use these diagnostic techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>The device is not transmitting packets to</td>
<td>Use Netstat DEVLINKS/-d to collect information to help you diagnose the problem. (See DEVLINKS/-d report option in z/OS Communications Server: IP System Administrator's Commands.)</td>
</tr>
<tr>
<td>the local network.</td>
<td></td>
</tr>
<tr>
<td>The remote host is not receiving or</td>
<td>Use Netstat ARP/-R to display the IPv4 entry for the remote host. (See the ARP/-R report option in z/OS Communications Server: IP System Administrator's Commands.)</td>
</tr>
<tr>
<td>transmitting packets on the network.</td>
<td>Use Netstat ND/-n to display the IPv6 entry for the remote host. (See the ND/-n report option in z/OS Communications Server: IP System Administrator's Commands.)</td>
</tr>
<tr>
<td>The remote host does not have a route back</td>
<td>Use Netstat ROUTE/-r on the remote host to make sure that it has a route back. (See ROUTE/-r report option in z/OS Communications Server: IP System Administrator's Commands.)</td>
</tr>
<tr>
<td>to the local z/OS server.</td>
<td></td>
</tr>
<tr>
<td>An intermediate router or gateway is not</td>
<td>Use a packet trace. (See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.)</td>
</tr>
<tr>
<td>correctly forwarding IP packets.</td>
<td></td>
</tr>
<tr>
<td>The IP reassembly timeout value might be set</td>
<td>See the TCP/IP Profile statements, IPCONFIG and IPCONFIG6, in z/OS Communications Server: IP Configuration Reference.</td>
</tr>
<tr>
<td>too low.</td>
<td></td>
</tr>
</tbody>
</table>

**Using the Netstat command**

You can use the Netstat command to verify your TCP/IP configuration. The information provided in the output from the Netstat command should be checked against the values in your configuration data sets.
for the TCP/IP stack. See the PROFILE DD statement in the TCP/IP started task procedure for the name of the configuration data sets.

Netstat can be invoked by using the TSO NETSTAT command, the z/OS UNIX shell `netstat/onetstat` command, or the console DISPLAY TCPIP,,NETSTAT command.

The following Netstat commands can be used to verify the state of those network resources that affect connectivity:

- “Netstat HOME/-h” on page 38
- “Netstat DEVLINKS/-d” on page 38
- “Netstat ROUTE/-r” on page 38
- “Netstat ARP/-R” on page 38
- “Netstat ND/-n” on page 39

For a complete description of the Netstat command and examples of Netstat output, see z/OS Communications Server: IP System Administrator's Commands.

**Netstat HOME/-h**

Use the Netstat HOME/-h command to verify the IP addresses defined for a TCP/IP stack, the names of the interfaces which are associated with the IP addresses, and the status of the IPv6 IP addresses. If any of the displayed information appears incorrect, check the HOME and INTERFACE statements in the PROFILE.TCPIP data set.

**Netstat DEVLINKS/-d**

Use the Netstat DEVLINKS/-d command to display the status and associated configuration values for a device and its defined interfaces, as coded in the PROFILE.TCPIP data set.

**Netstat ROUTE/-r**

The Netstat ROUTE/-r command displays the current routing tables for TCP/IP. To establish connectivity to a remote host, the remote host must also have a route back to the z/OS Communications Server.

The Netstat ROUTE/-r RSTAT command displays all of the static routes that are defined as replaceable.

The Netstat ROUTE/-r RADV command displays all of the IPv6 routes added based on information received in router advertisement messages.

The Netstat ROUTE/-r PR command displays all of the routes available in policy-based routing tables.

If there are any errors in the policy-based routing tables, check policy agent startup and configuration files for probable errors.

- Ensure that no error messages were generated during processing of either the initial profile or any subsequent VARY TCPIP,,OBEYFILE commands. (For information about the VARY TCPIP,,OBEYFILE command, see z/OS Communications Server: IP System Administrator’s Commands.)

- Check the PROFILE.TCPIP data set for the following:
  - Ensure that the HOME and INTERFACE statements have been coded correctly.
  - If static routing is provided by using the BEGINROUTES statement, ensure that following conditions are true:
    - Each route in the statement correlates to a valid interface name.
    - There are routes in the statement that correlate to the appropriate network and host addresses available on the network.

**Netstat ARP/-R**

Use the command Netstat ARP/-R to query the ARP cache for a given address. Use Netstat ARP/-R ALL to query an entire ARP cache table. Ensure Netstat ARP/-R displays an ARP entry for the remote hosts.
The ARP entry for the host on a remote network contains the IP address and the MAC address for the router.

To ensure the host has a route back to the z/OS Communications Server, review the routing tables on the remote host. The route back can be a host route or network route. Intermediate routers must also be configured correctly.

**Netstat ND/-n**

Use Netstat ND/-n to display the Neighbor Discovery entries.

### Using the DISPLAY TCPIP,,OSAINFO command

You can use the DISPLAY TCPIP,,OSAINFO command to retrieve information for an active IPAQENET/IPAQENET6 interface or link directly from an OSA-Express feature. The report includes information about the OSA-Express feature and about the interface or link. Registered unicast and multicast addresses are displayed as are routing variables for QDIO inbound workload queueing. Some of these values can be compared to the Netstat DEVlinks/-d report to ensure z/OS Communications Server and the OSA-Express are using the same information.

For a complete description of the command and examples of the command output, see DISPLAY TCPIP,,OSAINFO in z/OS Communications Server: IP System Administrator's Commands.

### Using the Traceroute command

Traceroute displays the route that a packet takes to reach the requested target. Traceroute starts at the first router and uses a series of UDP probe packets with increasing IP time-to-live (TTL) or hop count values to determine the sequence of routers that must be traversed to reach the target host. The Traceroute function can be invoked by either the TSO TRACERTE command or the z/OS UNIX shell `traceroute/otracer` command.

The packetSize option lets you increase the IP packet size to see how size affects the route that the Traceroute packet takes. It also shows the point of failure if a destination address cannot be reached.

If equal-cost multipath routes exist in the IP routing table for outbound IP traffic to reach a remote host, use the Traceroute SRCIP/-s option or the INTF/-i option to select a home IP address (for example, VIPA) for the source IP address and a routing interface with the attached equal-cost multipath route. Alternatively, for routing interfaces associated with an IPv6 link-local address, you can append the name of the routing interface as scope information to the IPv6 link-local address of the remote host. When running multiple TCP/IP stacks on the same MVS image, specify the TCP/-a parameter, with the scope, to indicate the stack to which the routing interface is configured. Whenever applicable, use one of these options to test connectivity. For more information about using scope, see the information about support for scope in z/OS Communications Server: IPv6 Network and Application Design Guide.

For the complete syntax of the TSO TRACERTE and z/OS UNIX `traceroute/otracer` command and examples of command output, see the z/OS Communications Server: IP System Administrator's Commands.

### Using SNMP remote Ping command

Use the SNMP remote Ping command to determine the response time between two remote hosts. For example, from Host A, you can determine the response time (Ping) between Hosts B and C, assuming the SNMP agent and TCP/IP subagent are running on Host B. See the z/OS Communications Server: IP System Administrator's Commands.

### Documentation for the IBM Support Center

In most cases, persistent error conditions indicate an installation or configuration problem. Contact the local IBM branch office for installation assistance.
If a software defect is suspected, collect the following information before contacting the IBM Support Center:

- PROFILE.TCPIP
- TCPIP.DATA
- Output from Netstat commands. If using policy-based routing, collect Netstat ROUTE/-r output for all possible route tables involved in the failed routing.
- Output from Ping traces
- If using policy-based routing, output from `pasearch` commands
- Network diagram or layout
- Error messages received. See z/OS Communications Server: IP Messages Volume 4 (EZ2, SNM) for information about messages.
- Component traces, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43
- If using dynamic routing protocols for IP route table management, see the following information:
  - Chapter 30, “Diagnosing OMPROUTE problems,” on page 687
Part 2. Traces and control blocks
Chapter 5. TCP/IP services traces and IPCS support

This topic describes selected procedures for TCP/IP Services component trace, packet trace, and Socket API trace. The following subtopics are included:

- “Component trace” on page 43
- “Event trace (SYSTCPIP) for TCP/IP stacks and Telnet” on page 55
- “Packet trace (SYSTCPDA) for TCP/IP stacks” on page 87
- “Data trace (SYSTCPDA) for TCP/IP stacks” on page 139
- “Intrusion Detection Services trace (SYSTCPIS)” on page 142
- “OSAENTA trace (SYSTCPOT)” on page 158
- “Network security services (NSS) server trace (SYSTCPNS)” on page 162
- “Defense Manager daemon (DMD) trace (SYSTCPDM)” on page 162
- “OMPROUTE trace (SYSTCPRT)” on page 162
- “RESOLVER trace (SYSTCPRE)” on page 162
- “Configuration profile trace” on page 162

The TN3270E Telnet server uses a subset of the TCP/IP Services component trace. Specify the started procedure name of Telnet instead of TCP/IP to control component tracing in the Telnet address space.

Component trace

You typically use component trace when recreating a problem.

Component trace performs the following functions:

- Captures trace requests.
- Adds trace records to an internal buffer.
- Writes the internal buffer to an external writer, if requested.
- Formats the trace records using the Interactive Problem Control System (IPCS) subcommand CTRACE.
- Provides a descriptor at the beginning of a trace record that specifies the address and length of each data area. Each data area in the trace record is dumped separately.
- Provides an optional identifier for the connection (UDP, TCP, and so on) as part of each record.

Tip: Trace data can contain user IDs, passwords, and other sensitive information. The trace data files should be protected to prevent disclosure. As an example, packet trace of the FTP port 21 used to control FTP sessions contains user IDs and passwords in the CLEAR. However, a customer can use Secure Socket Layer for FTP and for TELNET. The Packet Trace (V TCPIP,.PKTTRACE) command can be RACF® protected.

For detailed information, see the following information:

- z/OS MVS Diagnosis: Tools and Service Aids for information about component trace procedures.
- z/OS MVS Initialization and Tuning Reference for information about the component trace SYS1.PARMLIB member.
- z/OS MVS System Commands for information about commands.
- z/OS MVS Programming: Authorized Assembler Services Guide for procedures and return codes for component trace macros.
- z/OS MVS IPCS Commands for information about IPCS commands.
- z/OS MVS IPCS User's Guide for information about using IPCS.
Modifying options with the TRACE CT command

After initialization, you must use the TRACE CT command to change the component trace options. Modifying options with the TRACE CT command can be done with or without the PARMLIB member. The component trace buffer size can be changed for the SYSTCPDA, SYSTCPIP, SYSTCPIS, and SYSTCPOT components.

Modifying with the PARMLIB member

Because TCP/IP, OMPROUTE, RESOLVER, IKE daemon, NSS server, DMD, and the trace command are accessing the PARMLIB data sets, they need to be authorized for read access to these data sets by RACF or another security product.

To change component trace options using a PARMLIB member, create a SYS1.PARMLIB member and specify the component member on the PARM= keyword of the TRACE CT command.

Use the following syntax:

```
TRACE CT,ON,COMP=component_name,SUB=(procedure_jobname)
 ,PARM=parmlib_member
```

Following are descriptions of the parameters:

**COMP**

Indicates the component name:

- **SYSTCPDA**
  TCP/IP packet trace. There is no parmlib member. Options are specified by the VARY TCPIP,PKTTRACE command (see “Packet trace (SYSTCPDA) for TCP/IP stacks” on page 87).

- **SYSTCPDM**
  Defense Manager daemon, parmlib = CTIDMD00 (see “TCP/IP services component trace for the Defense Manager daemon” on page 657).

- **SYSTCPIK**
  IKE daemon, parmlib = CTIIKE00 (see “TCP/IP services component trace for the IKE daemon” on page 329).

- **SYSTCPIP**
  TCP/IP event trace, parmlib = CTIEZBxx, where xx is any 2 alphanumeric characters (see “Event trace (SYSTCPIP) for TCP/IP stacks and Telnet” on page 55).

- **SYSTCPIS**
  TCP/IP intrusion detection service, parmlib = CTIIDSxx (see “Intrusion Detection Services trace (SYSTCPIS)” on page 142).

- **SYSTCPNS**
  Network security services server, parmlib = CTINSS00 (see “TCP/IP services component trace for the network security services (NSS) server” on page 356).

- **SYSTCPOT**
  TCPIP OSA-Express Network Traffic Analyzer (OSAENTA) trace. TCP/IP event trace, parmlib = CTINTA00, (see “OSAENTA trace (SYSTCPOT)” on page 158). An alternate CTINTA00 member cannot be specified on the EXEC statement of the TCPIP procedure. CTINTA00 will always be used when starting TCPIP. Only an alternate buffer size or external writer procedure can be specified. All options are provided by the OSAENTA command.

- **SYSTCPRE**
  Resolver, parmlib = CTIRESxx (see Chapter 37, “Diagnosing resolver problems,” on page 767).

- **SYSTCPRT**
  OMPROUTE, parmlib = CTIORA00 (see “TCP/IP services component trace for OMPROUTE” on page 712).

**Tip:** An optional suffix, CTIORAxX, is also available.
**SUB**

Indicates the started procedure name for TCP/IP, the OMPROUTE application, the RESOLVER, the IKE daemon started task name, the network security services (NSS) server started task name, the Defense Manager daemon (DMD) started task name, or the Telnet started task name for which the trace is run. If you use the `S procname,jobname` method to start TCP/IP, OMPROUTE, IKE daemon, network security services (NSS) server, DMD, or Telnet, you must specify the same value for the SUB parameter that is specified for the `jobname` value. There can be as many as eight TCP/IP sessions and eight Telnet sessions active in one system.

**Restrictions:**

- Only one OMPROUTE application can be active on each TCP/IP stack.
- Only one RESOLVER application can be active with each operating system.
- Only one IKE daemon application can be active with each operating system.
- Only one network security services (NSS) server application can be active with each operating system.
- Only one Defense Manager daemon (DMD) application can be active with each operating system.

**PARM**

Identifies the PARMLIB member that contains the trace options (see COMP). All options can be respecified. However, the buffer size cannot be changed if OMPROUTE, the IKE daemon, the NSS server, the DMD, or the RESOLVER are running. If a different size is required, you must stop OMPROUTE, IKE daemon, network security services server, DMD, or the RESOLVER, and then restart it after modifying the PARMLIB member.

If the incorrect parmlib member is specified, one of the following messages might be issued:

- An incorrect CTIEZBxx member is specified on the TRACE CT,ON command:

  ```
  IEE5381 CTIEZBxx MEMBER NOT FOUND IN SYS1.PARMLIB
  ITO101 COMPONENT TRACE PROCESSING FAILED FOR PARMLIB MEMBER=CTIEZBxx:
  PARMLIB MEMBER NOT FOUND.
  ```

- An incorrect CTIEZBxx member is specified on the CTRACE() keyword of the EXEC statement of the TCP/IP started procedure:

  ```
  IEE5381 CTIEZBxx MEMBER NOT FOUND IN SYS1.PARMLIB
  ```

- An incorrect CTIORAxx member is specified on the TRACE CT,ON command:

  ```
  IEE5381 CTIORAxx MEMBER NOT FOUND IN SYS1.PARMLIB
  ITO101 COMPONENT TRACE PROCESSING FAILED FOR PARMLIB MEMBER=CTIORAxx:
  PARMLIB MEMBER NOT FOUND
  ```

- An incorrect CTINTA00 member is specified on the TRACE CT,ON command:

  ```
  IEE5381 CTINTA00 MEMBER NOT FOUND IN SYS1.PARMLIB
  ITO101 COMPONENT TRACE PROCESSING FAILED FOR PARMLIB MEMBER=CTINTA00:
  PARMLIB MEMBER NOT FOUND
  ```

**Modifying without the PARMLIB member**

To change component trace options without using a PARMLIB member, issue the TRACE CT command without the PARM= parameter and specify the options on the reply. Though the SYSTCPDA component for packet or data trace does not have a parmlib member, SYSTCPDA can be used on the trace command without the PARMLIB member.

Use the following syntax:

```
TRACE CT,ON,COMP=component_name,SUB=(procedure_jobname)
```
After issuing the TRACE CT command, you are prompted to specify the trace options. Respond using the following syntax:

```
Reply nn
[,.ASID=(asid-list)]
[,.JOBNAME=(jobname-list)]
[,.OPTIONS=(name[name]...)]
[,.WTR={membername|DISCONNECT}]
[,CONT|END]
```

**Restriction:** ASID and JOBNAME are not valid for OMPROUTE.

**Reply nn**
Specifies the identification number (in the range 0-9999) in the prompting message. For example, if the response is

```
06 ITT066A SPECIFY OPERAND(S) FOR TRACE CT COMMAND
```

You might reply

```
I 06, WTR=PTTCP, END
```

**ASID**
The ASID (address space identifiers) of the client whose TCP/IP requests are to be traced.

**JOBNAME**
The job name of the client whose TCP/IP requests are to be traced. The job name might be:

- The job name associated with a client application.
- The SNA LU associated with a TELNET session.

**Restriction:** Do not use the JOBNAME parameter with the TELNET CTRACE option.

- The FTP user ID associated with an FTP data connection.

**OPTIONS**
Options valid for use with SYSTCPIP are listed in this topic; options valid for use with OMPROUTE are listed in Chapter 30, “Diagnosing OMPROUTE problems,” on page 687; and options for SYSTCPR (the Resolver component) are listed in Chapter 37, “Diagnosing resolver problems,” on page 767.

Options valid for use with IKE daemon are listed in Chapter 9, “Diagnosing IKE daemon problems,” on page 309.

Options valid for use with the network security services (NSS) server are listed in Chapter 10, “Diagnosing network security services (NSS) server problems,” on page 335.

Options valid for use with the Defense manager daemon (DMD) are listed in Chapter 28, “Diagnosing Defense Manager daemon problems,” on page 651.

**membername**
The member containing the source JCL that invokes the external writer. The membername in the WTR parameter must match the membername in a previous TRACE CT,WTRSTART command. (See “Steps for obtaining component trace data with an external writer” on page 48.)

**WTR=DISCONNECT**
Disconnects the component trace external writer and the trace. You must also specify a TRACE CT,WTRSTART or TRACE CT,WTRSTOP command to start or stop the writer.

**CONT or END**
CONT specifies that the reply continues on another line. Specify END to complete the response.

**Displaying component trace status**
To display information about the status of the component trace, issue the following command:

```
DISPLAY TRACE, COMP=component_name, SUB=(procedure_jobname)
```

See **COMP** for more information about **component_name**.
This command displays information about the status of the component trace for one procedure. To display information about the status of the component trace for all active procedures, issue the following command:

```
DISPLAY TRACE,COMP=component_name,SUBLEVEL,N=8
```

For the TCP/IP CTRACE components, do not be misled by the line in the middle of the display showing the MODE is OFF. This part of the display always says the MODE is OFF because TCP/IP uses the subtrace for all tracing. The subtrace for TCPCS2 indicates the actual state of the trace. In the example shown in “4” on page 49, the trace is active (MODE is ON) with an internal buffer size of 16 M, tracing all ASIDs and all JOBNAMES, using MINIMUM options, and using the external writer PTTCP. Another version of the DISPLAY TRACE command D TRACE,COMP=component_name,SUBLEVEL,N=8 shows all subtraces for the component.

**Modifying the trace buffer size**

To modify the amount of trace buffer in use for the SYSTCPIP, SYSTCPDA, SYSTCPIS and SYSTCPOT traces use the following command:

```
TRACE CT,nnnnM,COMP=component_name,SUB=(procedure_jobname)
```

where nnnnM is the new buffer size in mega bytes. The buffer size is subject to the minimum and maximum buffer size established for each component.

See COMP for more information about component_name.

**Stopping a component trace**

To stop current tracing, issue the following TRACE CT command:

```
TRACE CT,OFF,COMP=component_name,SUB=(procedure_jobname)
```

See COMP for more information about component_name.

With the TRACE,CT,OFF command, TCP/IP discontinues recording of all trace data.

```
TRACE CT,OFF,COMP=SYSTCPIP,SUB=(procedure_jobname)
```

**Obtaining component trace data with a dump**

You can request a dump to obtain component trace data for:

- TCP/IP stack
- OMPROUTE
- Resolver
- TELNET
- IKE daemon
- Network security services (NSS) server
- Defense Manager daemon (DMD)

**TCP/IP stack**

If an abend occurs in the TCP/IP address space or in a user’s address space, TCP/IP recovery dumps the home ASID, primary ASID, and the secondary ASID. This also contains the trace data for the SYSTCPIP, SYSTCPDA, SYSTCPIS and SYSTCPOT components.
To view the trace records for a problem where no abend has occurred, use the DUMP command. The following example illustrates a DUMP command:

```
DUMP COMM=(your dump title here)
R n,JOBNAME=(tcpipprocname),CONT
R n,SDATA=(NUC,CSA,LSQA,PSA,RGN,SQA,TRT),END
```

**Figure 7. Example of DUMP command for TCP/IP stack**

To generate a meaningful dump, specify (at a minimum):

- CSA
- LSQA
- RGN
- SQA

**OMPROUTE**

To obtain a dump of the OMPROUTE address space (which contains the trace table), use the DUMP command, as shown in the following example:

```
DUMP COMM=(enter your dump title here)
R n,JOBNAME=omproute_started_task_name,SDATA=(CSA,RGN,ALLPSA,SQA,SUM,TRT,ALLNUC),END
```

**Figure 8. Example of DUMP command for OMPROUTE**

**RESOLVER**

To obtain a dump of the RESOLVER, use the DUMP command, as shown in the following example:

```
DUMP COMM=(enter your dump title here)
R n,JOBNAME=resolver_started_task_name,SDATA=(CSA,RGN,ALLPSA,SQA,SUM,TRT,ALLNUC),END
```

**Figure 9. Example of DUMP command for RESOLVER**

**TELNET**

To obtain a dump of TELNET, use the DUMP command, as shown in the following example:

```
DUMP COMM=(enter your dump title here)
R n,JOBNAME=telnet_started_task_name,SDATA=(CSA,RGN,ALLPSA,SQA,SUM,TRT,ALLNUC),END
```

**Figure 10. Example of DUMP command for TELNET**

**Steps for obtaining component trace data with an external writer**

You can use an external writer to obtain component trace data for TCP/IP stacks, packet trace, OMPROUTE, and Telnet.

**Procedure**

Perform the following steps to obtain component trace data with an external writer:

1. Enter the appropriate writer procedure in SYS1.PROCLIB, as shown in the following example. Use a separate external writer for each CTRACE component. You can have multiple procedures writing to as many as 16 TRCOUT files either on disk or tape.

```
//PTTCP  PROC
//* REFER:  SYS1.PROCLIB(PTTCP)
//* COMPID: OPER
//* DOC:  THIS PROCEDURE IS THE IPCS CTRACE1 EXTERNAL WRITER PROCEDURE.
//*      USED BY TCP/IP.
//*      IEFPROC  EXEC  PGM=ITTTRCWR,REGION=0K,TIME=1440
//*      TIME=1440 to prevent S322 abends
//*      TRCOUT01 DD DSN=MEGA.IPCS.CTRACE1,UNIT=SYSDA,
//*          VOL=SER=STORAGE,
//*          SPACE=(4096,(100,10),,CONTIG),DISP=(NEW,CATLG)
```

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Restrictions:

- Do not specify the DCB parameters RECFM, LRECL, and BLKSIZE. The external writer defaults to an optimal blocking factor.
- Do not specify the RLSE subparameter of the SPACE parameter. The output data sets are opened and closed more than once when GTF runs.

2. Start the external writer using the following command:

```
TRACE CT,WTRSTART=procedure_name,WRAP
```

3. Turn on the trace and connect the external writer to the component either by specifying the external writer name in the PARMLIB member, or by specifying the external writer name in the TRACE command. When starting TCP/IP, because the SYSTCPDA component has no PARMLIB member, the PARMLIB option is not applicable for SYSTCPDA. For example, TRACE `CT,ON,COMP=SYSTCPDA, SUB=(TCPCS), PARM=CTIEZBDA` is a valid command. The PARMLIB member can specify a new buffer size or the name or a writer. To turn the trace on and connect the external writer to the component using a PARMLIB member, add the following TRACEOPTS option to the PARMLIB member:

```
WTR(xxx)
```

where `xxx` is the procedure name of the external writer. Then use this PARMLIB member when starting the program (TCP/IP, OMPROUTE, TELNET, or the Resolver) or if the program is already executing, issue the following command:

```
TRACE CT,ON,COMP=component_name, SUB=(procedure_name), PARM=parmlib_member
```

To turn on the trace and connect the external writer without using the PARMLIB member, enter the following command:

```
TRACE CT,ON,COMP=component_name, SUB=(procedure_name)
```

When the system responds, enter the following command:

```
R n,WTR=procedure_name,END
```

where `n` is the response number issued by the system. You can add options to the response. The options vary for each component name. See “Formatting component traces” on page 51 for references to the component options.

4. Use the DISPLAY command to check the external writer status. Include a sublevel.

```
D TRACE,COMP=SYSTCPDA, SUB=(TCPCS2)
```

```plaintext
SYSTEM STATUS INFORMATION
ST=(ON,0064K,00064K) AS=ON BR=OFF EX=ON MT=(ON,064K)
TRACENAME
=======
SYSTCPDA
       MODE BUFFER HEAD SUBS
       =======================
       OFF HEAD 2
       NO HEAD OPTIONS
       SUBTRACE
       MODE BUFFER HEAD SUBS
       ------------------------------------------
           TCPCS2 ON 0016M
ASIDS   *NONE*
JOBAMES  *NONE*
OPTIONS  MINIMUM
WRITER   PTTCP
```

Tip: The external writer is active for packet and data.
5. Turn off the trace or disconnect the external writer. The following two commands disconnect from the external writer, while leaving the trace running internally.

\[
\text{TRACE CT,ON,COMP=component\_name,SUB=(procedure\_jobname)}
\]

When the system responds, enter the second command:

\[
\text{R nn,WTR=DISCONNECT,END}
\]

6. Stop the external writer using the following command:

\[
\text{TRACE CT,WTRSTOP=procedure\_name}
\]

**Tips for using component trace external writer**

Consider the following when using the component trace external writer:

- Do not use the same writer to trace more than one TCP/IP stack, TELNET, or OMPROUTE application. If you need to trace multiple stacks or applications, use separate writers.
- If your external writer fills up and the wrap option is on, the writer overwrites itself. If the nowrap option is on, the writer stops.
- Use \text{REGION=0K} on the trace writer procedure EXEC statement. This helps ensure that there is enough virtual memory for trace buffers.
- Use \text{TIME=1440} on the EXEC statement. This prevents S322 abends.
- Use \text{CONTIG} on the disk space allocation of the trace data when using the WRAP option. For example: SPACE=(1024,(4096,100),,CONTIG). This ensures that the space for the trace data set is available.
- Do not specify DCB parameters for trace data sets. The writer optimizes the logical record length and block size for new trace data sets.
- Ensure that the dispatching priority of the writer is equal to or greater than the application that is being traced.
- The CTRACE or packet trace formatter messages ITT10016I, PTRPT14I or PTRPT15I indicate lost buffers. This normally occurs when packet tracing is set up with no capture filters, causing all protocols for all IP addresses to be captured. The result is that some trace buffers are unable to be processed and are flagged as lost. The reason behind these lost records is the amount of data that is being traced overrunning the CTRACE writer. This trace data is arriving at the CTRACE writer faster than it can be written out. Setting filters such as IPADDR or PORTNUM will help eliminate lost records.

**Using a VSAM linear data set**

Using a VSAM linear data set for output trace data provides better performance than using a sequential data set.

**Procedure**

Perform the following steps:

1. Define a VSAM Linear data set.

   ```
   //DEFINE EXEC PGM=IDCAMS
   //SYSPRINT DD SYSOUT=*  
   //SYSIN DD *
   DELETE +
       (hlq.CTRACE.LINEAR) +
   CLUSTER
   DEFINE CLUSTER( +
       NAME(hlq.CTRACE.LINEAR) +
   LINEAR +
       MEGABYTES(10) +
       VOLUME(CPDLB0) +
       CONTROLINTERVALSIZE(32768) +
       ) +
   DATA( +
       NAME(hlq.CTRACE.DATA) +
   ```
2. Update the CTRACE writer procedure:

```plaintext
//IEFPROC EXEC PGM=ITTTRCWR
//TRCOUT01 DD DSNAMES=hlq.CTRACE.LINEAR,DISP=SHR
//SYSPRINT DD SYSOUT=* 
```

3. Issue the COPYTRC command.
   The VSAM data set must be copied with COPYTRC to a sequential data set before being sent to IBM Service.

**Formatting component traces**

You can format component trace records using IPCS panels or a combination of IPCS panels and the CTRACE command, either from a dump or from external-writer files. The code for the component trace record formatter can be found in the SYS1.MIGLIB data set. This data set should be added as a concatenation to the STEPLIB data set. For details, see z/OS MVS IPCS Commands and z/OS MVS IPCS User's Guide.

**Steps for formatting component traces using IPCS panels**

Format component traces by using only IPCS panels.

**Procedure**

Follow these steps:

1. Log on to TSO.
2. Access IPCS.
3. Select option 2 (ANALYSIS) from the option list.
4. Select option 7 (TRACES) from the option list.
5. Select option 1 (CTRACE) from the option list.
6. Select option D (Display) from the option list.

**Results**

You know you are done when the CTRACE DISPLAY PARAMETERS screen is displayed (Figure 11 on page 51), as shown below.

```plaintext
ITTPC503----------CTRACE DISPLAY PARAMETERS-----------------------------
System =======> (System name or blank)
Component =======> (Component name (required))
Subnames =======> 
GMT/LOCAL =======> (Greenwich Mean Time or Local; GMT is default)
Start time =======> (mm/dd/yy,hh:mm:ss.dddddd)
Stop time =======> 
Limit =======> Exception =======> 
Report type =======> FULL (SHort, SUmmary, Full, Tally)
User exit =======> (Exit program name)
Override source =======> 
Options =======> 
To enter/verify required values, type any character
Entry IDS =======> Jobnames =======> ASIDs =======> OPTIONS =======> SUBS =======> 
CTRACE COMP(xx) FULL
COMMAND =======> F1=Help  F2=Split  F3=End  F4=RETURN  F5=RFIND  F6=MORE  F7=UP 
F8=DOWN  F9=Swap  F10=LEFT  F11=RIGHT  F12=CURSOR
```

*Figure 11. IPCS CTRACE*
Enter the component name in the COMPONENT field and as the value in COMP(xx). For descriptions of options, see the following topics:

- SYSTCPDA, see COMP.
- SYSTCPDM, see “TCP/IP services component trace for the Defense Manager daemon” on page 657.
- SYSTCPIK, see “TCP/IP services component trace for the IKE daemon” on page 329.
- SYSTCPNS, see “TCP/IP services component trace for the network security services (NSS) server” on page 356.
- SYSTCPIP, see COMP.
- SYSTCPIS, see COMP.
- SYSTCPOT, see “OSAENTA trace (SYSTCPOT)” on page 158.
- SYSTCPRE, see Chapter 37, “Diagnosing resolver problems,” on page 767.
- SYSTCPRT, see “TCP/IP services component trace for OMPROUTE” on page 712.

**Steps for using the CTRACE command**

Format component traces by using the CTRACE command.

**Procedure**

Perform the following steps:

1. Log on to TSO.
2. Access IPCS.
3. Select option 6 (COMMAND) from the option list.
4. Enter a CTRACE command and options on the IPCS command line.

**Syntax**

Following is the syntax of the IPCS CTRACE command:

**CTRACE syntax**

```
CTRACE Component selection Report type Data selection Address space selection
```

**Component Selection**

```
QUERY (compname) SUB (name)
```

**Report Type**

```
SHORT SUMMARY FULL TALLY GMT LOCAL
```

**Data Selection**
Parameters

See z/OS MVS IPCS Commands for details on the CTRACE parameters.

Keywords

You can use the following CTRACE keywords with TCP/IP component trace formats:

**JOBLIST, JOBNAME**

Use the JOBLIST and JOBNAME keywords to select packet trace records with a matching link name. However, only the first 8 characters of the link name are matched and no asterisks are accepted in the job name. Also, use them to match the job name in data trace records.

**ASIDLIST**

Use the ASIDLIST to select trace records only for a particular address space.

**GMT**

The time stamps are converted to GMT time.

**LOCAL**

The time stamps are converted to LOCAL time.

**SHORT**

If the OPTIONS string does not specify any reports, then format the trace records. Equivalent to the FORMAT option.
FULL
If the OPTIONS string does not specify any reports, then format and dump the trace records.
Equivalent to the FORMAT and DUMP options.

SUMMARY
If the OPTIONS string does not specify any reports, then create a one line summary for each trace
record. Equivalent to the SUMMARY option.

TALLY
If the OPTIONS string does not specify any reports, then count the trace records.

START and STOP
These keywords limit the trace records that are seen by the formatter. The STOP keyword determines
the time when records are no longer seen by the packet trace report formatter.

Rule: CTRACE always uses the time the trace record was moved to the buffer for START and STOP
times.

LIMIT
Determines the number of records the formatter is allowed to process.

USEREXIT
The CTRACE USEREXIT is called for TCP/IP formatter, except for the packet trace formatters.
Therefore, the packet trace formatter calls the CTRACE USEREXIT before testing the records with the
filtering criteria. If it returns a nonzero return code, then the record is skipped. The USEREXIT can also
be used in the OPTIONS string. It is called after the record has met all the filtering criteria in the
OPTIONS string. For details, see “Formatting packet traces using IPCS” on page 90.

Examples of formatting component traces
The following example shows the error message when the specified address space is not available in the
dump.

CTRACE QUERY(SYSTCPIP) SUB((TCPSVT1)) FULL LOCAL
COMPONENT TRACE QUERY SUMMARY
ITT10003I There are no trace buffers in the dump for COMP(SYSTCPIP)SUB((TCPSVT1))

The following example shows the results when the CTRACE QUERY command is issued for a dump when
the address space is available.

CTRACE QUERY(SYSTCPIP) SUB((TCPSVT2)) FULL LOCAL
COMPONENT TRACE QUERY SUMMARY
COMP(SYSTCPIP)SUBNAME((TCPSVT2))
START = MT  02/21/2001 15:25:49.432  LOCAL
STOP  = 180  02/21/2001 15:51:16.8
Buffer size: 0050M
OPTIONS: CONFIG,CSOCKET,FIREFALL,IOCTCL,MESSAGE,OETCP,OPCMDS,
OPMSGS,PASAPI,PING,SOCKAPI,TN,UDP,XCF,CLAW,INT
INTERNET,VCAM,VTAM,VTAMDATA
OPTIONS: MINIMUM

Tip: The first option is the relevant one (ignore the second options list). The buffer size and options list are
displayed only for a dump data set, not an external writer data set.

Formatting component traces using a batch job
A component trace can also be formatted through the use of a batch job. The following is an example of
JCL for a batch job:

//jobname   DD (accounting),pgmname,CLASS=A,MSGCLASS=A
//DUMP    EXEC PGM=IKJEFT01
//STEPLIB DD DISP=SHR,DSN=SYS1.MIGLIB
//SYSPRINT DD SYSOUT=*
IKE daemon trace (SYSTCPIK)

TCP/IP Services component trace is also available for use with the IKE daemon. See “TCP/IP services component trace for the IKE daemon” on page 329.

Event trace (SYSTCPIP) for TCP/IP stacks and Telnet

The TN3270E Telnet server running as its own procedure also uses the SYSTCPIP event trace.

Restrictions: All discussion that follows where TCP/IP is used as an example also pertains to the TN3270E Telnet server with the following exceptions:

- The TN3270E Telnet server does not use 64-bit common storage for trace collection, it uses its own private storage.
- A subset of trace commands are used by Telnet. A default parmlib member, CTIEZBTN, is provided that indicates all trace options available. The default parmlib member can be overridden in the same manner as the TCP/IP parmlib can be overridden.
- A subset of IPCS commands are used by Telnet.

Event trace for TCP/IP stacks traces individual TCP/IP components (such as STORAGE, INTERNET, and so forth) and writes the information either to a data set (using an external writer), or internally to 64-bit common storage. To aid in first failure data capture, a minimal component trace is always started during TCP/IP initialization if you use the TCP/IP Component Trace SYS1.PARMLIB member, CTIEZBxx. You can select trace records at run time by any of the following methods:

- JOBNAME
- Address space identifiers (ASID)
- Trace option
- IP address
- Port number
- Event identifier

Restriction: If using the TELNET options, do not specify the JOBNAME parm when starting CTRACE.

Specifying trace options

You can specify component trace options at TCP/IP initialization or after TCP/IP has initialized.
Specifying trace options at initialization

To start TCP/IP with a specific trace member, use the following command:

```
S tcpip_procedure_name,PARMS=CTRACE(CTIEZBxx)
```

where CTIEZBxx is the component trace SYS1.PARMLIB member.

You can create this member yourself, or you can update the default SYS1.PARMLIB member, CTIEZB00. For a description of trace options available in the CTIEZB00, see Table 11 on page 58.

**Tip:** Besides specifying the TCP/IP traces that you want, you can also change the component trace buffer size.

You can use IBM Health Checker for z/OS to check whether TCP/IP Event Trace (SYSTCPIP) is active with options other than the default options (MINIMUM, INIT, OPCMDS, or OPMSGS). For more details about IBM Health Checker for z/OS, see Appendix C, “IBM Health Checker for z/OS,” on page 889.

---

```plaintext
/* IBM Communications Server for z/OS */
/* SMP/E Distribution Name: CTIEZB00 */
/* MEMBER:  CTIEZB00 */
/* Copyright: Licensed Materials - Property of IBM */
/* 5650-ZOS */
/* Copyright IBM Corp. 1996, 2017. */
/* */
/* STATUS = CSV2R3 */
/* */
/* DESCRIPTION = This parmlib member causes component trace for */
/* the TCP/IP product to be initialized with a */
/* trace buffer size of 8 megabytes. */
/* */
/* This parmlib member only lists those TRACEOPTS */
/* value specific to TCP/IP. For a complete list */
/* of TRACEOPTS keywords and their values see */
/* z/OS MVS INITIALIZATION AND TUNING REFERENCE. */
/* */
/* $MAC(CTIEZB00) PROD(TCPIP): Component Trace SYS1.PARMLIB member */
/* */
/* *********************************************************************/

TRACEOPTS
/* */
/* ON OR OFF: PICK 1 */
/* */
ON
/* */
/* OFF */
/* */
/* BUFSIZE: A VALUE IN RANGE 1M TO 1024M */
/* */
BUFSIZE(8M)
/* */
/* JOBNAME(jobname1,...) */
/* */
/* ASID(Asid1,...) */
/* */
/* WTR(wtr_procedure) */
/* */
/* Note, the following groups of trace options are supported: */
/* */
/* ALL = All options except MISC, PFSSMIN, ROUTE, SERIAL, */
/* SOCKAPI, STORAGE, TCPMIN, and TIMER */
/* CSOCKET = PFS + SOCKET */
/* DLC = CLAW + INTERNET + LCS + VTAM + VTAMDATA */
/* IN = CONFIG + INIT + IOCTL + OPCMDS + OPMSGS */
/* LATCH = SERIAL */
/* MINIMUM = INIT + OPCMDS + OPMSGS */
/* ALLMIN = INIT + OPCMDS + OPMSGS + MINPFS + MINTCP */
```
/*       OETCP = ENGINE + PFS + QUEUE + TCP                         */
/*       OEUDP = ENGINE + PFS + QUEUE + UDP                         */
/*       PING  = ARP + ICMP + RAW + ND                             */
/*       RW    = ENGINE + PFS + QUEUE + RAW + SOCKET                */
/*       SYSTEM = INIT + OPCMDS + OPMSGS + SERIAL + STORAGE + TIMER + */
/*                      WORKUNIT                                    */
/*       TC    = ENGINE + PFS + QUEUE + SOCKET + TCP               */
/*       TN    = PFS + TCP + TELNET + TELNVTAM                    */
/*       UD    = ENGINE + PFS + QUEUE + SOCKET + UDP               */
/*       SYSTEM = INIT + OPCMDS + OPMSGS + SERIAL + STORAGE + TIMER + */
/*                      WORKUNIT                                    */
/*       TN    = PFS + TCP + TELNET + TELNVTAM                    */
/*       UD    = ENGINE + PFS + QUEUE + SOCKET + UDP               */
/*                                                                 */
/*                                                                 */
/*       PFSMIN = Reduced set of PFS trace data                  */
/*       TCPMIN = Reduced set of TCP trace data                   */
/*       ALLMIN = PFSMIN + TCPMIN                                  */
/*                                                                 */
/*                                                                 */
/*       NOTE: The xxxMIN and the corresponding xxx options should */
/*            not be active at the same time. The will collect    */
/*            duplicate information.                            */
/*                                                                 */
/*       OPTIONS: NAMES OF FUNCTIONS OR GROUPS TO BE TRACED:      */
/*                                                                 */
/*       OPTIONS(                                              */
/*                  'ALL         '   */
/*                  ,'ALLMIN  '   */
/*                  ,'ACCESS'   */
/*                  ,'AFP'      */
/*                  ,'ARP'      */
/*                  ,'CLAW'     */
/*                  ,'CONFIG'   */
/*                  ,'CSOCKET'  */
/*                  ,'DLC'      */
/*                  ,'EID(hhhhhhh,hhhhhhh) ' */
/*                  ,'ENGINE'   */
/*                  ,'FIREWALL' */
/*                  ,'ICMP'     */
/*                  ,'IN'       */
/*                  ,'INIT'     */
/*                  ,'INTERNET' */
/*                  ,'IOCTL'    */
/*                  ,'IPADDR(nn.nnn.nn.nn/mnn.mmm.mmm, */
/*                        nnn.nnn.nn.nn/pp, */
/*                        hhhhh/hhhhh/ppp) */
/*                  ,'IPSEC'    */
/*                  ,'LATCH'    */
/*                                                                 */
/*                  ,'LCS'     */
/*                  ,'MESSAGE' */
/*                  ,'MINIMUM' */
/*                  ,'MISC'     */
/*                  ,'NONE'     */
/*                  ,'OETCP'   */
/*                  ,'OEUDP'   */
/*                  ,'OPCMDS'  */
/*                  ,'OPMSGS'  */
/*                  ,'PASAPI'  */
/*                  ,'PFS'     */
/*                  ,'PFSMIN'  */
/*                  ,'PING'    */
/*                  ,'POLICY'  */
/*                  'PORT(ppppp,ooooo,rrrrr,ttttt)' */
/*                  ,'QUEUE'   */
/*                  ,'RAW'     */
/*                  'ROUTE'    */
/*                  'RW'      */
/*                  'PFS SERIAL' */
/*                  'SNMP'    */
/*                  'SOCKAPI' */
/*                  'SOCKET'   */
/*                  'STORAGE'  */
/*                  'SYSTEM'   */
/*                  'TC'      */
/*                  'TCP'     */
/*                                                                 */
/*                  'TCMPN' */
/*                                                                 */

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Figure 12. SYS1.PARMLIB member CTIEZB00

A group activates multiple trace options. The group name identifies traces that should be activated for a specific problem area, and trace groups provide a way to collect trace data by problem type.

Table 11 on page 58 describes the available trace options and groups.

<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
</table>
| ALL         | All types of records except MISC, PFSMIN, ROUTE, SERIAL, STORAGE, TCPMIN, and TIMER.  
**Slow Performance:** Using this option slows performance considerably, so use with caution.  
Also available for the TN3270E Telnet server running in its own address space. |
| ALLMIN      | Turns on the following trace options:  
- INIT  
- OPCMDS  
- OPMQS  
- PFSMIN  
- TCPMIN |
| ACCESS      | Trace creation, modification, and manipulation of the Network Access tree, along with results of all Network Access queries. |
| AFP         | Turns on trace for fast response cache accelerator. |
| ARP         | Shows address resolution protocol (ARP) cache management and ARP timer management. This option also shows all outbound and inbound ARP packets.  
**Tip:** The information provided differs depending on the type of device.  
**Guideline:** The ARP and ND options are aliases. If you turn one on, you turn on the other option, and if you turn one off, you turn off the other option. When formatting the trace, these options can be filtered separately. |
<p>| CLAW        | Shows all control flows for a CLAW device. |
| CONFIG      | Turns on trace for configuration updates. |</p>
<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSOCKET</td>
<td>Turns on the following trace options:</td>
</tr>
<tr>
<td></td>
<td>• PFS</td>
</tr>
<tr>
<td></td>
<td>• SOCKET</td>
</tr>
<tr>
<td>DLC</td>
<td>Turns on the following trace options:</td>
</tr>
<tr>
<td></td>
<td>• CLAW</td>
</tr>
<tr>
<td></td>
<td>• INTERNET</td>
</tr>
<tr>
<td></td>
<td>• LCS</td>
</tr>
<tr>
<td></td>
<td>• VTAM</td>
</tr>
<tr>
<td></td>
<td>• VTAMDATA</td>
</tr>
<tr>
<td>EID(list)</td>
<td>Turns on trace by event identifier. The event identifiers are 8 hexadecimal digits. Up to 16 can be specified. Use only under the direction of IBM Support.</td>
</tr>
<tr>
<td>ENGINE</td>
<td>Turns on trace for stream head management.</td>
</tr>
<tr>
<td></td>
<td><strong>Guideline:</strong> The ENGINE and QUEUE options are aliases. If you turn one on, you turn on all related options, and if you turn one off, you turn off all related options. These alias options are only for recording the trace. When formatting the trace, these options can be filtered separately.</td>
</tr>
<tr>
<td>FIREWALL</td>
<td>Turns on trace for firewall events.</td>
</tr>
<tr>
<td></td>
<td><strong>Tip:</strong> Synonymous with IPSEC option.</td>
</tr>
<tr>
<td>ICMP</td>
<td>Turns on trace for the ICMP protocol.</td>
</tr>
<tr>
<td>IN</td>
<td>Turns on the following trace options:</td>
</tr>
<tr>
<td></td>
<td>• CONFIG</td>
</tr>
<tr>
<td></td>
<td>• INIT</td>
</tr>
<tr>
<td></td>
<td>• IOCTL</td>
</tr>
<tr>
<td></td>
<td>• OPCMDS</td>
</tr>
<tr>
<td></td>
<td>• OPMSGS</td>
</tr>
<tr>
<td>INIT</td>
<td>Turns on trace for TCP/IP Initialization/Termination.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The INIT, OPCMDS, and OPMGS options are aliases. If you turn one on, you turn on all related options, and if you turn one off, you turn off all related options. These alias options are only for recording the trace. When formatting the trace, these options can be filtered separately.</td>
</tr>
<tr>
<td></td>
<td>Also available for the TN3270E Telnet server running in its own address space.</td>
</tr>
<tr>
<td>INTERNET</td>
<td>Turns on trace for Internet Protocol layer.</td>
</tr>
<tr>
<td></td>
<td><strong>Tip:</strong> Using this option slows performance considerably, so use with caution.</td>
</tr>
<tr>
<td>IOCTL</td>
<td>Turns on trace for IOCTL processing.</td>
</tr>
<tr>
<td>Trace Event</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>IPADDR(list)</td>
<td>Turns on trace by IP address.</td>
</tr>
</tbody>
</table>
| IPSEC | Turns on trace for IP security events.  
**Tip:** Synonymous with FIREWALL option. |
| LATCH | Turns on the following trace option:  
• SERIAL |
| LCS | Shows all control flows for an LCS device. |
| MESSAGE | Turns on trace for message triple management.  
**Tip:** Using this option slows performance considerably, so use with caution.  
Also available for the TN3270E Telnet server running in its own address space. |
| MINIMUM | Turns on the following trace options:  
• INIT  
• OPCMDS  
• OPMSGS |
| MISC | Turns on trace for miscellaneous TCP/IP internal diagnostic tests. |
| NONE | Turn off all traces but exception traces, which always stay on.  
Also available for the TN3270E Telnet server running in its own address space. |
| ND | Enable Neighbor Discovery trace option.  
**Guideline:** The ARP and ND options are aliases. If you turn one on, you turn on the other option, and if you turn one off, you turn off the other option. When formatting the trace, these options can be filtered separately. |
| OETCP | Turns on the following trace options:  
• ENGINE  
• PFS  
• QUEUE  
• TCP |
| OEUDP | Turns on the following trace options:  
• ENGINE  
• PFS  
• QUEUE  
• UDP |
<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPCMDS</td>
<td>Turns on traces of operator commands. <strong>Guideline:</strong> The INIT, OPCMDS, and OPMGS options are aliases. If you turn one on, you turn on all related options, and if you turn one off, you turn off all related options. These alias options are only for recording the trace. When formatting the trace, these options can be filtered separately.</td>
</tr>
<tr>
<td>OPMGS</td>
<td>Turns on message trace for console messages. <strong>Guideline:</strong> The INIT, OPCMDS, and OPMGS options are aliases. If you turn one on, you turn on all related options, and if you turn one off, you turn off all related options. These alias options are only for recording the trace. When formatting the trace, these options can be filtered separately.</td>
</tr>
<tr>
<td>PASAPI</td>
<td>Turns on traces for transforms that handle Pascal APIs.</td>
</tr>
<tr>
<td>PFS</td>
<td>Turns on trace for the physical file system layer. <strong>Tip:</strong> The PFS and PFSMIN options should not be specified together; the PFS option gathers all the information that the PFSMIN option gathers.</td>
</tr>
<tr>
<td>PFSMIN</td>
<td>Turns on the minimum PFS trace option. <strong>Tip:</strong> The PFS and PFSMIN options should not be specified together; the PFS option gathers all the information that the PFSMIN option gathers.</td>
</tr>
</tbody>
</table>
| PING | Turns on the following trace options:  
- ARP  
- ICMP  
- RAW |
<p>| POLICY | Trace the stack usage of Policy Rules and Actions. |
| PORT(list) | Turns on trace by port number. |
| QUEUE | Turns on trace for stream queue management. <strong>Guideline:</strong> The ENGINE and QUEUE options are aliases. If you turn one on, you turn on all related options, and if you turn one off, you turn off all related options. These alias options are only for recording the trace. When formatting the trace, these options can be filtered separately. |
| RAW | Turns on trace for the RAW transport protocol. |
| ROUTE | Trace manipulation of IP Routing Tree. |</p>
<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
</table>
| RW         | Turns on the following trace options:  
|            | • ENGINE  
|            | • PFS  
|            | • QUEUE  
|            | • RAW  
|            | • SOCKET |
| SERIAL     | Turns on trace for lock obtain and release.  
|            | **Tip:** Using this option slows performance considerably, so use with caution.  
|            | Also available for the TN3270E Telnet server running in its own address space. |
| SNMP       | Turns on trace for SNMP SET requests. |
| SOCKAPI    | Trace Macro and Call Instruction API calls (see “Socket API traces” on page 70). |
| SOCKET     | Turns on trace for the Sockets API layer. |
| STORAGE    | Turns on trace for storage obtain and release.  
|            | **Tip:** Using this option slows performance considerably, so use with caution.  
|            | Also available for the TN3270E Telnet server running in its own address space. |
| SYSTEM     | Turns on the following trace options:  
|            | • INIT  
|            | • OPCMDS  
|            | • OPMSGS  
|            | • SERIAL  
|            | • STORAGE  
|            | • TIMER  
|            | • WORKUNIT |
| TC         | Turns on the following trace options:  
|            | • ENGINE  
|            | • PFS  
|            | • QUEUE  
|            | • SOCKET  
<p>|            | • TCP |</p>
<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP</td>
<td>Turns on trace for the TCP transport protocol.</td>
</tr>
<tr>
<td></td>
<td><strong>Restriction:</strong> The TCP and TCPMIN options should not be specified together; the TCP option gathers all the information that the TCPMIN option gathers.</td>
</tr>
<tr>
<td></td>
<td><strong>Slow Performance:</strong> Using this option slows performance considerably, so use with caution.</td>
</tr>
<tr>
<td>TCPMIN</td>
<td>Turns on the minimum TCP trace option.</td>
</tr>
<tr>
<td></td>
<td><strong>Slow Performance:</strong> The TCP and TCPMIN options should not be specified together; the TCP option gathers all the information that the TCPMIN option gathers. The same is also true for the PFS and PFSMIN options.</td>
</tr>
<tr>
<td>TELNET</td>
<td>Turns on trace for TELNET events.</td>
</tr>
<tr>
<td></td>
<td>Only useful when used by the TN3270E Telnet server.</td>
</tr>
<tr>
<td>TELNETV TAM (an alias for TELNET)</td>
<td>Turns on trace for TELNET events.</td>
</tr>
<tr>
<td>TIMER</td>
<td>Turns on trace for TCP timers.</td>
</tr>
<tr>
<td></td>
<td><strong>Slow Performance:</strong> Using this option slows performance considerably, so use with caution.</td>
</tr>
<tr>
<td></td>
<td>Also available for the TN3270E Telnet server running in its own address space.</td>
</tr>
<tr>
<td>TN</td>
<td>Turns on the following trace options for TCP:</td>
</tr>
<tr>
<td></td>
<td>• PFS</td>
</tr>
<tr>
<td></td>
<td>• TCP</td>
</tr>
<tr>
<td></td>
<td>Turns on the following trace option for the TN3270E Telnet server running in its own address space:</td>
</tr>
<tr>
<td></td>
<td>• TELNET</td>
</tr>
<tr>
<td>UD</td>
<td>Turns on the following trace options:</td>
</tr>
<tr>
<td></td>
<td>• ENGINE</td>
</tr>
<tr>
<td></td>
<td>• PFS</td>
</tr>
<tr>
<td></td>
<td>• QUEUE</td>
</tr>
<tr>
<td></td>
<td>• SOCKET</td>
</tr>
<tr>
<td></td>
<td>• UDP</td>
</tr>
<tr>
<td>UDP</td>
<td>Turns on trace for UDP transport protocol.</td>
</tr>
<tr>
<td></td>
<td><strong>Slow Performance:</strong> Using this option slows performance considerably, so use with caution.</td>
</tr>
<tr>
<td>VTAM</td>
<td>Shows all of the nondata-path signaling occurring between IF and VTAM.</td>
</tr>
</tbody>
</table>
Table 11. Trace options and groups (continued)

<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTAMDATA</td>
<td>Shows data-path signaling between IF and VTAM, including a snapshot of media headers and some data. <strong>Slow Performance:</strong> Using this option slows performance considerably, so use with caution.</td>
</tr>
<tr>
<td>WORKUNIT</td>
<td>Turns on trace for work unit scheduling.</td>
</tr>
<tr>
<td>XCF</td>
<td>Turns on trace for XCF events.</td>
</tr>
<tr>
<td>ZERT</td>
<td>Turns on trace for z/OS Encryption Readiness Technology events.</td>
</tr>
</tbody>
</table>

### Specifying trace options after initialization

After TCP/IP or Telnet initialization, you must use the TRACE CT command to change the component trace options. Each time a new component trace is initiated, all prior trace options are turned OFF, and the new traces are activated.

You can specify the TRACE CT command with or without the PARMLIB member.

You can use IBM Health Checker for z/OS to check whether TCP/IP Event Trace (SYSTCPIP) is active with options other than the default options (MINIMUM, INIT, OPCMDS, or OPGMSGS). For more details about IBM Health Checker for z/OS, see Appendix C, “IBM Health Checker for z/OS,” on page 889.

### Additional filters for SYSTCPIP

The following additional trace filters for limiting the volume of trace data are available:

- The IPADDR keyword filters by IP address
- The PORT keyword filters by port number
- The EID keyword filters by event identifier

The EID keyword specifies up to 16 trace event identifiers. Each identifier is 8 hexadecimal characters. For example: EID(00010001,00090001,40030003). Use the EID keyword only with the direction of IBM service personnel.

To execute a trace on a particular IP address, use the IP address, port number, ASID, and JOBNAME as targets for filtering the records.

To use this function, start by issuing the TRACE command:

```
TRACE CT,ON,COMP=SYSTCPIP, SUB=(tcpip_procedure_name)
R 01, OPTIONS=(IPADDR(12AB:0:0:CD30::/60), PORT(1012))
R 02, OPTIONS=(ENGINE, PFS), END
```

Trace records of type ENGINE or PFS for an IP address of 12AB:0:0:CD30::/60 and a port number of 1012 are captured. The IP address used is the foreign session partner IP address. The port number is the local session partner port number.

When filters are used, the trace record must be accepted by each filter. Each filter can specify multiple values (up to 16), and the trace record must match one of the values.

Table 12 on page 64 lists the data types and corresponding description.

Table 12. Data types

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound</td>
<td>Data received at the IP layer is considered inbound data. The source IP address and the destination port number are used.</td>
</tr>
</tbody>
</table>
Table 12. Data types (continued)

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound</td>
<td>Data sent in the PFS layer is considered outbound data. The destination IP address and the source port number are used.</td>
</tr>
</tbody>
</table>

The following are five criteria for selecting trace records for recording:

- **TYPE**
- **JOBNAME**
- **ASID**
- **IPADDR**
- **PORT**

Each criterion can specify one or more values. If a criterion has been specified, the record to be traced must match one of the values for that criterion. If a criterion has not been specified, the record is not checked and does not prevent the record from being recorded. However, the record must match all specified criteria.

In the above example, JOBNAME and ASID were not specified, so the value of JOBNAME and ASID in the record are not checked.

**Restriction:** IPADDR and PORT are exceptions. Some trace records do not have a IP address or a port number. Therefore, the IP address in the trace record is only checked if it is nonzero, and the port number is checked only if it is nonzero.

You can also specify a range of IP addresses to trace. For example,

```
TRACE CT,ON,COMP=SYSTCPIP, SUB=(TCPIP_PROC_NAME)
R xx, OPTIONS = (IPADDR(nn.nn.nn.nn, {nn.nn.nn.nn/mm.mm.mm.mm}), PORT(pppp{, pppp}))
```

**IPADDR**

An IP address. Up to 16 addresses can be specified. IPv4 addresses are in dotted decimal notation, for example: 192.48.24.57. IPv6 addresses are in colon-hexadecimal notation or in a combination of both colon-hexadecimal and dotted decimal for IPv4-mapped IPv6 addresses, for example: beef::c030:1839. Use an IP address of 0 for trace records that do not have an IP address. A subnet mask is indicated by a slash (/) followed by the prefix length in decimal or by a dotted decimal subnet mask for IPv4 addresses. The prefix length is the number of one bits in the mask. For IPv4 addresses it might be in the range of 1–32; for IPv6 addresses it might be in the range of 1–128, for example: 192.48.24/24 or 2001:0DB8::0/10, respectively.

**PORT**

The list of port numbers to be filtered. Up to 16 port numbers can be specified. The port numbers, specified in decimal, must be in the range 0–65535. A trace record with a zero port number is not subject to port number filtering.

You can specify the IPADDR and PORT keywords multiple times in an OPTIONS string. If you do, all the values are saved.

**Restriction:** All the values in the OPTIONS keyword must be specified in one trace command. The next trace command with an OPTIONS keyword replaces all the options specified.

**Formatting event trace records for TCP/IP stacks and Telnet**

You can format event trace records using IPCS panels or a combination of IPCS panels and the CTRACE command. For a description of the relevant IPCS panels, see “Steps for formatting component traces using IPCS panels” on page 51.

For more information about other CTRACE options, see the z/OS MVS IPCS Commands.
When using an IPCS panel, enter the trace types in the following format:

```plaintext
option DUCB() CID()
```

Following is the syntax for the CTRACE command for TCP/IP stacks and Telnet. For more information about the command and IPCS, see the z/OS MVS IPCS User's Guide.

**Type Name**
The name of a trace type. Only records of these types are formatted. For a list of types, see Table 11 on page 58.

**ADDR**
A control block address. Up to 16 control block addresses can be specified. Addresses in hexadecimal should be entered as `x'hhhhhhh'`.

**DUCB**
A process index for the thread of execution. Up to 16 indexes can be specified. The DUCB index values can be entered either in decimal (such as DUCB(18)) or hexadecimal (such as DUCB(X'12')), but are displayed in hexadecimal format.
CID
A connection identifier. Up to 16 identifiers can be specified. The CID values can be entered in either decimal (such as CID(182)) or hexadecimal (such as CID(X'0006CE7E')), but are displayed in hexadecimal. This is the same value that appears in the NETSTAT connections display.

IPADDR
An IP address. Up to 16 addresses can be specified. IPv4 addresses are in dotted decimal notation, for Example: 192.48.24.57. IPv6 addresses are in colon-hexadecimal notation or in a combination of both colon-hexadecimal and dotted decimal for IPv4-mapped IPv6 addresses, for example: beef::c030:1839. Use an IP address of 0 for trace records that do not have an IP address. A subnet mask is indicated by a slash (/) followed by the prefix length in decimal or by a dotted decimal subnet mask for IPv4 addresses. The prefix length is the number of one bits in the mask. For IPv4 addresses it might be in the range of 1 - 32; for IPv6 addresses it might be in the range of 1–128, for example: 192.48.24/24 or 2001:0DB8::0/10

PORT
A port number. Up to 16 port numbers can be specified. The port numbers can be entered in decimal, such as PORT(53), or hexadecimal, such as PORT(x'35'), but are displayed in decimal. These are port numbers in the range 0–65535. Use a port number of 0 for trace records that do not have a port number.

RECORD
The record number can be specified as a single hexadecimal value (for example, x'hhhhhhhh') or as a range (for example, x'hhhhhhhh':x'hhhhhhhh'). The record number is assigned as the records are written and can be found on the line of equal signs (=) that separates each record.

SESSION(DETAIL|SUMMARY)
Generate a report that shows TCP and socket send/receive activity on a per-session basis. This formatting option operates on TCPMIN and PFSMIN trace entries.

Tip: The SESSION formatting option for SYSTCPIP traces is useful for analyzing TCP traffic that is flowing over an IPSec tunnel. If you are accustomed to using packet trace (SYSTCPDA) for diagnosis, IPSec encryption of TCP headers and insertion of AH|ESP headers can result in an inability to do TCP-layer diagnosis (for example, matching up Acknowledgment with data packets, spotting retransmissions, analyzing flow control issues) with the packet trace report. By contrast, the SESSION formatting option for SYSTCPIP trace operates on TCP headers in the clear before encryption and after decryption, so this report can be more informative than a standard packet trace if encryption is involved or AH|ESP headers are present.

DETAIL
List each inbound or outbound flow within the socket and TCP layers. If neither the PFSMIN or TCPMIN CTRACE options were enabled in the trace, a null report is produced. DETAIL is the default.

SUMMARY
Show only the summary statistics.

Standard TSO syntax is used for the keywords and their values. For example, CID (1 2 3).

Figure 13 on page 68 shows the beginning of the CTRACE formatted output. The CTRACE command parameters are followed by the trace date and column headings. Then, there is one TCP/IP CTRACE record with four data areas.
**COMPONENT TRACE FULL FORMAT**

**COMP(SYSTCPIP)SUBNAME((TCPSVT))**

**** 11/03/1999

<table>
<thead>
<tr>
<th>Sysname</th>
<th>Mnemonic</th>
<th>Entry</th>
<th>Id</th>
<th>Time Stamp</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIC142</td>
<td>PFS</td>
<td>60010018</td>
<td>14:57:59.207826</td>
<td>Socket IOCTL Exit</td>
<td></td>
</tr>
<tr>
<td>HASID..001E</td>
<td>PASID..000E</td>
<td>SASID..001E</td>
<td>USER...OMPROUTE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCB....007E7A6</td>
<td>MOD1O..EZBPFIOC</td>
<td>REG14..16106C0</td>
<td>DUCB...000000C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CJD....000003A</td>
<td>PORT....0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IPADDR 3F98::D002:A521

ADDR 00000000 14D9F4E4 LEN 00000048 IOCTL Request

ADDR 00000000 12D7F874 LEN 00000004 SCB Flags

ADDR 00000000 12E88598 LEN 00000010 Return Value Errno ErrnoJr

ADDR 00000000 14D9FD0C LEN 0000008E CFGMREQ

Figure 13. Start of component trace full format

The parts of the TCP/IP CTRACE record are:

1. Standard IPCS header line, which includes the system name (VIC142), TCP/IP option name (PFS), time stamp, and record description.
2. TCP/IP header line with address space and user (or job name) information.
3. TCP/IP header line with task and module information.
4. TCP/IP header line with session information (CID, IP address, and port number).
5. TCP/IP header line for a data area. This line has the address (first four bytes are the ALET), the length of data traced, and the data description. Following the description, the actual data is in dump format (hexadecimal offset, hexadecimal data, and EBCDIC data).
6. There are four data areas in this example. The third data area (Return Value Errno ErrnoJr") has an extra line. The ERRNO line is added only when the return value is -1 and the ERRNO indicates an error. In this example, the return code is hexadecimal 462 (decimal 1122). See z/OS Communications Server: IP and SNA Codes for more information.
7. TCP/IP trailer and separator line with the record sequence number (hexadecimal 573E).

Additional fields in CTRACE output

The ERRNO line in Figure 13 on page 68 is one of two cases in which the formatter extracts data and formats it in a special way. The other case is for "TCB CTRL" and "IUDR" data. Several fields are copied from the data and formatted with character interpretation of fields, such as converting values to decimal...
or dotted decimal. Figure 14 on page 69 is an example. Note the additional fields (TcpState, TpiState, and others) following the hexadecimal data.

Figure 14. Component trace full format showing character interpretation of fields

SESSION report example

Purpose

This report shows traffic for TCP sessions, and is generated from PFSMIN and TCPMIN event trace entries.

Format

CTRACE COMP(SYSTCPIP) SUB((TCPCS)) SHORT OPTIONS((SESSION))

Example

COMPONENT TRACE SHORT FORMAT
COMP(SYSTCPIP)SUBNAME((TCPCS))
OPTIONS((SESSION))

Performance Sessions Report
16 Sessions Found

Explanation of Unique Fields

<table>
<thead>
<tr>
<th>RECTYPE</th>
<th>UNIQUE-1</th>
<th>UNIQUE-2</th>
<th>UNIQUE-3</th>
<th>UNIQUE-4</th>
<th>UNIQUE-5</th>
<th>UNIQUE-6</th>
<th>UNIQUE-7</th>
<th>UNIQUE-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SCB Flags</td>
<td>OSI Flags</td>
<td>Sel Bits</td>
</tr>
<tr>
<td>PFSX</td>
<td>RetVal</td>
<td>RetCode</td>
<td>RsnCode</td>
<td></td>
<td></td>
<td>SCB Flags</td>
<td>OSI Flags</td>
<td>Sel Bits</td>
</tr>
<tr>
<td>TCRE</td>
<td></td>
<td>(Msg Flags</td>
<td>EventPtr</td>
<td>UsrRecvBuf</td>
<td>Recv QLen</td>
<td>RecWin</td>
<td>OSI Flags</td>
<td>Conn State</td>
</tr>
<tr>
<td>TCRX</td>
<td>RetVal</td>
<td>RetCode</td>
<td>RsnCode</td>
<td>UsrSendBuf</td>
<td>Send QLen</td>
<td>SendWin</td>
<td>OSI Flags</td>
<td>Conn State</td>
</tr>
<tr>
<td>TCWE</td>
<td></td>
<td>Msg Flags</td>
<td>EventPtr</td>
<td>UsrSendBuf</td>
<td>Send QLen</td>
<td>SendWin</td>
<td>OSI Flags</td>
<td>Conn State</td>
</tr>
<tr>
<td>TCX</td>
<td>RetVal</td>
<td>RetCode</td>
<td>RsnCode</td>
<td></td>
<td></td>
<td>SCB Flags</td>
<td>OSI Flags</td>
<td>Sel Bits</td>
</tr>
<tr>
<td>TCW</td>
<td></td>
<td>Msg Flags</td>
<td>EventPtr</td>
<td>UsrSendBuf</td>
<td>Send QLen</td>
<td>SendWin</td>
<td>OSI Flags</td>
<td>Conn State</td>
</tr>
<tr>
<td>TCSN</td>
<td>IpID/TCPI</td>
<td>DataInPipe</td>
<td>NumPktSent</td>
<td>Bytes Sent</td>
<td>Send QLen</td>
<td>CongstWin</td>
<td>XmitCnt/Tot</td>
<td></td>
</tr>
<tr>
<td>TCSQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCRD</td>
<td>DropRsn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: If the trace does not contain TCPMin entries, the Session Summary will be missing or incorrect.

Directional Arrow Flow Descriptions:

--> Application to Network Call
<-- Network to Application Call
S-> Application Send/Write Call
<-> Application Send/Write Return
R-> Application Receive
<-> Application Receive Return
-Q Application Send/Write Data Queued (slow start, congestion avoidance, delayack, etc)
-Q O Application Send/Write Data Queued (malformed, bad checksum, no listener, etc)

TCP/IP services traces and IPCS support 69
Socket API traces

The SOCKAPI option, for the TCP/IP CTRACE component SYSTCPIP, is intended to be used for application programmers to debug problems in their applications. The SOCKAPI option captures trace information related to the socket API calls that an application might issue. The SOCKET option is primarily intended for use by TCP/IP Service and provides information meant to be used to debug problems in the TCP/IP socket layer, UNIX System Services, or the TCP/IP stack.

CTRACE is available only to users with console operator access. If the application programmer does not have console access, someone must provide the CTRACE data to the programmer. For security reasons, it is suggested that only the trace data related to the particular application be provided. The following sections explain how to obtain the trace data for a particular application, format it, and save the formatted output. The application data can be isolated when recording the trace, or when formatting it, or both.

z/OS provides several socket APIs that applications can use. The figure in the example shows different APIs along with the high level flows of how they interact with the TCP/IP stack.

The SOCKAPI trace output is captured in the Sockets Extended Assembler Macro API (the Macro API). Given the structure of the TCP/IP APIs, this trace also covers the Call Instruction API, the CICS Socket API, and the IMS socket API. Some of the socket APIs based on the Macro API currently encapsulate some of the Macro API processing.
For example, in a CICS TS environment, CICS sockets-enabled transactions do not have to issue an 
SOCKAPI call. Rather, this is done automatically for the socket API by the TCP/IP CICS TRUE (Task 
Related User Exit) component layer. If the socket API trace is active, trace records for the SOCKAPI calls 
are created.

Figure 15. TCP/IP networking API relationship on z/OS

**Recommended options for the application trace**

The CTRACE facility has flexibility such as filtering, combining multiple concurrent applications and 
traces, and using an external writer.

**Guidelines:** Consider the following guidelines when using CTRACE:

- Although the CTRACE can be used to trace multiple applications at the same time and in conjunction 
  with other trace options, it is not recommended. Multiple traces make problem determination more 
difficult.

- For performance reasons, the data being recorded should be filtered, to minimize the overhead of 
  recording the trace, to make formatting faster, to save storage, and to minimize wrapping (overwriting of 
older trace records by new trace records).

Ideally, you should use the CTRACE facility to capture all the SOCKAPI trace records for one application. 
The trace can be filtered various ways when formatting. If necessary, you can limit the trace data 
collected by IP address or port number, but you risk some records not being captured. For example, the 
problem might be that the wrong IP address or port number was coded or used. Both the IP address and 
port number are formatting options.

**Guidelines:** Consider the following guidelines to optimally capture the application data:

- Trace only one application.
  Use the job name or ASID option when capturing the trace to limit the trace data to one application.

- Trace only the SOCKAPI option.
  To get the maximum number of SOCKAPI trace records, specify only the SOCKAPI option.

**Tip:** You also receive exception records. Exception records are always traced because they are 
considered unusual events.

- Use an external writer.
  The external writer is recommended to:
- Separate the SOCKAPI trace records from other internal data that exist in a dump (for security and other reasons)
- Avoid interrupting processing with a dump of the trace data
- Keep the buffer size from limiting the amount of trace data
- Avoid increasing the buffer size, which requires restarting TCP/IP
- Handle many trace records
  
  • Trace only one TCP/IP stack.

  If you are running with multiple TCP/IP stacks on a single z/OS image, use the external writer for only one TCP/IP stack.

  • Activate the data trace only if more data is required.

  The SOCKAPI trace contains the first 96 bytes of data sent or received, which is sufficient. If additional data is needed, the data trace records can be correlated with the SOCKAPI records.

### Collecting the SOCKAPI trace option

This topic describes how to collect the trace for use by application programmers.

The existing CTRACE facility for TCP/IP's SYSTCPIP component is used for the SOCKAPI trace option. Collecting the trace is described generally in “Component trace” on page 43.

The trace can be started automatically when TCP/IP starts or can be started or modified while TCP/IP is executing. A CTRACE PARMLIB member is required for starting the trace automatically, and can optionally be used after TCP/IP has been started.

**CTRACE PARMLIB member CTIEZBxx**

Sample member CTIEZB00 is shipped with TCP/IP.

### TCP/IP start procedure

The CTRACE PARMLIB member can be specified in the TCP/IP start procedure or on the `START` command.

The sample TCPIPROC start procedure specifies member name CTIEZB00. Specifying the member name on the `START` command depends on how the TCP/IP start procedure is coded.

The following example illustrates overriding the PARMLIB member name using the sample TCPIPROC start procedure.

```
S TCPIPROC,PARM='CTRACE(CTIEZBAN)'
```

Use the `TRC` option to specify the suffix of the SYS1.PARMLIB member for SYSTCPIP CTRACE initialization. The `TRC` option appends the two letters to CTIEZB. The full member name is CTIEZBxx. The default value is 00. In this example, the PARMLIB member for SYSTCPIP is CTIEZBAN, an equivalent command is

```
S TCPIPROC,PARM='TRC=AN'
```

Use the `IDS` option to specify the suffix of the SYS1.PARMLIB member for SYSTCPI S CTRACE initialization. The `IDS` option appends the two letters to CTIIDS. The full member name is CTIIDSxx. The default value is 00.

```
S TCPIPROC,PARM='IDS=AN'
```

You can specify multiple parameters. If you specify both the CTRACE and TRC parameters, the parameter that appears last in the parameter string is used.

### TRACE command

Use the MVS TRACE command to start, modify, or stop the trace after TCP/IP has been started. The TRACE command replaces all prior settings except the buffer size. When modifying the options, be sure to specify the SOCKAPI option.
The examples below show how to start the trace.

The SUB option is the subtrace name, which for TCP/IP, is the job name of the stack (this is the TCP/IP start procedure name). In the following examples, the subtrace is TCPIPROC (the name of the sample procedure), and the variable fields are in lowercase.

To activate the trace with just the SOCKAPI option, code the following:

```
TRACE CT,ON,COMP=SYSTCPIP,SUB=(tcpiproc)
R n,JOBNAME=(ezasokjs),OPTIONS=(sockapi),end
```

To specify a PARMLIB member, which contains the trace options, code the following:

```
TRACE CT,ON,COMP=SYSTCPIP,SUB=(tcpiproc),PARM=ctiezban
```

To stop the trace, either use the TRACE CT,OFF command or reissue the TRACE CT,ON command with different parameters.

The following is an example of the OFF option:

```
TRACE CT,OFF,COMP=SYSTCPIP,SUB=(tcpiproc)
```

When using the TRACE command, be sure to notice message ITT038I, which indicates whether the command was successful or not. The following is an example of ITT038I:

```
14.11.29  ITT038I NONE OF THE TRANSACTIONS REQUESTED VIA THE TRACE CT COMMAND WERE SUCCESSFULLY EXECUTED.
```

or

```
14.11.40  ITT038I ALL OF THE TRANSACTIONS REQUESTED VIA THE TRACE CT COMMAND WERE SUCCESSFULLY EXECUTED.
```

See z/OS MVS System Commands for more information about the TRACE command.

**External writer**

If the trace is active, it is always written to an internal buffer (whose size is set to BUFSIZE during TCP/IP initialization). The internal buffer is available only in a dump of TCP/IP. Optionally, the trace can also be written to an external data set using the MVS CTRACE external writer. If you use an external writer, the trace records are copied to a data set.

To use an external writer, you must create a procedure that specifies the job to run (the external writer) and the trace output data sets. Also, see z/OS MVS Diagnosis: Tools and Service Aids for more information about CTRACE, the external writer (including a sample procedure), dispatching priority for the external writer job, and wrapping.

The external writer must be started before the trace can be activated. The trace must be inactivated before the writer can be stopped. The writer must be stopped before the data set can be formatted or transferred. For example, here is a sequence of commands for using an external writer procedure named ctw:

```
TRACE CT,WTRSTART=ctw
TRACE CT,ON,COMP=SYSTCPIP,SUB=(tcpiproc)
    R n,JOBNAME=(ezasokjs),OPTIONS=(sockapi),WTR=ctw,end
<run application being traced>
TRACE CT,OFF,COMP=SYSTCPIP,SUB=(tcpiproc)
TRACE CT,WTRSTOP=ctw
```

The external data set (specified in the procedure "ctw") is now available for formatting.

**Filtering options when recording the trace**

Options for filtering include the following:

**Component**

- Required - SYSTCPIP for SOCKAPI.
**Subtrace**  
Required - TCP/IP stack name.

**Trace option**  
Highly recommended to limit the tracing to the SOCKAPI option. You can also filter on this option when formatting the trace.

**Jobname**  
Highly recommended for socket applications to limit the trace to one application. You can also filter on this option when formatting the trace.

**ASID**  
Highly recommended as an alternative to the job name if the application has already started running (otherwise, the ASID is unknown). You can also filter on this option when formatting the trace.

**IP address**  
Recommended only for certain scenarios (see discussion below). The IP address is a filtering option when formatting the trace.

**Port**  
Recommended only for certain scenarios (see discussion below). The port number is a filtering option when formatting the trace.

If trace data for multiple applications is collected in the same data set or in a dump, the trace output should be filtered so that application programmers see only the data for their applications for security reasons.

Use the IP address and Port options to filter the trace, both when collecting the trace and when formatting the trace. Generally, it is best to collect all the application records to avoid having to re-create the problem. After the records are collected, you can filter the records various ways when formatting the trace.

An example scenario in which you would only want to collect records for one IP address is if there is a problem with a particular remote client, and the local application has many clients. If you tried to record the trace records for all clients, there could be a lot of data and the trace could wrap, thus overwriting older records. Note that if you specify an IP address when collecting the trace, the trace records with no IP address are also collected. So you get all the records for the problem client, and some other client records.

An example scenario, in which you would only want to collect records for one port number, is if there is a problem with a server on one port. If you specify a port number when collecting the trace, the trace records with no port number are also collected. You get all the records for the problem server application, and some other applications' records.

IP address/port filtering, when specified, has a varying effect depending on the type of socket call being traced. Table 13 on page 74 describes the effect of IP address/port filtering for the different types of socket API calls. The Yes or No specified in columns 2 and 3 indicates whether local port filtering and remote IP address filtering can be activated for the socket calls in column 1. Yes means that if a filter is set, only the calls matching that filter are collected. No means that whether a filter is specified, all the calls are collected (no filtering is done).

<table>
<thead>
<tr>
<th>Socket call</th>
<th>Filtering active?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local port</td>
<td>Remote IP address</td>
</tr>
<tr>
<td>ACCEPT</td>
<td>Yes</td>
<td>No (1)</td>
</tr>
<tr>
<td>BIND</td>
<td>Yes/No (2)</td>
<td>No</td>
</tr>
<tr>
<td>CONNECT</td>
<td>Yes/No (3)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 13. IP address and port filtering effect on different types of socket API calls
<table>
<thead>
<tr>
<th>Socket call</th>
<th>Filtering active?</th>
<th>Local port</th>
<th>Remote IP address</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANCEL</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>FREEADDRINFO</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>GETADDRINFO</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>GETCLIENTID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETHOSTBYADDR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETHOSTBYNAME</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETHOSTID</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETHOSTNAME</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETNAMEINFO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INITAPI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECFROM</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>RECVMSG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SELECT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SELECTEX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SENDMSG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SENDTO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCKET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAKESOCKET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TERMAPI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LISTEN</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>CLOSE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GETPEERNAME</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETSOCKNAME</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GETSOCKOPT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GIVESOCKET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FNCTL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOCTL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>READ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>READV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RECVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHUTDOWN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SETSOCKOPT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRITE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WRITEV</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where Yes is indicated in Table 13 on page 74, the assumption is made that the information necessary for the filtering option is available. For example, if a SEND is issued on a socket that is not bound or not connected, no filtering takes place. In addition, the following describe some of the special considerations for the different socket calls in the previous table.

1. Even though the remote IP address is available after an ACCEPT call, it is not used for filtering the exit ACCEPT trace record. This is done to avoid confusion where the entry trace record for ACCEPT would not be filtered, but the exit trace record would.

2. Assumes a BIND issued for a nonzero port. If a BIND is issued for port 0 (meaning an ephemeral port is assigned by TCP/IP), no filtering takes place for this BIND call.
3. If the socket is bound at the time of the CONNECT, local port filtering is honored. Otherwise, the CONNECT is not subject to local port filtering.

**Monitoring the trace**

Use the MVS DISPLAY TRACE command to check the trace options currently in effect. The following example is an example of a console showing the display command and the resulting output (the line numbers were added for discussion reference).

```
1. 14.27.14  D TRACE,COMP=SYSTCPIP, SUB=(tcpiproc)
2. 14.27.14  IEE843I 14.27.14  TRACE DISPLAY
3.  SYSTEM STATUS INFORMATION
4.  ST=(ON,0064K,00064K) AS=ON   BR=OFF  EX=ON  MT=(ON,064K)
5.  TRACENAME
6.  =========
7.  SYSTCPIP   MODE BUFFER HEAD SUBS
8.  =============
9.  OFF        HEAD    1
10. SUBTRACE    MODE BUFFER HEAD SUBS
11. =-----------------------------------------------
12. TCPIPROC    ON   0008M
13. ASIDS      *NONE*
14. JOBNAME    EZASOKJS
15. OPTIONS    SOCKAPI
16. WRITER     CTW
```

For component SYSTCPIP, do not be misled by line 10 in the example. It always says the trace is off because TCP/IP uses the subtrace for all tracing. The subtrace TCPIPROC on line 14 indicates the actual state of the trace. In this example, the trace is active (ON) with an internal buffer size of eight megabytes and only the SOCKAPI option is active. Only one application (EZASOKJS) is being traced and the trace is being written to an external writer.

**Line Description**

1. The MVS DISPLAY TRACE command. For more information about this command, see z/OS MVS System Commands.

2–4. These are explained in z/OS MVS System Messages, Vol 1 (ABA-AOM) for IEE843I.

5–7. Show that this is the CTRACE component SYSTCPIP.

8–11. These are not applicable for TCP/IP because TCP/IP uses only the subtrace facility of the MVS CTRACE service. Instead of activating a global trace, the trace options are specified for each stack individually. Thus, there can be multiple TCP/IP stacks with different CTRACE options. Note however that line 10 is useful — it shows that there is one subtrace (meaning one TCP/IP stack is active).

14. Shows the "subtrace" name is the TCP/IP procedure name (TCPIPROC in this example), whether the trace is active (MODE=ON), and the buffer size is eight megabytes. The buffer size is the number of bytes that is used for recording the trace.

15–16. Show the ASID and JOBNAME filtering values. If any ASIDs or JOBNAMEs are listed, only those trace entries matching the ASID or JOBNAME are collected. "ASIDS *NONE*" indicates that all address spaces are being traced (there is no filtering).

17. Shows the specific options that are active, as specified in the TRACE command or in the CTIEZBxx PARMLIB member. If port or IP address filtering were active, they would appear on this line.

18. Shows the external writer is inactive. If the writer is active, the writer procedure name is shown instead of *NONE*.
Capturing the trace

If you use only the internal buffer, you must obtain a dump of TCP/IP to view the CTRACE records. It is usually a good idea to also capture the application address space. For example, using the MVS DUMP command, type the following commands.

**Tip:** The SDATA options specified are appended to other options.

The SDATA options shown here are the generally recommended options.

```
DUMP COMM=(Sample dump for SOCKAPI)
R n,JOBNAM=(tcpiproc,ezasokjs),CONT
R n,SDATA=(ALLNUC,CSA,LPA,LSQA,GNR,SWA,SQA,TRT),CONT
R n,END
```

**Notes:**

- You can type the first three commands in advance, and you can then just type the fourth command at the correct moment to capture the events.
- If you use the external writer, “External writer” on page 73, explains how to capture the trace in a data set.

Formatting the SOCKAPI trace option

Use the IPCS CTRACE command to format the trace, both for a dump and for an external writer. Interactively, you can either type the CTRACE command on the IPCS Command panel or you can use the panel interface. IPCS is also available in batch. Whichever interface you choose, for TCP/IP we recommend using the CTRACE QUERY command to find out what subtraces are contained in the data set. For example, the CTRACE QUERY(SYSTCPIP) SHORT command produced the following output:

```
COMPONENT TRACE QUERY SUMMARY
COMPONENT SUB NAME
--------- --------
0001. SYSTCPIP TCPSVT
0002. SYSTCPIP TCPSVT3
0003. SYSTCPIP TCPSVT1
0004. SYSTCPIP TCPSVT2
```

There are several filters available that can help to limit the amount of data formatted. In addition to the CTRACE options (start and stop time, and such) provided by IPCS, there are some options specifically for TCP/IP:

**DUCB**

Not applicable for SOCKAPI. (DUCB is an internal TCP/IP token.)

**CID (connection identifier)**

Not applicable for SOCKAPI.

**IPADDR**

Use for SOCKAPI. Specify the IPv4 addresses in dotted decimal format, with an optional prefix value (1 to 32) or a subnet mask in dotted decimal form. Specify the IPv6 address in colon-hexadecimal notation (or in a combination of colon-hexadecimal and dotted decimal for IPv4–mapped IPv6 addresses), with an optional prefix value (1 to 128). Several socket calls do not use an IP address. To see the trace records without an IP address (or with an IP address of all zeros), specify zero for one of the IPADDR values. For example, IPADDR(0,9.67.113/24) formats all CTRACE records with an IP address of 000.000.000.000 and formats all CTRACE records with an IP address of 009.067.113.*, where * is any number from 0 to 255.

**PORT**

Use for SOCKAPI. Specify the port number in decimal. Several socket calls do not have an associated port number, such as INITAPI and SOCKET. To see the trace records without a port (or with a port of 0), specify zero for one of the port values. For example, PORT (0, 389, 1925).

You can save the formatted output to the IPCSPRNT data set.

If the formatted output does not contain the records you expect:
• In a dump, you can check the options specified when recording the trace by using the TCPIPCS TRACE command to display the TCP/IP CTRACE filtering options in effect. This also indicates whether any records were lost. See Chapter 6, “IPCS subcommands for TCP/IP,” on page 165 for more information about the TCPIPCS TRACE command.

• For either a dump or an external writer data set, use the CTRACE QUERY command to see what tracing was in effect (subtrace name, start and stop times). For a dump, this command also shows the buffer size and options. For example, the command CTRACE QUERY (SYSTCPIP) SUB ((TCPIPROC)) FULL command produced the following output for a dump:

```
COMPONENT TRACE QUERY SUMMARY
COMP (SYSTCPIP) SUBNAME ((TCPIPROC))
    START = 01/10/2000 19:49:21.234490 GMT
    STOP = 01/10/2000 19:51:51.360653
    Buffer size: 0256K
    OPTIONS: ACCESS , OPCMDS , OPMGS , QUEUE , ROUTE , INIT , SOCKAPI , SOCKET
    OPTIONS: MINIMUM
```

For TCP/IP, the first line of "options" (showing ACCESS) is the applicable one. This shows the options as specified on the command line or in the CIEZBxx PARMLIB member.

See z/OS MVS IPCS User's Guide for more information about CTRACE formatting. See z/OS MVS IPCS Commands for more information about the CTRACE command.

**Reading and interpreting the SOCKAPI trace option**

The SOCKAPI trace records trace the input and output parameters for most of the API calls. The API calls not traced are GETIBMOPT, TASK, GLOBAL, NTOP, PTON, and any API calls that fail before the trace point is reached. (An API call fails if module EZBSOH03 cannot be located, if EZBSOH03 is unable to obtain storage, and so on.) In addition to tracing API calls, trace records are created for a few special situations (Default INITAPI and Unsolicited Event exit being driven). For API calls, there is an Entry record describing the input parameters, and an Exit record describing the output parameters (with some input parameters repeated for clarification). For asynchronous calls, there is also an Async Complete (Asynchronous Complete) record (see “Examples of SOCKAPI trace records” on page 80).

The following examples include:

• A SOCKAPI trace record
• Trace records for asynchronous applications
• Resolver API calls
• External IOCTL commands
• API Call with an IOV parameter
• Default INITAPI
• Default TERMAPI
• SELECT
• SELECTEX
• Token error
• Unsolicited event exit

**A SOCKAPI trace record**

A typical SOCKAPI record is shown below. This example is a READ Entry.

The lines are numbered for discussion reference only. The description for each line is for the example shown. Lines 1-5 are the separator and header lines that exist for all SOCKAPI trace records. Lines 6-7 are optional header lines.
The parameters for the specific call follow the header lines. For Entry records, the input parameters are shown. For Exit and Asynchronous Complete records, the output parameters are shown and some input parameters might also be shown for reference. Parameters are only formatted if they were specified in the call (optional parameters not supplied are not formatted). The parameters are listed in a specific order for consistency. The parameter names are the same as the names in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference with a few exceptions; for example, S is formatted as SOCKET. The parameter name, value, and address are shown on one line if the value fits. Numeric parameter values are in decimal unless followed by a lowercase x indicating hexadecimal. Whenever possible, the values are interpreted (such as ERRNO) for reference.

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>This separator line shows the previous SYSTCPIP component trace record number in hexadecimal.</td>
</tr>
<tr>
<td>2</td>
<td>The first data line has the host name (MVS026), trace option (SOCKAPI), trace code (60050042), time, and trace record name.</td>
</tr>
<tr>
<td>3</td>
<td>The home, primary, and secondary ASIDs are always the same value (application's ASID) for the SOCKAPI trace option. The job name is also shown.</td>
</tr>
<tr>
<td>4</td>
<td>The MVS TCB address is shown. TIE (Task Interface Element) is the value of the TASK parameter on the EZASMI macro. The TIE is described in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference. The parameter list address and DUCB are shown. Multiple concurrent calls can use the TIE; if so, they must have a different PLIST. The key is the 4-bit storage key from the PSW.</td>
</tr>
<tr>
<td>5</td>
<td>The ADSNAME (from the INITAPI call) is formatted in EBCDIC. The subtask name (from the INITAPI call) is formatted in EBCDIC if possible; otherwise, it is formatted in hexadecimal. The token is an 8-byte value, which identifies the INITAPI call instance.</td>
</tr>
<tr>
<td>6–7</td>
<td>If applicable, the ports and IP addresses are shown. The ports are formatted in decimal; the IP addresses are in dotted decimal.</td>
</tr>
<tr>
<td>8</td>
<td>The REQAREA parameter is shown because it was specified by the application. This is the 4-byte token presented to the application’s exit when the response to the function request is complete. At the far right, the address in the application program of the REQAREA parameter is shown.</td>
</tr>
<tr>
<td>9</td>
<td>The SOCKET parameter is formatted in decimal. Its address is also shown.</td>
</tr>
<tr>
<td>10</td>
<td>The NBYTE parameter (number of bytes to be read) is formatted in decimal, followed by its address.</td>
</tr>
<tr>
<td>11</td>
<td>The ALET parameter is formatted in hexadecimal, followed by its address.</td>
</tr>
</tbody>
</table>
The BUF parameter currently has no data (because no data has been read) but its address is shown. In the READ Exit (or READ Async Complete) record, if the call was successful, the first 96 bytes of the data are also shown.

Examples of SOCKAPI trace records

This topic includes descriptions and examples of the SOCKAPI trace records.

- “Successful API Call” on page 80
- “API call fails synchronously” on page 80
- “API call fails synchronously with parameter not addressable” on page 81
- “API call fails synchronously with diagnostic reason code” on page 81
- “Resolver API calls” on page 81
- “External IOCTL commands” on page 83
- “API call with an IOV parameter” on page 84
- “Default INITAPI” on page 84
- “Default TERMAPI” on page 84
- “SELECT” on page 84
- “SELECTEX” on page 85
- “Token Error” on page 86
- “Unsolicited event exit” on page 86

Successful API Call

For asynchronous APIs, the Exit record merely indicates whether the call was acceptable. The contents of general-purpose register 15 are displayed to indicate this. The Asynchronous Complete record shows the actual results of the call. In addition to the output parameters, several interesting values are traced, including the contents of general-purpose register 0, the pointer to the asynchronous exit routine, the token passed to the asynchronous exit, the key in which the asynchronous exit was invoked, and the authorization state in which the exit is invoked. These values are not parameters on the GETHOSTID call, so their addresses are not shown. In this example, note also that the return code is formatted in dotted decimal and the meaning of the return code is provided.

Note: The API call might complete synchronously, in which case the Async Complete trace record might appear in the trace prior to the Exit record.

------------------------------------------------------------------------
MVS026 SOCKAPI 60050012 19:27:08.111729 GETHOSTID Exit
HASID....0027 PASID....0027 SASID..0027 JOBNAME..EZASOKOS
TCB......006E6A68 TIE......00006DF8 PLIST..00006E0C DUCB.....0000000C KEY..8
ADSNAME..EZASOKOS SUBTASK..00000000 00000000 TOKEN....7F6F3798 09902FB0
REQAREA..: 00006D90x Addr..00006D90
R15......: 0 (CALL ACCEPTED)
------------------------------------------------------------------------
MVS026 SOCKAPI 60050032 19:27:08.111741 GETHOSTID Async Complete
HASID....0027 PASID....0027 SASID..0027 JOBNAME..EZASOKOS
TCB......006E6A68 TIE......00006DF8 PLIST..00006E0C DUCB.....0000000C KEY..8
ADSNAME..EZASOKOS SUBTASK..00000000 00000000 TOKEN....7F6F3798 09902FB0
REQAREA..: 00006D90x Addr..00006D90
R0.......: 0x (NORMAL RETURN)
ASYNC PTR: 00006B1C
EXIT TOKEN: 00006B9B
EXIT KEY.: 8x
AUTHORIZATION STATE: PROBLEM
RETCODE..: 9.67.113.58 (HOST IP ADDRESS) Addr..00006EB4

API call fails synchronously

An asynchronous API call might fail synchronously or asynchronously. In this example, the WRITE call error was detected in the synchronous processing, so general-purpose register 15 has a nonzero value.
The ERRNO value is interpreted (in this case, the NBYTE parameter on the WRITE call had a value of zero, which is not acceptable).

**Note:** The ERRNO value is the TCP/IP Sockets Extended Return Code. See z/OS Communications Server: IP and SNA Codes for information about TCP/IP Sockets Extended Return Codes.

---

```plaintext
API call fails synchronously with parameter not addressable

If a parameter specified in the API call is not addressable by TCP/IP when creating the SOCKAPI record, the string (** PARAMETER NOT ADDRESSABLE **) is shown instead of the parameter value. The parameter address is shown at the far right, as usual.

---

```plaintext
API call fails synchronously with diagnostic reason code

If the API call does not complete successfully, the return code, ERRNO value (in decimal and interpreted), and possibly a diagnostic reason code are shown. The first two bytes of the diagnostic reason code are a qualifier (IBM internal use only). The last two bytes of the diagnostic reason codes are the UNIX ERRNOJR values described in z/OS Communications Server: IP and SNA Codes.

---

**Resolver API calls**

The GETHOSTBYADDR and GETHOSTBYNAME IPv4 Resolver API calls use the HOSTENT structure described in the calls in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference. As shown in the following GETHOSTBYADDR Exit trace example, the HOSTENT address is shown on one line, and the contents of the HOSTENT structure are described on separate lines. There can be multiple aliases and host addresses; each one is listed separately. In this example, there are two aliases.

---
The GETADDRINFO for IPv4 or IPv6 Resolver API shows that the call is requesting the IP address for the host (node) name MVS150. No service name is provided. GETADDRINFO exit shows that the hostname was resolved to the IPv4 address 9.67.113.117. These fields are described in the Macro and CALL section in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.

The FREEADDRINFO for IPv4 or IPv6 Resolver API call displays the RES (ADDRINFO) structure that is freed. This field is in the Macro and CALL section in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.
The GETNAMEINFO for IPv4 or IPv6 Resolver API shows that the call is requesting the name of the IPv6 address \( ::1 \) and the service name for port 1031. GETNAMEINFO Exit shows that the IP address was resolved to the name loop6int.resdns.ibm.com and no service name was found for port 1031 (hence the service name is the input port number). These fields are in the Macro and CALL section in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.

External IOCTL commands

For external IOCTL commands, the command name is interpreted. For IBM internal-use-only commands, the hexadecimal value of the command is shown. The input and output for each command can differ. In this example, the SIOCGIFCONF command requests the network interface configuration. The exit record shows the call was successful (the return code is zero) and the network interface configuration is shown.
API call with an IOV parameter

The IOV parameter is an array of structures used on the READV, RECVMSG, SENDMSG, and WRITEV API calls. Each structure contains three words: the buffer address, the ALET, and the buffer length. Each IOV entry is shown on one line. When there is data available (READV Exit, RECVMSG Exit, SENDMSG Entry, and WRITEV Entry), some of the buffer data is also displayed. A maximum of 96 bytes of data are displayed.

In the READV Exit example, three IOV entries were specified, but only two were used. All the data is displayed because the total is less than 96 bytes.

Default INITAPI

An explicit INITAPI call is not required prior to some API calls, so TCP/IP creates a default INITAPI. (See z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference for the complete list.) The default INITAPI record is traced after the Entry record for the API call that caused the default INITAPI to occur. There is just one record for this event (no Exit record).

Default TERMAPI

Usually, an application ends the connection between itself and TCP/IP by issuing the TERMAPI call. But sometimes, the connection ends for another reason, such as the application being canceled. In this case, TCP/IP issues a default TERMAPI. The default TERMAPI is traced in a SOCKAPI trace record. There is just one record for this event (no Exit record).

SELECT

For SELECT and SELECTEX, the socket masks are formatted in both binary and decimal. The socket list is displayed first in binary. The socket numbers are indicated by the bit position in the mask, starting with bit position 0 (for socket 0), which is the rightmost bit. The bit positions (socket numbers) are shown at left.

For example, the lowest numbered sockets are on the last line; they are sockets 0 - 31. In this line, only sockets 0, 1, 2, and 3 are selected. As shown in the following example, the binary mask, the decimal
socket numbers are listed in numerical order. This is a convenient way to check whether the mask is coded as intended.

SELECTEX

The SELECTEX call can contain a list of ECBs. The high-order bit on the SELECB address indicates whether a list of ECBs was specified. Since the high-order bit is on in this example, there is a list of ECBs. The end of the list is indicated by the high-order bit in the ECB address. In this example, the time limit expired before any ECBs were posted. Since no selected sockets were ready, the read, write, and error masks indicate that there is no data to report.
**Token Error**

When an API call fails early in processing, before the SOCKAPI Entry record is created, the Token Error SOCKAPI record is written. In the example, the BIND call failed due to the token being overwritten. (The token at offset eight has X'FFFF'.) There is no BIND Entry or Exit record.

---

**Unsolicited event exit**

If the unsolicited event exit is driven, a SOCKAPI trace record is created (if the SOCKAPI trace option is active).

**Note:** The key in the header is 0. This means that the UEE trace record was created when TCP/IP was in key zero. The UEEXIT has key 8, which means the UE exit is invoked in key eight.

---

**Correlating the data trace and packet trace with the SOCKAPI trace**

The SOCKAPI option only records the first 96 bytes of data. To see all the data that was sent or received, you must also activate the data trace or packet trace. The data trace can be correlated easily with the SOCKAPI trace option because both traces are recording data between the application and the TCP/IP stack. The traces can be merged with the IPCS MERGE subcommand. The data trace header contains fields that allow the full data to be correlated.

Figure 16 on page 87 shows the data trace record corresponding to the READ Exit SOCKAPI trace entry in Figure 17 on page 87. The server issues READ and waits for a message. The data trace record shows the entire 120 bytes of data because the FULL option was used when starting the data trace. In the READ Exit record, only the first 96 bytes of data are shown.

The records in the two traces can be correlated by the following:

**Time**

The data trace must be prior to the READ Exit record time. The data trace time is 20:08:09.181239. The READ Exit record time is 20:08:09.181354.

**Jobname**

The job name is EZASOKAS in both records.

**ASID**

The ASID is the server’s 0024 (hexadecimal) in both records.

**TCB**

The TCB is 0066E6A68 in both records.

**Data length**

In the data trace, the length is 78 hexadecimal, which is 120 decimal. The SOCKAPI trace record shows that the return code is 120 (decimal) bytes.
Port
The source port number in the data trace record (11007 decimal) matches the local port number in the SOCKAPI trace record. The destination and remote ports also match (1040 decimal).

IP Address
The IP addresses are handled in the same way as the port numbers. In this example, both the client and server were on the same TCP/IP stack, so the IP addresses are the same.

---

Figure 16. Data trace record.

Figure 17. SOCKAPI trace record.

The packet trace, on the other hand, does not correlate well with the SOCKAPI trace option. The packet trace records data being sent or received between the TCP/IP stack and the network. The packet trace data has headers and the data can be segmented or packed.

Packet trace (SYSTCPDA) for TCP/IP stacks
Packet trace is a diagnostic method for obtaining traces of IP packets flowing to and from a TCP/IP stack on a z/OS Communications Server host. You can use the PKTTRACE statement to copy IP packets as they enter or leave TCP/IP, and then examine the contents of the copied packets. To be traced, an IP packet must meet all the conditions specified on the PKTTRACE statement.

The trace process
Trace data is collected as IP packets enter or leave TCP/IP. The actual collection occurs within the device drivers of TCP/IP, which capture the data that is received from or sent to the network.
Packets that are captured have extra information added to them before they are stored. This extra information is used during the formatting of the packets. The captured data reflects exactly what the network sees. For example, the trace contains the constituent packets of a fragmented packet exactly as they are received or sent.

The selection criteria for choosing packets to trace are specified through the PKTTRACE statement for the TCP/IP address space. See z/OS Communications Server: IP System Administrator's Commands for more information about the PKTTRACE statement and subcommand.

The PKTTRACE statement and subcommand are applied to device links that are defined in the TCP/IP address space through the LINK statement. Figure 18 on page 88 illustrates the overall control and data flow in the IP packet tracing facility.

**Supported devices**

IP packet tracing is supported for all network interfaces supported by TCP/IP (including loopback).

When using the MULTIPATH option of the IPCONFIG statement, packets can be sent over multiple interfaces. All of the interfaces must be traced. In this case specify an IP address to select the required packet. This statement also applies to the case where packets can be received over multiple interfaces (even if MULTIPATH is not used by this TCP/IP).

For information about the format of the packet trace command (VARY PKTTRACE) see z/OS Communications Server: IP System Administrator's Commands.

**Starting packet trace**

To start packet trace, use the following command:

```
V TCPIP,,PKT
```

**Security Note:** To use any VARY command, the user must be authorized in RACF.

The RACF profile for each user must have access for a resource of the form MVS.VARY.TCPIP.xxx, where xxx is the first eight characters of the command name. For packet trace, this would be MVS.VARY.TCPIP.PKTTRACE.

Traces are placed in an internal buffer, which can then be written out using an external writer. The MVS TRACE command must also be issued for component SYSTCPDA to activate the packet trace.
After starting packet trace, you can display the status using the Netstat command, as shown in the following example:

```
NETSTAT -p TCPCS -d
MVS TCP/IP NETSTAT CS V1R10 TCPIP Name: TCPCS 18:03:31
DevName: LOOPBACK      DevType: LOOPBACK
DevStatus: Ready
LnkName: LOOPBACK      LnkType: LOOPBACK   LnkStatus: Ready
NetNum: 0   QueSize: 0
BytesIn: 192537    BytesOut: 192537
ActMtu: 65535
BSD Routing Parameters:
  MTU Size: 00000    Metric: 00
  DestAddr: 0.0.0.0  SubnetMask: 0.0.0.0
Packet Trace Setting:
  Protocol: *      TrRecCnt: 00000000  PckLength: FULL
  Discard : 0
  SrcPort: *       DestPort: *         PortNum *
  IpAddr:   9.67.113.1 SubNet:   *
Multicast Specific:
  Multicast Capability: No
```

In this example, the packet length (PckLength) is FULL and TrRecCnt is the number of packets written for this device.

**Note:** If you are a TSO user, use the corresponding NETSTAT DEV command.

### Modifying options with VARY

After starting a packet trace, you can change the trace using the VARY command. For example, if you want to change the packet trace to abbreviate the data being traced, use the following command:

```
V TCPIP,tcp proc,PKT,ABBREV
```

You can display the results of the VARY command using the Netstat command:

```
NETSTAT -p TCPCS -d
MVS TCP/IP NETSTAT CS V1R10 TCPIP Name: TCPCS 18:03:31
DevName: LOOPBACK      DevType: LOOPBACK
DevStatus: Ready
LnkName: LOOPBACK      LnkType: LOOPBACK   LnkStatus: Ready
NetNum: 0   QueSize: 0
BytesIn: 813    BytesOut: 813
ActMtu: 65535
BSD Routing Parameters:
  MTU Size: 00000    Metric: 00
  DestAddr: 0.0.0.0  SubnetMask: 0.0.0.0
Packet Trace Setting:
  Protocol: *      TrRecCnt: 00000000  PckLength: 00200
  Discard : 0
  SrcPort: *       DestPort: *         PortNum *
  IpAddr:   *       SubNet:   *
Multicast Specific:
  Multicast Capability: No
```

**Tip:** If you are a TSO user, use the corresponding NETSTAT option.

By issuing multiple VARY commands, you can OR filters together. For example, issuing the following VARY commands records all packets whose destination port is xxxx or whose source port is xxxx.

```
V TCPIP,tcp proc,PKTTRACE,DEST=xxxx
V TCPIP,tcp proc,PKTTRACE,SRCP=xxxx
```

The result is a trace that contains only packets with a source port of xxxx or packets with a destination port of xxxx.

**Tip:** An alternative command to use is the PKTTRACE command with PORTNUM.

```
V TCPIP,,PKTTRACE,PORTNUM=xxxx
```
If both DEST and SRCP are specified in the same command, you can AND the parameters together. For example, issuing the following VARY command records only the packets with both a destination port of xxxx and a source port of yyyy.

```
V TCPIP,tcpproc,PKTTRACE,DEST=xxxx,SRCP=yyyy
```

You can use the VARY TCPIP,tcpproc,OBEYFILE command to make temporary dynamic changes to system operation and network configuration without stopping and restarting the TCP/IP address space. For example, if you started the address space TCPIPA and created a sequential data set USER99.TCPIP.OBEYFIL1 containing packet trace statements, issue the following command:

```
VARY TCPIP,TCPIPA,CMD=OBEYFILE,DSN=USER99.TCPIP.OBEYFIL1
```

The VARY TCPIP,PKTTRACE command is cumulative. You can trace all packets for specified IP addresses by entering multiple PKTTRACE commands. In the following example, the two commands trace all the packets received and all the packets sent for the specified IP addresses.

```
VARY TCPIP,,PKT,ON,IPADDR=10.27.142.44
VARY TCPIP,,PKT,ON,IPADDR=10.27.142.45
```

### Formatting packet traces using IPCS

The IPCS CTRACE command parameters are described in “Formatting component traces” on page 51. The following notes apply to the IPCS CTRACE parameters about the packet trace formatter:

#### JOBLIST, JOBNAME

The LINKNAME and JOBNAME keywords in the OPTIONS string can also be used to select records.

#### TALLY

Equivalent to the STATISTICS(DETAIL) option.

#### START and STOP

Packets are numbered after the START keyword has filtered records.

#### LIMIT

See the RECORDS keyword in the OPTIONS string.

#### USEREXIT

The packet trace formatter calls the CTRACE USEREXIT before testing the records with the filtering criteria. If it returns a nonzero return code, then the record is skipped. The USEREXIT can also be used in the OPTIONS string. It is called after the record has met all the filtering criteria in the OPTIONS string.

#### COMP

Must be SYSTCPDA.

#### SUB

The SUB must name the TCP/IP procedure that created the CTRACE records when the input is a dump data set.

#### EXCEPTION

Since there are no EXCEPTION records for packet trace, the EXCEPTION keyword must not be specified.

#### ENTIDLIST

The following are the valid values for packet trace:

1. IPv4 packet trace records
2. X25 trace records
3. IPv4 Enterprise Extender data trace records

**Tip:** Type 1, Type 2, and Type 3 records are no longer written by TCP/IP.
IPv4 and IPv6 packet trace records
IPv4 and IPv6 data trace records
Enterprise Extender trace records

The CTRACE OPTIONS string provides a means of entering additional keywords for record selection and formatting packet traces (COMP=SYSTCPDA). See “Syntax” on page 52 for the complete syntax of CTRACE.

OPTIONS syntax

OPTIONS — ( — Data Selection — Report Generation — ) —

Data Selection

Device Type — IP Identifier — IP Address — Name — Port Number — Protocol — Record Number —

Record Type — SNA Address

Device Type

DEVTYPE — ( — devtype — ) —

ETHTYPE — ( — type — ) — DEVICEID — ( — device_id — ) — MACADDR — ( —

macaddr — ) — QID — ( — qid — ) — VLANID — ( — vlanid — ) —

IP Identifier

ADDR — ( — IP Address — ) — BROADCAST — CLASSA — CLASSB — CLASSC —

CLASSD — CLASSE — HOST — IPADDR — ( — IP Address — ) —

IPID — ( — ip_id_number — ) — IPV4 — IPV6 — LINKLOCAL — LOOPBACK —

LOOPBACK6 — MULTICAST — QOS — ( — quality_of_service — ) —

SITELOCAL — TRAFFICCLASS — ( — traffic_class — ) —

IP Address
ipv4_address

/ipmm.mmm.mmm.mmm

/ip6_address

/nmm

X'HHH'HHHHHH'

Name

INTERFACE

LINKNAME

JOBLIST

JOBNAME

Port Number
TCP/IP services traces and IPCS support
OPTIONS component

REASSEMBLY
OPTIONS keywords

The following keywords are used for the OPTIONS component routine parameters. You can enter complete keywords. You can also enter a portion of the characters to make the keyword distinguishable from other keywords. For example, for the DISCARD keyword, you can enter DISCARD, DISCAR, DISCA, DISC, DIS, or DI.

AH
Select packets with an AH extension header.

ASCII
Packet trace data dumped is shown in hexadecimal and interpreted in ASCII translation only. The default is BOTH.

BASIC ([DETAIL|SUMMARY])
For specific packet types, format each element of the packet data. This parameter applies to DNS, RIP, and SNMP packet data.

DETAIL
Format the IP header, protocol header, and protocol data in as few lines as possible. DETAIL is the default.

SUMMARY
Format the IP and protocol headers in as few lines as possible.

BOOTP[(port_number|67 port_number|68)]
Select BOOTP and DHCP protocol packets. The port_number defines the BOOTP and DHCP port numbers to select packets for formatting. Equivalent to PORT(67 68).

BOTH
Packet trace data dumped is shown in hexadecimal and interpreted with both ASCII and EBCDIC translations. The default is set to BOTH, but it is subject to change depending on protocol used. For example, when using TELNET, only the EBCDIC translation is used.

BROADCAST
Select packets with a broadcast IPv4 address. Equivalent to IPADDR(255.255.255.255/255.255.255.255).

CHECKSUM [[(DETAIL|SUMMARY)]
The selected packets have their checksum values validated.

DETAIL
If there is a checksum error, then the packet is formatted and dumped.

SUMMARY
A message is issued for each packet that encounters a checksum error. SUMMARY is the default.

CID
Select data trace records that contain the specific connection ID value. The connection ID value can be determined from the Netstat CONn/-c report. For TCP connections across Shared Memory Communications, data trace records can be selected by using the local SMC link ID (LocalSMCLinkId). This SMC link ID can be determined from the Netstat ALL/-A or Netstat DEvlinks/-d report. Up to 16 values or ranges can be specified.

CLASSA
Select packets with a class A IPv4 address. Equivalent to IPADDR(0.0.0.0/128.0.0.0).

CLASSB
Select packets with a class B IPv4 address. Equivalent to IPADDR(128.0.0.0/192.0.0.0).

CLASSC
Select packets with a class C IPv4 address. Equivalent to IPADDR(192.0.0.0/224.0.0.0).
CLASSD
Select packets with a class D IPv4 address. Equivalent to IPADDR(224.0.0.0/24).

CLASSE
Select packets with a class E IPv4 address. Equivalent to IPADDR(240.0.0.0/24).

CLEANUP(nnnnn|500)
Defines a record interval where saved packet information in storage is released. The minimum value is 500 records; the maximum value is 1048576 records; the default is 500 records. If you set the record interval to 0, cleanup does not occur.

DATASIZE (data_size|0)
Selects packets that contain more protocol data than the data_size value. The minimum value is 0. The maximum value is 65535. The data size is determined from the amount of packet data available minus the size of any protocol headers. Equivalent to FLAGS(DATA).

DATTRACE
Select packets that are written from the VARY TCPIP,DATTRACE command.

DEBUG(debug_level_list)
Provides documentation about SYSTCPDA format processing. debug_level_list is a list of numbers from 1 to 64. Use only under the direction of an IBM Service representative.

DELAYACK(threshold|200)
The delay acknowledgment threshold in milliseconds used in the calculation of round-trip time in the TCP session report. The minimum value is 10 milliseconds. The maximum value is 1000 milliseconds. The default value is 200 milliseconds.

DEVICEID(device_id)
Selects packets that are written to or received from an OSAENTA trace with one of the specified device identifiers. One to 16 device IDs can be specified. This filter applies only to type 7 trace records. The device_id value is a hexadecimal number in the form X'csmfclua':

cs  
The channel subsystem ID for this datapath device.

mf  
The LPAR Multiple Image Facility ID for the LPAR that is using this datapath device.

cl  
The control unit logical identifier for this datapath device.

ua  
The unit address for this datapath device.

Each identifier is a two-digit hexadecimal value in the range 00 - FF.

Tip: You can obtain the device_id values for any active user of the OSA by using the Hardware Management Console (HMC). For a data device that is active on a z/OS stack, you can obtain the device_id value for that data device from message IST2190I of the output from the D NET,TRLE command.

DEVTYPE(device_type_list)
Select packets that are written to or received from an interface with one of the specified device types. This does not apply to data trace records. The following types can be specified:

• ATM
• CDLC
• CLAW
• CTC
• ETHER8023
• ETHERNET
• ETHEROR8023
• FDDI
DISCARD(reason_code_list)
Select packets with one of the specified discard reason codes. Up to 16 discard reason codes can be specified in the range 0 - 65535. Each entry in the list can be a range: low_number:high_number. Values can be decimal or hexadecimal.

<table>
<thead>
<tr>
<th>Discard Reason Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Packet was not discarded</td>
</tr>
<tr>
<td>1:4087</td>
<td>A packet was discarded by OSA-Express</td>
</tr>
<tr>
<td>1:1023</td>
<td>Select packets discarded by OSA-Express for DISCARD=EXCEPTION reasons</td>
</tr>
<tr>
<td>4096:8191</td>
<td>IP packet was discarded by TCPIP</td>
</tr>
<tr>
<td>8192:12287</td>
<td>TCP packet was discarded by TCPIP</td>
</tr>
</tbody>
</table>

See z/OS Communications Server: IP and SNA Codes for the TCP/IP discard reason codes.

DNS[(port_number|53)]
Select Domain Namer Service protocol packets. The port_number defines the DNS port number to select packets for formatting. Equivalent to PORT(53).

DOMAIN[(port_number|53)]
Select Domain Namer Service protocol packets. The port_number defines the DNS port number to select packets for formatting. Equivalent to PORT(53).

DUMP[(nnnnn|65535)]
Dump the selected packets in hexadecimal with EBCDIC and ASCII translations. The IP and protocol headers are dumped separately from the packet data. The value nnnnn represents the maximum amount of packet data that is to be dumped from each packet. The default value is 65535 bytes. The minimum value is 0. The maximum value is 65535. The IP and protocol headers are not subject to this maximum.
The default report options are DUMP and FORMAT.

The BOTH, ASCII, EBCDIC, and HEX keywords describe how the dumped packets are translated. The default is BOTH. The display can be changed by using these keywords. The default ASCII translation table is used. This table might not match the table that is being used by the application. When you are formatting the CTRACE, it is helpful to have the correct line length. Use the IPCS PROFILE LINESIZE command to set the line length. For example,

```
IPCS PROFILE LINESIZE(80)
```

sets the maximum line length to 80 characters so that all formatted data is viewable within 80 characters.

If the STREAM report is chosen, then the dump of the packets is deferred until the stream of data is collected.

### EBCDIC
Packet trace data dumped is shown in hexadecimal and interpreted with EBCDIC translation only. The default is BOTH.

### EE
Select Enterprise Extender (EE) protocol packets. The port number defines the first EE port number to select packets for formatting. The EE port number and the next four port numbers are used. Equivalent to PORT(12000:12004).

### ELEMENT\(\text{element_number_list}\)
Select SNA protocol packets with a matching origin or destination element address in the TH2 or TH4 transmission header. Valid values are in the range 0 - 65535. Up to 16 element numbers can be specified.

### ESP
Select packets with a protocol number of 50. Equivalent to PROTOCOL(50).

### ETHTYPE\(\text{type}\)
Selects packets that are written to or received from an OSAENTA trace with one of the specified frame types. From 1 to 16 types can be specified. This filter applies only to type 7 trace records. The following types can be specified:

- x'0800' for IP
- x'86DD' for IPV6
- x'0806' for ARP
- x'80d5' for SNA

### EXPORT\((\text{DETAIL|SUMMARY})\)
The selected packets are written to the EXPORT data set in .CSV (Comma Separated Value) format. In .CSV format, each character field is surrounded by double quotation marks and successive fields are separated by commas. The first line of the file defines the fields. Each subsequent line is a record that contains the values for each field.

- **DETAIL**
  Format the IP header, protocol header, and protocol data as separate lines of data.

- **SUMMARY**
  Format the IP header and protocol header in one line of data. SUMMARY is the default.

Allocate a file with DDNAME of EXPORT before you invoke the CTRACE command with EXPORT in the OPTIONS string.

```
ALLOC FILE(EXPORT) DA(PACKET.CSV) SPACE(15 15) TRACK
```

The record format is variable block with logical record length of 512 bytes.

### FINGER\((\text{port_number|79})\)
Select FINGER protocol packets. The port_number defines the FINGER port number to select packets for formatting. Equivalent to PORT(79).
**FIRST|LAST**
Selects which packet in a set of encapsulated packets is used for selection. An example is the ICMP error report packet that contains the IP header that is in error. FIRST indicates that the ICMP packet is used for selection. LAST indicates that the last encapsulated IP header is used for selection. FIRST is the default.

If a packet is encapsulated for IPSec with Encapsulating Security Payload (ESP), all inner packets are encrypted. In this case, FIRST is used for selection when these packets are analyzed.

**FLAGS(flags list)**
Select packets that have the matching characteristics. Flags that can be specified are:

- **ALL**
  When more than one flag is specified, the packet must meet all the criteria of the flags requested. ALL is the default.

- **ANY**
  When more than one flag is specified, the packet need meet only one of the criteria of the flags requested.

- **ABBREV**
  Select packets that are abbreviated.

- **ACK**
  Select packets that have a TCP header with the ACK flag set.

- **BAD**
  Select packets that might be too short to contain all the required headers

- **BBI**
  The SNA packet contains a begin bracket indicator.

- **BCI**
  The SNA packet contains a begin chain indicator.

- **CDI**
  The SNA packet contains a change direction indicator.

- **CEBI**
  The SNA packet contains a conditional end bracket indicator.

- **CKSUM**
  Select packets that have a check sum error

- **CLC**
  The SMC Connection Layer Control packets

- **CSI**
  The SNA packet contains a code selection indicator.

- **DATA**
  Selects packets that contain data.

- **DF**
  Select packets that have a non-zero discard code. These packets are discarded by TCP/IP.

- **DFC**
  The SNA packet is a data flow control packet.

- **DISCARD**
  Select packets that have a non-zero discard code. These packets are discarded by OSA-Express or by TCP/IP.

- **DR1**
  The SNA packet is requesting a DR1 response.

- **DR2**
  The SNA packet is requesting a DR2 response.

- **EBI**
  The SNA packet contains an end bracket indicator.
ECI
The SNA packet contains an end chain indicator.
EDI
The SNA packet contains an enciphered data indicator.
ERI
The SNA packet is an error response.
FI
The SNA packet contains formatted data.
FIB
The SNA packet is the first packet of a bracket (or of a conditional begin bracket). The RH BBI flag is set and the EBI flag is not.
FIC
Select packets that are the first in chain SNA RU.
FIN
Select packets that have a TCP header with the FIN flag set.
FIS
Select packets that are in the first fragment of an IPv4 or IPv6 packet or the first segment of a SNA PDU.
FMD
The SNA packet is a function management data packet.
FMH
The SNA packet is a function management data header.
FRAME
Selects OSAENTA packets that have a frame header.
FULL
Select packets that are complete.
HOME
Select packets that have an IP destination address equal to the IP source address.
IN
Select packets that are inbound.
IPEXT
Select packets that have an extension header.
IPO
Select packets that have an IPv4 header options field.
IPV4
Select IPv4 packets. IPv4 cannot be used in combination with other data selectors that are IPv6-specific, such as LINKLOCAL.
IPV6
Select IPv6 packets. IPv6 cannot be used in combination with other data selectors that are IPv4-specific, such as BROADCAST.
IPV6EXT
Select packets that have an extension header. IPV6EXT is equivalent to IPEXT.
IQDC
Select inbound packets that have arrived over a HiperSockets Converged (IQDC) Interface on behalf of an associated IPAQENET or IPQENET6 interface. For outbound flows, this flag will never be set as the packet trace is recorded before the decision is made to send the packet over the IQDC interface.
IQDCND
Select ICMPv6 neighbor advertisement and neighbor solicitation packets on an IQDC6 interface.
IQDXND
Select ICMPv6 neighbor advertisement and neighbor solicitation packets on an IQDX6 interface.

LIB
The SNA packet is a last packet of a bracket. The RH BBI flag is not set and the EBI flag is set.

LIC
Select packets that are the last in a chain of SNA RUs.

LIS
Select packets that are the last fragment of an IPv4 or IPv6 packet or the last segment of a SNA PDU.

LPAR
Select NTA packets that are transmitted between LPARs shared by an OSA-Express device.

L2
The OSAENTA packet is from a layer 2 OSA application.

L3
The OSAENTA packet is from a layer 3 OSA application (like TCP/IP).

MIB
The SNA packet is in the middle of a bracket. The RH BBI flag is not set and the EBI flag is not set.

MIC
Select packets that are the middle fragment of an IPv4 or IPv6 packet.

MIS
Select packets that are the middle fragment of an IPv4 or IPv6 packet or the middle segment of a SNA PDU.

NC
The SNA packet is a Network Control packet.

NTA
Select OSAENTA packets.

OFFLOAD
Select outbound packets for which segmentation is offloaded.

OIB
The SNA packet is the only packet of a bracket. The RH BBI flag is set and the EBI flag is set.

OIC
Select packets that are only in a chain SNA RH request.

OIS
Select packets that are IPv4 or IPv6 packets that are not fragmented or that are the only segment of a SNA PDU.

OUT
Select packets that are outbound.

PDI
Select SNA packets with the padded data indicator.

PDU
The IP packets that are packed by TCP/IP into a single PDU buffer.

PI
The SNA packet contains a pacing indicator.

PING
Select packets that are ICMP/ICMPv6 echo request and echo reply.

PSH
Select packets that have a TCP header with the PSH flag set.

QID
Select packets that have a QID value greater than one.
QRI
  The SNA packets with a queued response indicator

REQ
  The SNA packet is a request.

RESP
  The SNA packet is a response.

RLWS
  Select SNA packets with the request large window size indicator.

RSM
  Select packets that are reassembled.

RST
  Select packets that have a TCP header with the RST flag set.

SC
  The SNA packet is a session-control packet.

SDI
  The SNA packet contains sense data.

SEG
  Select packets that are segmented.

SMC
  Select SMC packets.

SNA
  Select SNA packets.

SYN
  Select packets that have a TCP header with the SYN flag set.

TCPO
  Select packets that have a TCP header options field.

TOS
  Select IPv4 packets that have a nonzero value in the ip_tos field.

TUNNEL
  Select packets with protocol number 47 GRE or 41 (IPv6 over IPv4). z/OS Communications Server currently does not support IPv6 over IPv4 (protocol number 41).

URG
  Select packets that have a TCP header with the URG flag set.

VLAN
  Select packets that have a VLAN 802.1q tag

ZWIN
  Select packets that have a TCP header with a zero window value.

Notes:
  • The use of the FIC, MIC, and LIC flags require the use of the NOREASSEMBLY option.
  • When a packet is reassembled, then it becomes an OIC packet with the RSM flag set.
  • Do not intermix SNA and IP flags.

<table>
<thead>
<tr>
<th>Flag</th>
<th>Applies to IP</th>
<th>Applies to SNA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABBREV</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>BAD</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

Table 14. Flags that apply to IP or SNA packets
<table>
<thead>
<tr>
<th>Flag</th>
<th>Applies to IP</th>
<th>Applies to SNA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>BCI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>CDI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>CEBI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>CI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>CKSUM</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>CLC</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>CSI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>DATA</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>DF</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>DFC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>DISCARD</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>DR1</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>DR2</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>EBI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>ECI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>EDI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>ERI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FIB</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FIC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FIN</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>FIS</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FM</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FMD</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FMH</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>FRAME</td>
<td>N</td>
<td>Y</td>
<td>OSAENTA only</td>
</tr>
<tr>
<td>FULL</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>HOME</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>IPEXT</td>
<td>Y</td>
<td>N</td>
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<tr>
<td>IPO</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>IPV4</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>IPV6</td>
<td>Y</td>
<td>N</td>
<td></td>
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</table>
Table 14. Flags that apply to IP or SNA packets (continued)

<table>
<thead>
<tr>
<th>Flag</th>
<th>Applies to IP</th>
<th>Applies to SNA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPV6EXT</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>LIB</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>LIC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>LIS</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>LPAR</td>
<td>Y</td>
<td>Y</td>
<td>OSAENTA only</td>
</tr>
<tr>
<td>L2</td>
<td>Y</td>
<td>Y</td>
<td>OSAENTA only</td>
</tr>
<tr>
<td>L3</td>
<td>Y</td>
<td>Y</td>
<td>OSAENTA only</td>
</tr>
<tr>
<td>MIB</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>MIC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>MIS</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>NTA</td>
<td>Y</td>
<td>Y</td>
<td>OSAENTA only</td>
</tr>
<tr>
<td>OFFLOAD</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>OIB</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>OIC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>OIS</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>OUT</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>PDI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>PDU</td>
<td>Y</td>
<td>N</td>
<td>SYSTCPDA only</td>
</tr>
<tr>
<td>PI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>PING</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>PSH</td>
<td>Y</td>
<td>N</td>
<td>OSA-Express 3 or later ports with QDIO inbound workload queueing enabled.</td>
</tr>
<tr>
<td>QID</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>QRI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>REQ</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>RESP</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>RLWS</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>RSM</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>RST</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>SC</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>SDI</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>SEG</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Flag</td>
<td>Applies to IP</td>
<td>Applies to SNA</td>
<td>Comments</td>
</tr>
<tr>
<td>-------</td>
<td>---------------</td>
<td>----------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>SMC</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>SYN</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>TCPO</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>TOS</td>
<td>Y</td>
<td>Y</td>
<td>SNA TPF field</td>
</tr>
<tr>
<td>TUNNEL</td>
<td>Y</td>
<td>Y</td>
<td>TCP only</td>
</tr>
<tr>
<td>URG</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
<tr>
<td>VLAN</td>
<td>Y</td>
<td>Y</td>
<td>OSAENTA only</td>
</tr>
<tr>
<td>ZWIN</td>
<td>Y</td>
<td>N</td>
<td>TCP only</td>
</tr>
</tbody>
</table>

**FMT**
Equivalent to FORMAT.

**FORMAT[[DETAIL|SUMMARY ALL|FIRST|LAST]]**
The selected packets with defined packet data are to be formatted. The SHORT keyword on the CTRACE command selects this option if no other report options are specified. The default report options are DUMP and FORMAT.

**DETAIL**
Format the IP header, protocol header, and the protocol data.

**SUMMARY**
Format the IP header and protocol header. DETAIL is the default.

**ALL**
Format all encapsulated packets. ALL is the default.

**FIRST**
Format the first encapsulated packet.

**LAST**
Format the last encapsulated packet
An example of an encapsulated packet is an ICMP error report.

**FTP[[data_port_number|20 control_port_number|21]]**
Select FTP protocol packets. The port_number defines the FTP port numbers to select packets for formatting. Equivalent to PORT(20,21).

**FULL**
Equivalent to DUMP and FORMAT. The FULL keyword on the CTRACE command selects this option if no other report options are specified.

**GAIN(rtgain|125,vargain|250)**
Values of the round-trip gain (rtgain) and the variance gain (vargain), in milliseconds, used in the calculation of round-trip time in the TCP session report. Valid values are in the range 0 - 1000. The default value for rtgain is 125. The default value for vargain is 250.

**GOPHER[[port_number|70]]**
Select GOPHER protocol packets. The port_number defines the GOPHER port numbers to select packets for formatting. Equivalent to PORT(70).

**GRE**
Select packets with a protocol number of 47. Equivalent to PROTOCOL(47).

**GMT**
Format the time stamps in GMT time. The default is the value that is specified on the CTRACE subcommand.
HEX
Packet trace data dumped is shown in hexadecimal only with no translation. The default is BOTH.

HPRDIA[SUMMARY]
Select high-performance routing (HPR) packets and group them by transport connection identifier (TCID). The report shows session information that can be helpful for HPR diagnosis.

HOST
Select packets with a host IP address. Equivalent to IPADDR(0.0.0.0/255.255.0.0)

HTTP[port_number|80]
Select HTTP protocol packets. The port_number defines the HTTP port numbers to select packets for formatting. Equivalent to PORT(80). See "WWW[port_number|80]" on page 114.

ICMP
Select packets with a protocol number of 1. Equivalent to PROTOCOL(1).

ICMP6 or ICMPV6
Select packets with a protocol number of 58. Equivalent to PROTOCOL(58).

IGMP
Select packets with a protocol number of 2. Equivalent to PROTOCOL(2).

INTERFACE(interface_name_list) or LINKNAME(interface_name_list)
Select packet trace records with the specified interface name. Up to 16 interface names can be specified. Each interface name can be up to 16 characters. Use an asterisk (*) as a wildcard to replace characters at the end of the interface name.

IPADDR[ipaddr[/mask_or_prefixlength]|X'hhhhhhhh'[\]-nnnnn])
Select packets with a matching IP address, optional IPv4 address mask or IPv6 prefix length and optional port number. Up to 16 IP addresses can be specified. The IPADDR is specified in three parts:

1. An IPv4 or IPv6 address
   The IPv4 address can be in dotted decimal notation, a keyword, or a hex value.
   • IPv4 dotted decimal notation
     127.0.0.1
   • IPv4 keyword
     A
     A class A IPv4 address, 0.0.0.0/128.0.0.0
     B
     A class B IPv4 address, 128.0.0.0/192.0.0.0
     C
     A class C IPv4 address, 192.0.0.0/224.0.0.0
     D
     A class D IPv4 address, 224.0.0.0/240.0.0.0
     E
     A class E IPv4 address, 240.0.0.0/248.0.0.0
     H
     A local host address, 0.0.0.0/0.255.255
     L
     An IPv4 or IPv6 loopback address, 127.0.0.0/255.0.0.0 or ::1
     M
     The broadcast IPv4 address, 255.255.255.255/255.255.255.255
     *
     Any address, 0.0.0.0/0.0.0.0
     0
     An IPv4 or IPv6 address of zero, 0.0.0.0/255.255.255.255 or ::/128
2. An IPv4 address mask or IPv6 prefix length
   The IPv4 address mask (1 - 32) or IPv6 prefix length (1 - 128) is preceded by a slash (/). Specify an IPv4 address mask only when the IPv4 address is in dotted decimal notation. The IPv4 address mask can be in dotted decimal notation, for example: 9.37/255.0.0.0 or 9.37/255.255.0.0

3. A port number
   The port number is preceded by a dash (-). It is a decimal number in the range 0 - 65535.

Notes:
- There should be no spaces between the IP addresses and the subnet masks.
- The BROADCAST, CLASSA, CLASSB, CLASSC, CLASSD, CLASSE, HOST, LINKLOCAL, LOOPBACK, MULTICAST, and SITELOCAL keywords add to the total of 16 IP addresses.
- The port number when used adds to the total of 16 port numbers in the PORT keyword.
- IPv4 addresses and IPv4-mapped IPv6 addresses are treated as equivalent addresses.

**IPID(ipid_number_list)**
Select packets that match the ip_id number in the IPv4 packet header. Up to 16 ID numbers can be specified in the range 0 - 2147483647 or 0 - X'FFFFFFF'. Each entry in the list can be a range: low_number:high_number. Values can be decimal (nnnnn) or hexadecimal (X'hhhh'). If the packets are fragmented, specify NOREASSEMBLY to select each packet.

**IPV4**
Equivalent to FLAGS(IPV4).

**IPV6**
Equivalent to FLAGS(IPV6).

**IKE**
Select ISAKMP protocol packets. Equivalent to PORT(500). See the ISAKMP keyword.

**ISAKMP**
Select ISAKMP protocol packets. Equivalent to PORT(500). See the IKE keyword.

**JOBLIST|JOBNAME(job_name_list)**
Select data trace records with the specified JOBNAME. Up to 16 job names can be specified. Each job name can be up to eight characters. If the last character of a job name is an asterisk (*), then only the characters up to the asterisk are compared.

The CTRACE JOBLIST/JOBNAME parameter provides the same function, except that wildcards are not supported.

**LIMIT(record_count)**

`record_count`
The maximum number of records that are formatted. The default value 999999999 records.

**Guideline:** This keyword is also accepted if specified on the CTRACE subcommand.

**LINKLOCAL**
Select packets with an IPv6 link-local unicast prefix. Equivalent to IPADDR(FE80::/10).
LINKNAME(link_name_list)
   Select packet trace records with the specified LINKNAME. Up to 16 link names can be specified. Each link name can be up to 16 characters. If the last character of a link name is an asterisk (*), then only the characters up to the asterisk are compared.

   The CTRACE JOBLIST/JOBNAME parameter provides the same function, except that wildcards are not supported and only the first eight characters of the link name are compared.

LOCAL
   Format the time stamps in local time. The default is the value that is specified on the CTRACE subcommand.

LOOPBACK
   Select packets with either an IPv4 or IPv6 loop back address. Equivalent to IPADDR(127.0.0.0/255.0.0.0::1). If other addresses are defined as loopback, they can be selected explicitly by using IPADDR().

LOOPBACK6
   Select packets with an IPv6 loop back address. Equivalent to IPADDR(::1). If other addresses are defined as loopback, they can be selected explicitly by using IPADDR().

MACADDR(macaddr)
   Selects packets that are written to or received from an OSAENTA trace with one of the specified MAC addresses. From 1 to 16 addresses can be specified. This filter applies only to type 7 trace records. A MACADDR is 12 hexadecimal digits.

MULTICAST
   Select packets with either an IPv4 or IPv6 multicast address. Equivalent to CLASSD IPADDR(FF00::/8).

NAT
   Select NAT protocol packets. Equivalent to PORT(4500).

NOCHECKSUM
   The selected packets do not have their checksum values validated. CHECKSUM is the default.

NOREASSEMBLY
   Do not reassemble fragmented IP packets into a complete packet. REASSEMBLY is the default.

NOSEGMENT
   Packet trace records that span multiple CTRACE records are not recombined. Only the first segment record of packet is used. The rest of the segment records are discarded. SEGMENT is the default.

NOT
   If the NOT option is selected then any selection criteria is reversed. If a record matches the selection criteria, it is not processed. If a record does not match the selection criteria, it is processed.

NTP[(port_number|123)]
   Select NTP protocol packets. The port number defines the NTP port number to select packets for formatting. Equivalent to PORT(123).

OPTION
   The selected options with defaults are listed.

OSPF
   Select packets with a protocol number of 89. Equivalent to PROTOCOL(89).

PACKETTRACE
   Select packets that are written from the VARY TCPIP,,PKTTRACE command.

IPEXT
   Select packets with an extension header.

PORT(port_number_list)
   Select packets with one of the specified port numbers. Up to 16 port numbers can be specified in the range 0 - 65535. Each entry in the list can be a range: low_number:high_number. Values can be decimal (nnnnn) or hexadecimal (X'hhhh'). The following keywords add to the list of 16 port numbers:

   • BOOTP
PROTOCOL(protocol number list)
Select packets with one of the specified protocol numbers. Up to 16 protocol numbers can be specified in the range 0 - 255. Each entry in the list can be a range: low_number:high_number. Values can be decimal (nnn) or hexadecimal (X'hh').

Protocol filters on only the upper-layer header of an IPv6 packet. It does not filter for IPv6 extension headers (Hop-by-Hop Options, Routing, Fragment). Instead, IPv6 extension headers are included in the display of the basic IPv6 header. The following keywords add to the list of 16 protocol numbers:

- AH
- ESP
- GRE
- ICMP
- ICMP6,
- ICMPv6
- IGMP
- OSPFI
- TCP
- UDP

QOS(quality_of_service_list)
Select the records with the matching quality of service from the IPv4 Type of Service field. Up to 16 QoS values can be specified in the range 0 - 7. Each entry in the list can be a range: low_number:high_number. Values can be decimal (n) or hexadecimal (X'h').

QID(qid_list)
Select the records with the matching read queue identifier (QID) from the OSA-Express 3 or later ports with QDIO inbound workload queueing enabled. QID 1 selects records that are received on the primary input queue, and subsequent QIDs select records from the corresponding ancillary input
queue (AIQ). Up to 16 QID values can be specified in the range 0 - 8. Each entry in the list can be a range: low number: high number. Values can be decimal (n) or hexadecimal (X’h’).

**REASSEMBLY((packet size|65535,DETAIL|SUMMARY))**
Reassemble IP fragments into a complete packet.

- **packet_size**
  The maximum size of a reassembled packet that is allowed. The smallest value that is allowed is 576 bytes, the largest is 65535 bytes. The default value is 65535 bytes.

- **DETAIL**
  List each of the reassembly statistics for each packet when a packet completes reassembly.

- **SUMMARY**
  Show only the reassembly statistics and information about packets that did not complete reassembly.

REASSEMBLY(65535,SUMMARY) is the default.

**RECORDS(record number list)**
Select the records with matching record numbers in the trace data. Up to 16 record numbers can be specified. Record numbers are assigned after any IPCS CTRACE selection criteria are met. Each entry in the list can be a range: low_number:high_number. Values can be decimal (nnnnnnnnnn) or hexadecimal (X'hhhhhhhh').

**RIP((port number|520))**
Select RIP protocol packets. The port_number defines the RIP port number to select packets for formatting. Equivalent to PORT(520).

**ROUTER((port number|520))**
Select RIP protocol packets. The port_number defines the RIP port number to select packets for formatting. Equivalent to PORT(520).

**RIPNG**
Select packets with a port number of PORT(521). Equivalent to PORT(521).

**RPC((port number|111))**
Select RPC protocol packets. The port_number defines the RPC port number to select packets for formatting. Equivalent to PORT(111).

**SASP ((port number|3860))**
Select z/OS Load Balancing Advisor port numbers. The port_number defines the SASP port number to select packets for formatting. Equivalent to PORT(3860).

**SEGMENT**
Packet trace records that span multiple CTRACE records are recombined. Data from segment records is saved until all the CTRACE records are read to recreate the original packet. SEGMENT is the default.

**SESSION((DETAIL|PIPE|STATE|SUMMARY))**
Generate a report that shows TCP or UDP session traffic.

- **DETAIL**
  List each of the packets for a session, as well as the summary statistics. DETAIL is the default.

- **PIPE**
  List the amount of data left unacknowledged.

- **STATE**
  List the beginning and ending state of each session.

- **SUMMARY**
  Show only the summary statistics.

**Tip:** The UDP session analysis is also used for other protocols.

**SITELOCAL**
Select packets with an IPv6 site-local unicast address prefix. Equivalent to IPADDR(FEC0::/10).

**SMC**
This packet was sent across Shared Memory Communications.
SMCLLC
Select packets with a protocol number of 252 for Shared Memory Communications over Remote Direct Memory Access (SMC-R). Equivalent to PROTOCOL(252).

SMTP[(port_number|25)]
Select SMTP protocol packets. The port_number defines the SMTP port number to select packets for formatting. Equivalent to PORT(25).

SNIFFER[(nnnnn|200, ETHERNET|TCPDUMP)]
Writes the trace records in a format acceptable for downloading to other trace analysis programs, such as programs from http://www.tcpdump.org/.

nnnnn
The maximum size of trace data. Packets with more data than this value are truncated. The default is 200 bytes. The largest value is derived from the LRECL of the SNIFFER data set.

ETHERNET
If this keyword is specified, the output is formatted for the Ethernet analysis application of the analyzer. This keyword specifies the file format only and does not imply that only packets traced on an Ethernet are collected. Packets from all devices can be collected by using this option.

The default for the SNIFFER option is ETHERNET.

TCPDUMP
The format is compatible with the files with an Ethernet header.

Note: The TOKENRING keyword on the CTRACE OPTIONS(( SNIFFER(TOKENRING) )) on the IPCS CTRACE subcommand is ignored. The ETHERNET format of the sniffer data set is selected.

The trace records are written to the file with a DD name of SNIFFER. After the file is generated, it can be downloaded as a binary file to the analyzer and loaded by using the standard features of the analyzer. Use NOREASSEMBLY to prevent the formatter from reassembling packets. Then, each packet is passed as the packets are collected. The logical record length of the SNIFFER data set determines the largest amount of packet data that is written to the data set.

Allocate a file with DDNAME of SNIFFER before you invoke the CTRACE command with SNIFFER in the OPTIONS string as follows:

ALLOC FILE(SNIFFER)
DA(PACKET.TRC) SPACE(15 15) TRACK +
LRECL(8000) BLKSIZE(32000)

The data set has a record format of variable blocked with a logical record length of 8000 bytes. The maximum IP packet size is 7962 (8000 - 38) for SNIFFER(ETHERNET).

The minimum logical record length of the data set is 256 bytes.

Restriction: Do not use the SNIFFER option when the CTRACE subcommands are used with the IPCS MERGE subcommand. The SNIFFER data file is written over by the multiple CTRACE commands that specify the SNIFFER option.

SNMP[(port_number|161 port_number|162)]
Select SNMP protocol packets. The port_number defines the SNMP port number to select packets for formatting. Equivalent to PORT(161 162).

SPEED(local|10,remote|10)
The link speed, in megabits per second, for the local and remote link. These values are used in throughput calculations in the TCP session report. Valid values are in the range 0 - 17171. The default value is 10. Specify the slowest speed of the link in the route.

STATISTICS[(DETAIL|SUMMARY)]
After all the records are processed, generate statistical reports.

DETAIL
Reports are produced showing the number of records that are selected by record type, device type, job name, link name, protocol number, IP address and port numbers. The session summary
report is a listing of the IP address and port number pairs that shows the number of records, the first and last record numbers, and the first and last record times.

**SUMMARY**
Only the session summary report is produced. SUMMARY is the default.

**TALLY** on the CTRACE command selects this option if no other report options are specified.

**STATS**
Equivalent to the STATISTICS option.

**STREAMS**(stream_size|128 DETAIL|SUMMARY)]
Collect the packet data for dumping or formatting after the trace file is processed. The value nnn represents the maximum amount of storage that is used to capture each stream. The value stream_size represents the maximum amount of storage that is used to capture each stream. The smallest value is 16 KB. The largest value is 512 KB. The default value is 128 KB. The value is in 1024 bytes (1K) units.

**SUMMARY**
List about each packet in the stream. SUMMARY is the default.

**DETAIL**
Issue messages about the status of the stream.

**Requirement:** The DUMP keyword is required to dump the packet data.

**SUBAREA**(subarea_number_list)
Select SNA protocol packets with a matching subarea address in the TH4 transmission header. Valid values are in the range 1 - 65535. You can specify up to 16 subarea numbers.

**SUMMARY**
Format a single line for each trace record. SUMMARY on the CTRACE command selects this option if no other report options are specified. If no other report option specified on the CTRACE command, then SUMMARY is selected as the report.

**NOTOD**
Use the time that the trace data was moved to the CTRACE buffers for the reports. Normally, the time that the trace data was moved to the trace buffer is shown. The CTRACE command uses the time stamp when the trace data was moved to the buffers for START and STOP time selection. NOTOD is the default value for SYSTCPDA and SYSTCPIs traces.

**TOD**
Use the time that the trace data was captured for the reports. Normally, the time that the trace data was moved to the trace buffer is shown. The CTRACE command uses the time stamp when the trace data was moved to the buffers for START and STOP time selection. TOD is the default value for SYSTCPOT traces, which uses the time stamp that is generated by the OSA trace function.

**TALLY**
Equivalent to the STATISTICS(DETAIL) option.

**TCID**(transport connection_id_list)
Select SNA protocol packets with a matching transport connection identifier in the RTP transport header. Valid values include 1 - 16 hexadecimal digits. Up to 16 transport connection identifiers can be specified.

**TCP**
Select packets with a protocol number of 6. Equivalent to PROTOCOL(6).

**TELNET**(port_number|23 [screen_width|80] [SUMMARY|DETAIL] )
Select TELNET protocol packets. The port_number defines the TELNET port number to select packets for formatting. Equivalent to PORT(23).

The screen_width parameter defines the value that is used for converting buffer offsets into row and column values for the 3270 data stream formatting. If the screen_width parameter is provided, then the port_number parameter must also be used. The minimum value is 80. The maximum value is 255. The default value is 80.
SUMMARY formats the 3270 data stream into a representation of the screen.

DETAIL formats each 3270 command and order.

There is no default for DETAIL or SUMMARY.

TFTP[(port_number|69)]
Select TFTP protocol packets. The port_number defines the TFTP port number to select packets for formatting. Equivalent to PORT(69).

TH5ADDR(session_address_list)
Select SNA protocol packets with a matching session address in the TH5 transmission header. Valid values include 1 - 16 hexadecimal digits. You can specify up to 16 session addresses.

TIME[(port_number|37)]
Select TIME protocol packets. The port_number defines the TIME port number to select packets for formatting.

TRAFFICCLASS(traffic_class)
Select the records with the matching IPv6 traffic class field. Up to 16 traffic class values can be specified in the range from 0 to 255. Each entry in the list can be a range: low_number:high_number. Values can be decimal (nn) or Hexadecimal (X'hh').

UDP
Select packets with a protocol number of 17. Equivalent to PROTOCOL(17).

USEREXIT(exitname)
Names the user exit to be called for each selected record. The USEREXIT keyword on the CTRACE command names a user exit that is called before the SYSTCPDA packet trace filtering is done. If this exit routine returns a nonzero return code, then the record is skipped by the SYSTCPDA formatter.

VLANID(vlanid)
Select packets that are written to or received from an OSAENTA trace with one of the specified VLAN identifiers. From 1 to 16 identifiers can be specified. This filter applies only to type 7 trace records. A VLAN identifier has a value in the range 0 - 4094.

Tip: The DEVICEID, MACADDR, ETHTYPE, and VLANID filter keywords apply to SYSTCPOT data. If these keywords are specified with SYSTCPDA data, then these filters are ignored.

WWW[(port_number|80)]
Select HTTP protocol packets. The port_number defines the HTTP port number to select packets for formatting. Equivalent to PORT(80).

X25
Select packet trace records created by the X25 processor.

Tip: This option is obsolete, but it is still accepted.

Report Examples
The CTRACE packet trace (SYSTCPDA) report generation outputs are described in the following examples. Because IPv6 increases the IP address size, formatted IPv6 packet/data traces might be much wider than 80 columns.

OPTION

Purpose
List the selected options and default keyword values.

Format
CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((STAT(DETAIL) OPTION TCP))

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The following fields are on the OPTION report.

1. **DSNAME** - The name of the source data.

2. **OPTIONS** - A listing of the active options with default values.

3. When a filter is specified, the list of filters with the number of filter values and filter values.

**SUMMARY**

**Purpose**

Show one or two lines of information about each record in the trace.

**Format**

```
CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SUMMARY
```

The following fields are on the SUMMARY report.

```
**** 2004/01/26
I - Inbound packet
O - Outbound packet
DP Nr hh:mm:ss.mmmmmm IpId Seq_num Ack_num Wndw Flags DatLn Source/Destination
OT 1 14:18:00.447462 19E6 1452693653 0 32768 SYN 0 10.7.1.61-3470
192.168.248.44-5000
IT 2 14:18:00.601784 4E3C 3454024895 1452693654 32768 ACK SYN 0 192.168.248.44-5000
10.7.1.61-3470
OT 3 14:18:00.601917 1A00 1452693654 3454024896 32768 ACK 0 10.7.1.61-3470
192.168.248.44-5000
IT 4 14:18:01.111074 4E3D 3454024943 1452693654 32768 ACK PSH 47 192.168.248.44-5000
3232302D 2057656C *.......% 220- Wel*
10.7.1.61-3470
IT 5 14:18:01.126148 4E3E 3454025008 1452693664 32768 ACK PSH 65 192.168.248.44-5000
32323020 52582E69 *........ 220 RX.i*
10.7.1.61-3470
OT 6 14:18:01.126248 1A46 1452693654 3454025008 32703 ACK 0 10.7.1.61-3470
192.168.248.44-5000
OT 7 14:18:03.290611 1B7F 1452693654 3454025008 32703 ACK PSH 10 192.168.248.44-5000
55534552 20637673 *....... USER cvs*
10.7.1.61-3470
IT 8 14:18:03.373175 4E3F 3454025008 1452693664 32768 ACK PSH 3333120 56617373 *....&/.. 331 Pass*
32192.168.248.44-5000
```

**Figure 19. Example of a SUMMARY report**

D
Direction of the packet:
1. **I** - Inbound
2. **O** - Outbound

P
The packet protocol:
1. **T** - TCP
2. **U** - UDP

TCP/IP services traces and IPCS support 115
Neither TCP, UDP, ICMP, nor IGMP

The CTRACE record number

The time stamp of the record

The source IP address and port number

The destination IP address and port number

The packet ID number in hexadecimal

For TCP

The sequence number

The acknowledgment sequence number

The window size

The TCP header flags

The length of data in the datagram

The first 8 bytes with EBCDIC translation

The first 8 bytes with ASCII translation

For UDP

The length of the UDP datagram

The length of the UDP packet data

The first 8 bytes with EBCDIC translation

The first 8 bytes with ASCII translation

For ICMP

The type of ICMP message

The first 8 bytes of the user data in hexadecimal

For IGMP
The maximum response time

The type of IGMP message

The IGMP group address

• Other protocols

The protocol name

The length of the protocol data

**EXPORT**

**Purpose**

Reformat the information about the IP header, protocol header, and packet data into a file with CSV format.

**Format**

ALLOC FILE(EXPORT) DA(EXPORT.CSV) SPACE(15 15) TRACK

CTRACE COMP(SYSTCPDA) SUB((TCPICS)) SHORT OPTIONS((EXPORT))

The following describe the EXPORT, EXPORT(SUMMARY), and EXPORT(DETAIL) report outputs.

• EXPORT

  Export Report

  1  124 records written to USER2.EXPORT.CSV
  2  20,168 bytes written

The following fields are on the EXPORT report.

1  The number of data records written to the export data set.

2  The size of the export data set.

• EXPORT (SUMMARY)

<table>
<thead>
<tr>
<th>Flags</th>
<th>Packet</th>
<th>Absolute Time</th>
<th>Rel Time</th>
<th>Delta Time</th>
<th>Device</th>
<th>Source</th>
<th>Destination</th>
<th>IpId</th>
<th>IpLen</th>
<th>Protocol</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>O O</td>
<td>I O</td>
<td>19:49:42.788207</td>
<td>0.000000</td>
<td>0.000000</td>
<td>&quot;OSAQDIOLINK&quot;</td>
<td>&quot;9.67.115.17&quot;</td>
<td>&quot;9.67.115.63&quot;</td>
<td>17158</td>
<td>78</td>
<td>&quot;UDP&quot;</td>
<td>&quot;S=137 D=137 LEN=58&quot;</td>
</tr>
<tr>
<td>O O</td>
<td>I O</td>
<td>19:52:21.240160</td>
<td>158.451952</td>
<td>0.016739</td>
<td>&quot;OSAQDIOLINK&quot;</td>
<td>&quot;9.67.115.69&quot;</td>
<td>&quot;9.67.115.5&quot;</td>
<td>5971</td>
<td>29</td>
<td>&quot;ICMP&quot;</td>
<td>&quot;LEN=28&quot;</td>
</tr>
<tr>
<td>O O</td>
<td>I O</td>
<td>19:52:27.78944</td>
<td>164.995736</td>
<td>0.000134</td>
<td>&quot;LOOPBACK&quot;</td>
<td>&quot;9.67.115.5&quot;</td>
<td>&quot;9.67.115.5&quot;</td>
<td>129</td>
<td>56</td>
<td>&quot;ICMP&quot;</td>
<td>&quot;LEN=28&quot;</td>
</tr>
<tr>
<td>I O</td>
<td>0 O</td>
<td>19:52:39.284870</td>
<td>176.496662</td>
<td>0.000067</td>
<td>&quot;OSAQDIO46&quot;</td>
<td>&quot;FEC9:C2D4::6:2908:E0C:217C&quot;</td>
<td>&quot;FF02::1:FF15:17&quot;</td>
<td>5971</td>
<td>32</td>
<td>&quot;ICMPv6&quot;</td>
<td>&quot;ICMPv6&quot;</td>
</tr>
<tr>
<td>I O</td>
<td>0 O</td>
<td>19:52:39.284870</td>
<td>176.496662</td>
<td>0.000067</td>
<td>&quot;OSAQDIO46&quot;</td>
<td>&quot;FEC9:C2D4::6:2908:E0C:217C&quot;</td>
<td>&quot;FF02::1:FF15:17&quot;</td>
<td>5971</td>
<td>32</td>
<td>&quot;ICMPv6&quot;</td>
<td>&quot;ICMPv6&quot;</td>
</tr>
</tbody>
</table>

TCP/IP services traces and IPCS support 117
The following describes fields found on the EXPORT (SUMMARY) report:

**Control flags**

**Direction**
- I — Input
- O — Output

A
The packet was abbreviated (used with the following fragment flags).

R
Reassembled packet.

O
The Only fragment of a packet (it is complete).

F
First fragment of a packet.

M
Middle fragment of a packet.

L
Last fragment of a packet.

T
The packet was in a tunnel.

**Packet**
The packet number

**Absolute Time**
The time stamp on the packet

**Rel Time**
The time from the first packet in seconds

**Delta Time**
The time from the previous packet in seconds

**Device**
The device the packet was received on or sent from

**Source**
The source IP address

**Destination**
The destination IP address

**IpId**
The ID number from the IP packet header

**IpLen**
The length of the IP packet

**Protocol**
The protocol from the IP packet

**Summary**
Additional information from the protocol header.

- EXPORT (DETAIL)
The following describes fields found on the EXPORT (DETAIL) report:

**Control flags**

**Direction**
- I — Input
- O — Output

A
The packet was abbreviated (used with the following fragment flags).

R
Reassembled packet.

O
Only fragment of a packet (it is complete).

F
First fragment of a packet.

M
Middle fragment of a packet.

L
Last fragment of a packet.

T
The packet was in a tunnel.

**Packet**
The packet number.

**Delta Time**
The time from the previous packet in seconds.

**Source**
The source IP address.

**Destination**
The destination IP address.

**Protocol**
There are multiple lines about a single packet. The first line contains "IP" to identify the data in the summary field. The second line identifies information about the protocol used by the packet. The possible third line identifies the application data in the packet.

**Summary**
Additional information from the protocol headers or packet data.

**FORMAT**

**Purpose**
Format the CTRACE record header, the IP packet header, the protocol header, and the packet data. If one of the ports is a well-known port number and the SYSTCPDA supports data for the port number, the packet data is shown.
A summary line indicating the source of the trace record showing:

- The record number.
- The system name.
- The type of the trace record.
- The time the record was moved to the trace buffer, or with the TOD option the time the trace data was captured.
- The description of the trace record, Packet Trace, Data Trace, EE, or OSAENTA.

The trace header with these fields:

- The direction of the trace record: From or To.
- The network interface name (or job name for Data Trace).
- The device type.
- Full or Abbrev with amount of trace data available.
- The time the trace record was captured.
- The number of records lost.

The segment number of the CTRACE record for which this packet trace record was written.

The flags that describe this trace record:

**CfTxt**
This packet contains confidential text.

**Adj**
The CTRACE record size was adjusted to a halfword length.

**Tunnel**
This packet consists of multiple protocol headers, for example, UDP that has an SNA packet (EE).

**Rsm**
This packet was reassembled from multiple packets.
Home
The source and destination of this packet are the same.

IpExt
The packet has IP header extensions.

LS
The packet was part of a segmentation offload group of packets.

Ping
The packet is ICMP or ICMPv6 echo or echo reply packet.

Dat
The packet was written in response to a DATTRACE command.

AH
The packet contains an authentication header.

Seg
This trace record was assembled from multiple CTRACE record segments.

In
This packet is an inbound packet.

Out
This packet is an outbound packet.

Bad
The packet had a validation error.

CkSum
The packet had a checksum error.

Pdus
This packet was written when multiple packets were in the same set of buffers.

QID
This packet contains a nonzero OSA QID.

Nta
This packet was written in response to an OSAENTA command.

VLan
This packet contains a VLAN identifier.

Frame
This packet contains an Ethernet header.

LPAR
This packet sent over an OSA as LPAR to LPAR.

L2
This packet was sent as a Level 2 packet (directly routed by using MAC addresses).

L3
This packet was sent as a Level 3 packet (indirectly routed by using IP addresses).

Dscrd
This packet was discarded by OSA or by TCPIP.

Rsp
This packet is a SNA RU response.

Req
This packet is a SNA RU request.

FMD
This packet is a SNA Function Management RU.

NC
This packet is a SNA Network Control RU.

SC
This packet is a SNA System Control RU.
DFC
This packet is a SNA Data Flow Control RU.

FMH
This packet contains a SNA Function Management header.

SMC
This packet was sent over an SMC-R interface.

4
The IP header showing fields from the IPv4 header. The header length is the number of bytes for the header. The offset field is the number of bytes from the end of the IP header where the fragment appears. With the REASSEMBLY option active, this field always contains zeros.

5
The check sum value. If possible, the check sum of the packet is calculated. If the calculated value is X'FFFF', the check sum is correct. If X'0000', the check sum could not be calculated because the packet was incomplete or fragmented. Other values indicate a check sum error.

6
The UDP protocol header. The fields of the header are shown.
The port number for the PORT keywords define the port numbers to be used to invoke a format routine.

**Port**
- **Keyword**
- **67, 68**
  - BOOTP
- **67, 68**
  - DHCP
- **53**
  - Domain
- **12000:12004**
  - EE
- **79**
  - Finger
- **70**
  - Gopher
- **80**
  - HTTP
- **500**
  - IKE
- **4500**
  - NAT
- **123**
  - NTP
- **111**
  - RPC
- **520**
  - RIP
- **520**
  - Router
- **25**
  - SMTP
- **161,162**
  - SNMP
The length of the DNS packet data following is shown.

The DNS header and resource records are formatted. Using the protocol numbers and the known port numbers, format routines are invoked to format standard packet data records.

```
<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>7</td>
</tr>
<tr>
<td>TFTP</td>
<td>37</td>
</tr>
<tr>
<td>TELNET</td>
<td>69</td>
</tr>
<tr>
<td>TIME</td>
<td>7</td>
</tr>
</tbody>
</table>
```

Figure 20. Format report example

A summary line indicating the source of the trace record showing:

- The record number.
- The system name.
- The type of the trace record.
- The time the record was moved to the trace buffer, or with the TOD option the time the trace data was captured.
- The description of the trace record, Packet Trace or Data Trace.

The trace header with these fields:

- The direction of the trace record: From or To.
- The network interface name (or job name for Data Trace).
- The device type.
- Full or Abbrev with amount of trace data available.
- The time the trace record was captured.
- The number of records lost.
- The packet trace header flags.
- For inbound traffic, the queue identifier (QID) and queue type (for example, SYSDIST, BULKDATA, or EE) on which this packet was received using QDIO inbound workload queueing. For more information about QIDs, see QDIO inbound workload queueing in z/OS Communications Server: IP Configuration Guide.

TCP/IP services traces and IPCS support 123
The IP header showing fields from the IPv4 header. The header length is the number of bytes for the header. The offset field is the number of bytes from the end of the IP header where the fragment appears. With the REASSEMBLY option active, this field always contains zeros. If segmentation is offloaded, the ID number field shows the range of IP identifiers represented by this send and the Offload Length field shows the total length of the send (total data length plus one set of headers).

The check sum value. If possible, the check sum of the packet is calculated. If the calculated value is \text{X'FFFF}', the check sum is correct. If \text{X'0000'}', the check sum could not be calculated because the packet was incomplete or fragmented. Other values indicate a check sum error.

The TCP protocol header. The fields of the header are shown. If segmentation is offloaded, the Offload Segments field shows the number of TCP segments represented by this send and the length of each segment. The length of each segment is the data length (not including headers). If all the segments are the same size, then the Last field does not appear. If the remainder of data length is nonzero, then Last field contains the remainder.

**DUMP**

**Purpose**

Format the IP header, protocol header, and packet data in hexadecimal. The data can also be translated into EBCDIC, ASCII, or both.

**Format**

```
CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((DUMP))
```

1 MVS073 PACKET 00000001 19:49:42.788207 Packet Trace
   From Interface : OSAQDIOLINK       Device: QDIO Ethernet   Full=78
   Tod Clock : 2002/02/12 19:49:42.788204
   Sequence # : 0               Flags: Pkt Ver2
   Source Port : 137            Dest Port: 137     Asid: 002B TCB: 00000000

1 IP Header: 20
   000000 4500004E 43060000 8011FEC2 09437311  0943733F

2 Protocol Header: 8
   000000 00090089 003AD7D7

3 Data: 50 Data Length: 50
   000000 0A3D0110 00100000 00000000 28464845 ............ FHE|
   000010 50464345 4C454846 43455046 46464143 ..........<... PFCELEHFCEPFFFAC|
   000020 41434143 41434143 41434142 4C000020 ..........<... ACACACACACABL .. |
   000030 0001 .. ..
```

1 The IP header is dumped with no translation.

2 The protocol header is dumped with no translation.

3 The packet data is dumped with the translation specified by the ASCII, BOTH, EBCDIC or HEX keyword. The default is BOTH. The amount of data dumped can be limited by the value specified with the DUMP keyword. The default is 65535 bytes.

**HPR**

**Purpose**

Select HPR packets and group them by TCID.
Hpr Stats
Report
16384 bytes of storage were used for the HPR reports

<table>
<thead>
<tr>
<th>TCID</th>
<th>Pkt</th>
<th>Byte</th>
<th>OfOrder</th>
<th>OfOrder</th>
<th>ReXmit</th>
<th>ReXmit</th>
<th>SlowDown</th>
</tr>
</thead>
<tbody>
<tr>
<td>1B7580F800010034</td>
<td>1</td>
<td>101</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>00:00:00:000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B7580F900010035</td>
<td>3789</td>
<td>220212</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>00:00:00:000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B762A7F0001001E</td>
<td>1</td>
<td>156</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>00:00:00:000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B762A800001001F</td>
<td>3340</td>
<td>218802</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>00:00:00:000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B762A800001002D</td>
<td>4340</td>
<td>518802</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>258</td>
<td>0</td>
</tr>
<tr>
<td>00:00:00:000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TCID**
Provides the name of the TCID (local or remote) for that particular session.

**Pkt**
Total number of packets for that TCID.

**Byte**
Total number of bytes for that TCID.

**PktOutOfOrder**
Number of out-of-order packets for that TCID.

**ByteOutOfOrder**
Number of out-of-order bytes for that TCID.

**PktReXmit**
Number of packets retransmitted for that TCID.

**ByteReXmit**
Number of bytes retransmitted for that TCID.

**SlowDwn**
Number of ARB slow downs for that TCID.

**SlowDownElapsedTime**
Total time spent in adaptive rate base (ARB) slowdown mode.

**REASSEMBLY**

**Purpose**
This report shows the packets that were reassembled. Use the REASSEMBLY(DETAIL) option to see all the packets that were reassembled. If the reassembled packets are larger than 32K then use REASSEMBLY(nnnnn), where nnnnn is the maximum size of a reassembled packet.

**Format**

CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((REASSEMBLY(DETAIL) STAT))

<table>
<thead>
<tr>
<th>Rcd Nr</th>
<th>Time</th>
<th>Delta</th>
<th>Offset Length</th>
<th>Next</th>
<th>Gap</th>
<th>Data Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>1638</td>
<td>15:28:49.975479</td>
<td>00:00:00.000000</td>
<td>0</td>
<td>3976</td>
<td>3976</td>
<td>0 3976</td>
</tr>
<tr>
<td>1639</td>
<td>15:28:49.975501</td>
<td>00:00:00.000022</td>
<td>3976</td>
<td>3976</td>
<td>7952</td>
<td>0 3976</td>
</tr>
<tr>
<td>1640</td>
<td>15:28:49.975524</td>
<td>00:00:00.000044</td>
<td>7952</td>
<td>3976</td>
<td>11928</td>
<td>0 3976</td>
</tr>
<tr>
<td>1641</td>
<td>15:28:49.975545</td>
<td>00:00:00.000066</td>
<td>11928</td>
<td>3976</td>
<td>15904</td>
<td>0 3976</td>
</tr>
<tr>
<td>1642</td>
<td>15:28:49.975567</td>
<td>00:00:00.000088</td>
<td>15904</td>
<td>3976</td>
<td>19880</td>
<td>0 3976</td>
</tr>
<tr>
<td>1643</td>
<td>15:28:49.975594</td>
<td>00:00:00.00115</td>
<td>19880</td>
<td>3976</td>
<td>23856</td>
<td>0 3976</td>
</tr>
<tr>
<td>1644</td>
<td>15:28:49.975620</td>
<td>00:00:00.00141</td>
<td>23856</td>
<td>3976</td>
<td>27832</td>
<td>0 3976</td>
</tr>
</tbody>
</table>
Reassembly is always done (except with the NOREASSEMBLY option). However, the REASSEMBLY(DETAIL) option is needed for the report on completed reassemblies.
The current packet that was reassembled is identified with source and destination IP address and port numbers. The IP identification number is shown. The status of the reassembly is shown. Completed packets are shown when the final packet is received. Incomplete packets are shown during the final processing.

Each packet that was reassembled is shown. The flag shows the type of packet:

- **Fis**: First in the segment. The offset was 0.
- **Mis**: Middle in the segment. The offset was a nonzero value and the more fragment flag was set.
- **Lis**: Last in the segment. The offset was nonzero and the more fragment flag was not set.
- **Ooo**: The packet arrived out of order.

The Gap field is the number of bytes between the end of one packet and the start of the next. This should have a value of zero for normal processing. Nonzero values indicate duplicate data being sent.

When all the trace records have been processed the final report on reassembly is formatted. The maximum reassembly buffer size is shown. Packets that would exceed this size are rejected. This simulates the Ping of Death processing.

Incomplete packets that did not complete reassembly are shown.

The total number of trace records that were reassembled is shown with other statistics.

- **200 packets required reassembly**: The number of packets that required reassembly (that had a fragment offset or the more fragment flag set).
- **57 IP packet reassemblies were done**: The number of reassembled packets.
- **54 IP packets were completely reassembled**: The number of reassembled packets where all the fragments were found.
- **3 IP packets were incomplete**: The number of reassembled packets where all the fragments were not found.
- **0 packets failed reassembly**: The number of packets that would have caused the completed packet to exceed the reassembly size.
- **170 storage requests for buffers were made**: The number of times a request for reassembly buffer was made.
- **128,747 bytes of buffer space is still in use**: The amount of storage still in use for incomplete packets.
- **284,158 bytes of buffer space was the maximum in use**: The maximum amount of storage in use while reassembling packets.

**Guideline**: For reassembled packets, the calculated check sum fields are not 'FFFF', because the packets were modified by the reassembly process.

**SESSION TCP**

**Purpose**

This report shows traffic for a TCP session.
### Format

CTRACE COMP(SYSCPDA) SUB((TCPCS)) SHORT OPTIONS((SESSION TCP))

<table>
<thead>
<tr>
<th>1</th>
<th>2 packets summarized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Ip Address:</td>
<td>FEC9:C2D4::6:2900:EDC:217C</td>
</tr>
<tr>
<td>Remote Ip Address:</td>
<td>FEC9:C2D4::9:67:115:17</td>
</tr>
<tr>
<td>Host:</td>
<td>Local, Remote</td>
</tr>
<tr>
<td>Client or Server:</td>
<td>CLIENT, SERVER</td>
</tr>
<tr>
<td>Port:</td>
<td>1027, 21</td>
</tr>
<tr>
<td>Application:</td>
<td>ftp</td>
</tr>
<tr>
<td>Link speed (parm):</td>
<td>10, 10 Megabits/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Connection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>First timestamp:</td>
<td>19:55:46.934032</td>
</tr>
<tr>
<td>Last timestamp:</td>
<td>19:55:46.934989</td>
</tr>
<tr>
<td>Duration:</td>
<td>00:00:00.000957</td>
</tr>
<tr>
<td>Average Round-Trip-Time:</td>
<td>0.000 sec</td>
</tr>
<tr>
<td>Final Round-Trip-Time:</td>
<td>0.000 sec</td>
</tr>
<tr>
<td>Final state:</td>
<td>CLOSED (PASSIVE RESET)</td>
</tr>
<tr>
<td>Out-of-order timestamps:</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Data Quantity &amp; Throughput:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application data bytes:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Sequence number delta:</td>
<td>0, 1</td>
</tr>
<tr>
<td>Total bytes Sent:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Throughput:</td>
<td>0, 0 Kilobytes/s</td>
</tr>
<tr>
<td>Bandwidth utilization:</td>
<td>0.00%, 0.00%</td>
</tr>
<tr>
<td>Minimum Ack Time:</td>
<td>0.000957, 0.000000</td>
</tr>
<tr>
<td>Average Ack Time:</td>
<td>0.000957, 0.000000</td>
</tr>
<tr>
<td>Maximum Ack Time:</td>
<td>0.000957, 0.000000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>Data Segment Stats:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of data segments:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Maximum segment size:</td>
<td>1432, 0</td>
</tr>
<tr>
<td>Largest segment size:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Average segment size:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Smallest segment size:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Segments/window:</td>
<td>0.0, 0.0</td>
</tr>
<tr>
<td>Average bytes/window:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Most bytes/window:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Offload Sends:</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>Offload Segments:</td>
<td>6</td>
</tr>
<tr>
<td>Offload Bytes:</td>
<td>43616 (72.69%)</td>
</tr>
<tr>
<td>Total Packets(normal + offload):</td>
<td>18 (83.33%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5</th>
<th>Window Stats:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of windows:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Maximum window size:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Largest window advertised:</td>
<td>0, 32768</td>
</tr>
<tr>
<td>Average window advertised:</td>
<td>0, 32768</td>
</tr>
<tr>
<td>Smallest window advertised:</td>
<td>0, 32768</td>
</tr>
<tr>
<td>Window scale factor:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Window frequency:</td>
<td>0, 0 Windows/s</td>
</tr>
<tr>
<td>Time Stamp updates:</td>
<td>0, 0</td>
</tr>
<tr>
<td>Total Round Trip Time:</td>
<td>0.000000, 0.000000 (0%), (0%)</td>
</tr>
<tr>
<td>Average Round Trip Time:</td>
<td>0.000000, 0.000000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th>Number of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packets:</td>
<td>1, 0</td>
</tr>
<tr>
<td>(x) Untraced Packets:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(. ) In-order data:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(a) Acknowledgments:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(+) Data and ACK:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(u) Duplicate ACKs:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(w) Window size updates:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(z) Zero window sizes:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(p) Window probes:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(k) Keepalive segments:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(r) Retransmissions:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(o) Out-of-order:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(d) Delayed ACKs:</td>
<td>0, 0</td>
</tr>
<tr>
<td>(f) Fragments:</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7</th>
<th>Time Spent on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-order data:</td>
<td>00:00:00.000000, 00:00:00.000000 (0.00%), (0.00%)</td>
</tr>
<tr>
<td>Acknowledgments:</td>
<td>00:00:00.000957, 00:00:00.000000 (106.33%), (0.00%)</td>
</tr>
<tr>
<td>Data and ACK:</td>
<td>00:00:00.000957, 00:00:00.000000 (0.00%), (0.00%)</td>
</tr>
<tr>
<td>Duplicate ACKs:</td>
<td>00:00:00.000000, 00:00:00.000000 (0.00%), (0.00%)</td>
</tr>
<tr>
<td>Window size updates:</td>
<td>00:00:00.000000, 00:00:00.000000 (0.00%), (0.00%)</td>
</tr>
<tr>
<td>Zero window sizes:</td>
<td>00:00:00.000000, 00:00:00.000000 (0.00%), (0.00%)</td>
</tr>
<tr>
<td>Messages</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td>1) The largest inbound window is less than twice the inbound MSS.</td>
<td></td>
</tr>
<tr>
<td>2) This may reduce inbound throughput for bulk data transfers.</td>
<td></td>
</tr>
<tr>
<td>3) It is usually desirable for the window size to be at twice the MSS.</td>
<td></td>
</tr>
</tbody>
</table>

6) Window Stats
These statistics are about the window changes. The Window scale factor is captured from the SYN packet. The Time Stamp updates are captured from the Tcp header options.

7) Time Spent on:
These statistics are about the number of data packets that flow for carrying data. The percentages are based on the number of packets.
These statistics are about the delta times of data packets that flow for carrying data. The percentages are based on the duration of the session.

8
Number of
These statistics are about the number of control packets that flow for starting and ending a session. The percentages are based on the number of packets.

9
Time Spent on
These statistics are about the delta times of control packets that flow for starting and ending a session. The percentages are based on the duration of the session.

10
Details TcpHdr
The flags from the TCP header
*  This packet is reassembled.
A  This packet is an acknowledgment.
P  This packet has the PUSH flag set.
U  This packet is urgent.
S  This packet is a syn.
F  This packet is a fin.
R  This packet is a reset.
The type of data packet has one of the following flags:
  .  The packet flowed in order as per its sequence number.
  x  There is a gap in the sequence number and it looks like there is untraced data.
  a  The packet is a stand-alone acknowledgment of previously received data.
  +  The packet is an acknowledgment of previously received data and also contains data.
  u  The packet is an acknowledgment of data previously acknowledged.
  w  The packet updated the window size.
  z  The packet changed the window size to zero.
  p  The packet was a window probe.
  k  The packet was a keepalive packet.
  r  The packet was retransmission.
The packet arrived out of order.

The packet exceeded the delay time threshold.

The packet was a fragment of a complete IP packet.

A dropped packet that had a checksum error, that was a fragment, or that was discarded.

**SESSION UDP**

**Purpose**

This report shows traffic for a UDP session.

**Format**

CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((SESSION UDP))

| 1 | The number of packet records for this session. |
| 2 | The IP addresses and port numbers of the session, and the protocol that is used for the session. |
| 3 | The first and last time of a packet in the session and the length of the session. |
| 4 | Data Segment Stats  
These statistics are about the packets, the number of packets, and the sizes of the packet. The largest, average, and minimum packet size. The time spent sending and receiving packets. |
| 5 | Details about each packet. The following flags can be set:  
D  
Don’t Fragment flag is set  
O  
Only in chain packet |
F  First in chain packet
M  Middle in chain packet
L  Last in chain packet
T  Encapsulated packet
R  Reassembled packet
P  ICMP Echo packet
Q  ICMP Echo request packet
R  ICMP Echo reply packet
C  Check sum error in packet
N  OSAENTA packet
V  VLAN ID in packet
2  Layer 2 packet
3  Layer 3 packet
!  Discarded packet
I  Inbound packet
O  Outbound packet

SNIFFER

Purpose
This report shows information that is written to the SNIFFER data set.

Restriction: Do not use the SNIFFER option when the CTRACE subcommands are used with the IPCS MERGE subcommand. The SNIFFER data file is written over by the multiple CTRACE commands that specify the SNIFFER option.

Format
ALLOC F(SNIFFER) DATASET(SNIFFER.TRC) LRECL(1600) RECFM(V B) REUSE TRACK SPACE(15 15)
CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((SNIFFER NOREASSEMBLY STATS))

<table>
<thead>
<tr>
<th>Index</th>
<th>Count</th>
<th>Link</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>OSAQDIOLINK</td>
<td>9.67.115.63</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
<td>LOOPBACK</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>OSAQDIOLINK</td>
<td>9.67.115.5</td>
</tr>
<tr>
<td>5</td>
<td>21</td>
<td>OSAQDIOLINK</td>
<td>FE80:6:2900:EDC:217C</td>
</tr>
</tbody>
</table>

132  z/OS Communications Server: IP Diagnosis Guide
Sniffer Report

- 13,963 records written to USER2.SNIFFER.ETH
- 1,730,182 bytes written
- 1184 packets were abbreviated
- 200 is the maximum data size
- 12438 packets were truncated from 1546 bytes

The list of device names found in the selected records. Each device is assigned an interface index.

This record count includes the two header records and one trailer record written to the SNIFFER data set.

The number of data bytes written to the SNIFFER data set. This is the amount of data to be downloaded.

The number of abbreviated records. This number is included in 6.

Maximum size of the truncated records.

The number of truncated records. Records were truncated because the size of the packet exceeded the logical record length of the SNIFFER file. Increase the logical record length to prevent the records from being truncated. The maximum logical record length is 32,763 or the size of physical disk blocks, whichever is smaller.

STATISTICS

Purpose

The records are counted by record type, device type, device name, job name, protocol, IP address, TCP port number, and UDP port number.

Format

CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((STATISTICS(DETAIL)))

TCP/IP services traces and IPCS support 133
4 Interface Report

<table>
<thead>
<tr>
<th>Interface Address Report</th>
<th>Total</th>
<th>Input Data</th>
<th>Output Data</th>
<th>First yyyy/mm/dd hh:mm:ss</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/02/12 19:50:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:50:00</td>
<td>2010/02/12 19:50:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:51:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:51:00</td>
<td>2010/02/12 19:51:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:52:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:52:00</td>
<td>2010/02/12 19:52:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:53:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:53:00</td>
<td>2010/02/12 19:53:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:54:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:54:00</td>
<td>2010/02/12 19:54:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:55:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:55:00</td>
<td>2010/02/12 19:55:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:56:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:56:00</td>
<td>2010/02/12 19:56:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:57:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:57:00</td>
<td>2010/02/12 19:57:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:58:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:58:00</td>
<td>2010/02/12 19:58:00</td>
<td>1006:0/1006:177</td>
</tr>
<tr>
<td>2010/02/12 19:59:00</td>
<td>5</td>
<td>6787</td>
<td>6787</td>
<td>2010/02/12 19:59:00</td>
<td>2010/02/12 19:59:00</td>
<td>1006:0/1006:177</td>
</tr>
</tbody>
</table>

5 Protocol Report

<table>
<thead>
<tr>
<th>Protocol Report</th>
<th>Total</th>
<th>Data Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/02/12 19:50:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:51:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:52:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:53:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:54:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:55:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:56:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:57:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:58:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:59:00</td>
<td>5</td>
<td>6787</td>
</tr>
</tbody>
</table>

6 IP Address Report

<table>
<thead>
<tr>
<th>IP Address Report</th>
<th>Total</th>
<th>Data Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/02/12 19:50:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:51:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:52:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:53:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:54:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:55:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:56:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:57:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:58:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:59:00</td>
<td>5</td>
<td>6787</td>
</tr>
</tbody>
</table>

Qos Report

<table>
<thead>
<tr>
<th>Qos Report</th>
<th>Total</th>
<th>Data Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/02/12 19:50:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:51:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:52:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:53:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:54:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:55:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:56:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:57:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:58:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:59:00</td>
<td>5</td>
<td>6787</td>
</tr>
</tbody>
</table>

Tcp Port Report

<table>
<thead>
<tr>
<th>Tcp Port Report</th>
<th>Total</th>
<th>Data Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010/02/12 19:50:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:51:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:52:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:53:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:54:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:55:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:56:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:57:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:58:00</td>
<td>5</td>
<td>6787</td>
</tr>
<tr>
<td>2010/02/12 19:59:00</td>
<td>5</td>
<td>6787</td>
</tr>
</tbody>
</table>
The standard statistics shown with all executions of the SYSTCPDA packet trace formatter.

**ctrace records processed**
The total number of CTRACE records given to the SYSTCPDA packet trace formatter by IPCS.

**segmented trace records read**
The total number of packets that spanned multiple CTRACE records.

**segmented trace records were lost**
The total number of segmented packets records that could not be put back together.

**trace records read**
The total number of complete trace records.

**records could not be validated**
The number of incomplete CTRACE records that could not be used.
records passed filtering
   The number of records that were successfully formatted.

packet trace records processed
   The number of records that were packet trace records.

data trace records processed
   The number of records that were data trace records.

2  The totals by record type (Packet trace, X25, and data trace).

3  The totals by device type for packet trace records.

4  The totals by Interface or Link Name for packet trace records.

5  The totals by Protocol number for packet trace records.

6  The totals by IP Address. Both the destination and source IP addresses are counted except when they are the same within a record.

7  The totals by TCP Port number. Both the destination and source port numbers are counted except when they are the same within a record.

8  The totals by UDP port number. Both the destination and source port numbers are counted except when they are the same within a record.

   Restriction: Reports 2 through 8 are shown only when STATISTICS(DETAIL) is specified in the OPTIONS string.

9  The totals by session partner pairs (IP addresses, protocol number, and port numbers).

10 The number of records processed for the statistics report.

11 The time stamp of the first record in the input file, the time stamp of the last record in the input, and the duration from the first to last record.

   Note: Records that have been abbreviated are not shown in this example. The number of records that were abbreviated and the maximum abbreviated size are shown. Also, the number and maximum size of the records that were not abbreviated are shown.

12 The size of the largest packet found in the input file.

13 The number of records processed for the statistics report, the number of 1-KB blocks of storage required for this report, the number of storage requests, and the total amount of storage required for the requests.

   The report by Jobname for data trace records is not shown. Each category of totals is broken down by:
   • The total number of records
   • The total number of inbound records
   • The total amount of inbound data
   • The total number of outbound records
   • The total amount of outbound data
   • The record number of the first record
- The time stamp of the first record
- The record number of the last record
- The time stamp of the last record

**STREAM**

**Purpose**

Sometimes messages span multiple packets. TELNET and DNS are examples. The STREAM report (with the DUMP or FORMAT keywords) captures the entire stream of data.

**Format**

```
CTRACE COMP(SYSTCPDA) SUB((TCPCS)) SHORT OPTIONS((STREAM DUMP ASCII))
```

<p>|===============================================================================|
|1  Streams Report                                                          |
|60 Streams found                                                           |
|23600 bytes of storage for the session report was allocated                |</p>
<table>
<thead>
<tr>
<th>1146880 bytes of storage for buffers was allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 packets found</td>
</tr>
<tr>
<td>Stream buffer at 0A818000 for 20480 bytes. 144 bytes were used</td>
</tr>
<tr>
<td>3 packets moved for 144 bytes</td>
</tr>
<tr>
<td>I - Inbound packet</td>
</tr>
<tr>
<td>O - Outbound packet</td>
</tr>
<tr>
<td>3  D Rcd # Time              Delta Seq # Position Length  End_Pos</td>
</tr>
<tr>
<td>90 19:55:04.615118 00:00:00.000000 0 0 24 24</td>
</tr>
<tr>
<td>90 FEC9C2D4 00000000 2062AFF FE714400 02010066 2A714400</td>
</tr>
<tr>
<td>I    91 19:55:04.615118 00:00:00.000000 24 24 60 84</td>
</tr>
<tr>
<td>91 000000 60000000 00000000 00000000 00000000 00000000 00000000 00000000</td>
</tr>
<tr>
<td>91 000000 60000000 00000000 00000000 00000000 00000000 00000000 00000000</td>
</tr>
</tbody>
</table>
|When all the records have processed, the number of streams and the amount of storage required for the report and buffers are shown.

Each session is identified by the IP addresses, port number, and protocol. The time stamps of the first and last packet are shown along with the number of packets, the address, and size of the stream buffer.

When a stream is dumped, each packet and the data from the packet is shown. If there are gaps in the stream, the number of bytes skipped is displayed. The data about each packet formatted are:

- **D**
  - The direction of the packet: I for inbound and O for outbound.

- **Rcd #**
  - The record number.

- **Time**
  - The time stamp of the record.

- **Delta**
  - The time from the first record of the stream.

- **Seq #**
  - The sequence number of the TCP packet. For other packets it is the relative offset of the packet from the first packet.

- **Position**
  - The relative offset of the packet.
Length
The number of bytes in the packet.

End_Pos
The ending sequence number.

Formatting packet trace using a batch job

A Packet Trace can also be formatted through the use of a batch job. The following example is an example of JCL for a batch job:

```plaintext
//jobname   DD (accounting),pgmname,CLASS=A,MSGCLASS=A
//DUMP    EXEC PGM=IKJEFT01
//STEPLIB   DD DISP=SHR,DSN=hlq.MIGLIB
//SYSPRINT  DD SYSOUT=*
//SYSUDUMP  DD SYSOUT=*
//SYSTSPRT  DD SYSOUT=*
//PRINTER   DD SYSOUT=*
//SYSPROC   DD DISP=SHR,DSN=SYS1.CLIST
//       DD DISP=SHR,DSN=SYS1.SBLSCLIO
//       DD DISP=SHR,DSN=CPAC.PARMLIB
//       DD DISP=SHR,DSN=SYS1.IBM.PARMLIB
//       DD DISP=SHR,DSN=userid.IPCS.DMPDIR
//SYSTSIN   DD *
IPCS NOPARM
SETDEF DA('ctrace.dataset')
CTRACE COMP(SYSTCPDA) OPTIONS((systcpda_options_string))
END
/*
```

Data trace (SYSTCPDA) for TCP/IP stacks

Use the DATTRACE command to trace socket data (transforms) into and out of the physical file structure (PFS). For TCP and UDP sockets, data trace also creates the following records:

- A Start record with State field API Data Flow Starts that indicates the first data sent or received by the application for the associated socket
- An End record with State field API Data Flow Ends that indicates that the socket has been closed

DATTRACE operates with the following APIs:

- REXX
- C-sockets
- IMS
- CICS
- Native z/OS UNIX
- Macro
- CALL Instruction

See z/OS Communications Server: IP System Administrator’s Commands for information about the format of the data trace command (VARY DATTRACE).

Starting data trace

You can start data trace for all job names using the VARY command:

```
V TCPIP,tcpprocname,DAT
```

Tips:
To use any VARY command, the user must be authorized in RACF. This replaces the old OBEY list authorization.

Each user's RACF profile must have access for a resource of the form MVS.VARY.TCPIP.xxx, where xxx is the first eight characters of the command name. For data trace, this would be MVS.VARY.TCPIP.DATTRACE.

Traces are placed in an internal buffer, which can then be written out using an external writer. The MVS TRACE command must also be issued for component SYSTCPDA to activate the data trace.

Displaying data traces

You can use the Netstat CONFIG/-f command to display data traces. Figure 21 on page 140 shows a data trace for a single entry.

```
netstat -p TCPCS -f
...
Data Trace Setting:
JobName: *          TrRecCnt: 00000006  Length: FULL
IpAddr:  *              SubNet: *
PortNum: *
```

Figure 21. Data trace: Single entry

Figure 22 on page 140 shows a data trace for multiple entries.

```
netstat -p TCPCS -f
...
Data Trace Setting:
JobName: MEGA4        TrRecCnt: 00000000  Length: FULL
IpAddr:  127.0.0.3      SubNet: *
PortNum: *
JobName: *          TrRecCnt: 00000000  Length: FULL
IpAddr:  127.0.0.9      SubNet: *
PortNum: *
```

Figure 22. Data trace with multiple entries

Formatting data traces using IPCS

Data trace records are written to the same CTRACE component as packet trace records (SYSTCPDA). Thus, all the IPCS formatting features for packet trace are also available for data trace. You can use the ENTIDLIST parameter to isolate data trace records and packet trace records from each other. For an example of data trace records formatted by the FORMAT option, see the sample below. For a full description of the FORMAT option and information about other options that can be used to format data trace records, see “Formatting packet traces using IPCS” on page 90.

SYSTCPDA can create two types of records:

**Common data trace records**

SYSTCPDA creates common data trace records for every data exchange between the two endpoints of a session.

**Start and End records**

For TCP and UDP sockets, SYSTCPDA creates start and end records to delineate the logical boundaries of a session. The start and end records are created for the following socket processing:

- Initial socket read or write
- Close of a socket

The main difference between the two types of records is the absence of actual data in start and end records. Common data trace records have a field called Data, which contain payload data that is transmitted between the two endpoints. Start and end records also contain a field called State, which indicates whether the record represents the start or end of the session.

---

1 The term session here should be read as a logical connection between two endpoints, independent of the protocol used (which can be TCP or UDP).
Figure 23 on page 141 is an example of the FORMAT option output, which shows a set of records for a socket, including the start data trace record, a common data trace record, and the end data trace record.

<table>
<thead>
<tr>
<th>63 MVS182</th>
<th>DATA</th>
<th>00000005</th>
<th>13:18:52.705250</th>
<th>Data Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Jobname: USER12</td>
<td>Full=0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tod Clock: 2009/06/22 13:18:52.705248</td>
<td>Cid: 00000058</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domain: AF_Inet</td>
<td>Type: Stream Protocol: TCP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State: API Data Flow Starts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment #: 0</td>
<td>Flags: Out</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source: 10.81.2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destination: 10.81.2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Port: 0</td>
<td>Dest Port: 2000 Asid: 0041 TCB: 006FF1D8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>64 MVS182</th>
<th>DATA</th>
<th>00000005</th>
<th>13:18:52.705252</th>
<th>Data Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Jobname: USER12</td>
<td>Full=39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tod Clock: 2009/06/22 13:18:52.705252</td>
<td>Cid: 00000058</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domain: AF_Inet</td>
<td>Type: Stream Protocol: TCP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment #: 0</td>
<td>Flags: Adj Out</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source: 10.81.2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destination: 10.81.2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Port: 2000</td>
<td>Dest Port: 0 Asid: 0041 TCB: 006FF1D8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>63 MVS182</th>
<th>DATA</th>
<th>00000005</th>
<th>13:18:52.705250</th>
<th>Data Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Jobname: USER12</td>
<td>Full=0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tod Clock: 2009/06/22 13:18:52.705254</td>
<td>Cid: 00000058</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domain: AF_Inet</td>
<td>Type: Stream Protocol: TCP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State: API Data Flow Ends</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment #: 0</td>
<td>Flags: None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source: 10.81.2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destination: 10.81.2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source Port: 0</td>
<td>Dest Port: 2000 Asid: 0041 TCB: 006FF1D8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Format Option Output**

- **Jobname**: Provides the name of the job that performed the socket read or write operation.
- **Full or Abbrev**: Indicates whether the whole packet was traced and provides the length of the traced data.
  - The value Full = x indicates that the whole packet was traced.
  - The value Abbrev = x indicates that a truncated portion of the packet was traced.
- **Tod Clock**: Provides the timestamp of the time when the read or write operation took place.
- **Cid: xxxxxxxx**: Provides the connection id that uniquely identifies the session between the two endpoints. As shown in the example, the Cid is the same for the three records.
- **Domain**: Indicates whether this is IPv4 (AF_Inet) or IPv6 (AF_Inet6).
- **Type and Protocol**: Provide the type of traffic (e.g. Stream, Datagram, Raw) and protocol used.
- **State**: This field is only displayed for a start or end record and indicates whether this is a start or an end record.
- **Source and Destination**: Provide the source and destination IP addresses of the two end points. For TCP sockets, these values are always provided. For UDP sockets, these values are provided only when a connect or bind function was executed against the socket.
- **Source Port and Dest Port**: Provide the port numbers of the source and destination addresses.
Asid and TCB
Provide the address space id and TCB address.

Data
Provides the length of the payload data and is followed by a hexadecimal display of the actual payload data.

### Intrusion Detection Services trace (SYSTCPIS)

When starting the TCP stack, the stack reads the CTIIDS00 parmlib member to determine the size to reserve for the SYSTCPIS CTRACE. You can override this default by starting TCP/IP with the PARM option and the keyword IDS=xx, where xx is the suffix of the CTIIDSxx PARMLIB member. In the following example, the trace searches for PARMLIB member CTIIDSA3.

```
S tcpiproc,PARM='IDS=A3'
```

If the parmlib member is not found or the member contains data that is not valid, the following message is displayed.

```
EZZ4210I CTRACE DEFINE FAILED FOR CTIIDS00
```

If the EZZ4210I message indicates the parmlib member name CTIIDS00, the IDS CTRACE space is set up using the default BUFSIZE of 32M.

The CTIIDS00 member is used to specify the IDS CTRACE parameters. To eliminate this message, ensure that a CTIIDS00 member exists within Parmlib and that the options are correctly specified. A sample CTIIDS00 member is shipped with z/OS Communications Server.

Packets are traced based on IDS policy. See Intrusion Detection Services in z/OS Communications Server: IP Configuration Guide for information about defining policy.
See Chapter 26, “Diagnosing intrusion detection problems,” on page 631 for additional information about diagnosing policy problems.

Figure 24. SYS1.PARMLIB member CTIIDS00

Restrictions

For IDS trace records the COMP keyword must be SYSTCPIS. Because there are no EXCEPTION records for IDS trace, the EXCEPTION keyword must not be specified.

CTRACE keywords on SYSTCPIS

The following describes those CTRACE keywords that affect SYSTCPIS processing.

ENTIDLIST

Use the ENTIDLIST keyword to select trace records with a specific ProbeId.

JOBLIST, JOBNAME

Use the JOBLIST and JOBNAME keywords to select trace records with a matching job name. Also, use the JOBNAME keyword in the OPTIONS list to select records.

ASIDLIST

Use the ASIDLIST to select trace records with a matching Asid.

GMT

The time stamps are converted to GMT time.

LOCAL

The time stamps are converted to LOCAL time.
SHORT
If the OPTIONS keyword does not specify any reports, format the trace records. Equivalent to the FORMAT option.

FULL
If the OPTIONS keyword does not specify any reports, format and dump the trace records. Equivalent to the FORMAT and DUMP options.

SUMMARY
If the OPTIONS keyword does not specify any reports, create a one line summary for each trace record. Equivalent to the SUMMARY option.

TALLY
If the OPTIONS keyword does not specify any reports, then count the trace records. Equivalent to the STATISTICS option.

START and STOP
These keywords limit the trace records seen by the packet trace formatter. The START keyword determines the time when records are seen by the packet trace report formatter. The STOP keyword determines the time when records are no longer seen by the packet trace report formatter.

Rule: CTRACE always uses the time the trace record was moved to the buffer for START and STOP times.

LIMIT
Determines the number of records that the packet trace formatter is allowed to process. See the RECORDS keyword value in OPTIONS.

USEREXIT
The CTRACE USEREXIT is not called because the packet trace formatter tells CTRACE to skip all the records. Therefore, the packet trace formatter calls the CTRACE USEREXIT before testing the records with the filtering criteria. If it returns a nonzero return code, the record is skipped. The USEREXIT can also be used in the OPTIONS keyword. It is called after the record has met all the filtering criteria in the OPTIONS keyword. The OPTIONS keyword provides a means of entering additional keywords for record selection and formatting.

SYSTCPI5 OPTIONS
Use the CTRACE OPTIONS string to enter more keywords for record selection and formatting intrusion detection services (IDS) traces (COMP=SYSTCPI5). See “Syntax” on page 52 for the complete syntax of CTRACE.

The syntax for the OPTIONS keyword for IDS trace is the same as the syntax for the packet trace OPTIONS keyword, with a few exceptions. See “OPTIONS syntax” on page 91 for the values for the OPTIONS keyword.

You can use the following additional keywords to select records in an IDS trace:

Record Identifiers

- CORRELATOR
- GROUP
- INSTANCE
- PROBEID
- ENTRYID
- TYPE

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The following keywords that are available for packet trace are not available for selecting records in an IDS trace: ARP, DATTRACE, DEVICEID, ETHTYPE, HPRDIAG, MACADDR, PACKETTRACE, PKTTRACE, VLANID, and X25.

OPTIONS keywords

The following are keywords used for the OPTIONS component routine parameters.

CORRELATOR
Select trace records with one of the matching correlator identifiers. Up to 16 identifiers can be specified. Each identifier in the list can be a range: low_number:high_number. Values can be decimal (nnnnnnnnnn) or hexadecimal (X'hhhhhhhh'). This filter associates packets in the trace with an IDS event message in syslogd or the system console.

GROUP
Select trace records with one of the matching group identifiers. The following group identifiers can be specified:
• TCPTR
• UDPTR
• SCAN
• ATTACK

INSTANCE
Select trace records with one of the matching instance identifiers. The identifiers can be in decimal (nnnnn) or hexadecimal (x'hhhhhhhh'). The instance identifier is the lower 2 bytes of the probe identifier. Up to 16 identifiers can be specified.

PROBEID
Select trace records with one of the matching probe identifiers. The identifiers can be expressed in decimal (nnnnn) or hexadecimal (x'hhhhhhhh'). Up to 16 identifiers can be specified. You can also specify the probe identifiers on the ENTIDLIST keyword of the CTRACE subcommand. See z/OS Communications Server: IP and SNA Codes for additional information about probe identifiers.

TYPE(probe type identifier)
Select trace records with one of the matching probe type identifiers. The probe type identifier is the first 2 bytes of the probe identifier. Up to 16 identifiers can be specified. You can use the following probe types:

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0100</td>
<td>TCPTR</td>
</tr>
<tr>
<td>0200</td>
<td>UDPTR</td>
</tr>
<tr>
<td>0301</td>
<td>VSSCAN</td>
</tr>
<tr>
<td>0302</td>
<td>PSSCAN</td>
</tr>
<tr>
<td>0303</td>
<td>NORMSCAN</td>
</tr>
<tr>
<td>0401</td>
<td>MALFORMED</td>
</tr>
<tr>
<td>0402</td>
<td>RAW</td>
</tr>
<tr>
<td>0403</td>
<td>IPFRAGMENT</td>
</tr>
</tbody>
</table>
IDS reports

The SYSTCPIS CTRACE formatter is based on the SYSTCPDA formatter (and in fact shares many of the data structures and format routines) and includes the reports for the SYSTCPDA formatter. However, the REASSEMBLY, SESSION, and STREAMS reports might prove of little value for the SYSTCPIS, because they depend on having a more complete set of packets.

- The STATISTICS report (both SUMMARY and DETAIL) provides an overview of the data collected.
- The SUMMARY report provides one line per IDS event.
- The FORMAT, and DUMP reports format individual packets.
- The EXPORT and SNIFFER options write the packet to an external file for later analysis.

The following topics describe the various reports available.

OPTION

Purpose

List the selected options and default keyword values.
The following describes numbered areas of the example.

1 DSNAME is the name of the source data.

2 OPTIONS((...)) is a listing of the active options with default values.

**SUMMARY**

**Purpose**

Show one line of information about each record in the trace.

**Format**

The following command was used to obtain the example of this report.

```
CTRACE COMP(SYSTCPIS) SUB((TCPCS)) SUMMARY DSN('IBMUSER.CTRACE1')
```
The following describe areas of the example.

D
    Direction of the packet:
    I
        Inbound packet
    O
        Outbound packet

P
    The packet protocol:
    T
        TCP
    U
        UDP
    I
        ICMP
    G
        IGMP
    P
        Other

Nr
    The CTRACE record number.

hh:mm:ss.mmmmmm
    The time stamp of the record.

IpId
    The packet ID number in hexadecimal.

Group
    The group assigned to the trace record. The value can be ATTACK, SCAN, UD PTR or TC PTR.

Probed
    The probe identifier assigned to the trace record.

Corelatr
    The correlator assigned to the trace record. Use this to correlate the trace data with console or syslog messages.

JobName
    The job name assigned to the trace record.

Cid
    The connection identifier assigned to the trace record.

DatLn
    The length of the data.

Data
    The protocol in the IP header.

Source/Destination
    The source and destination IP address and port number.
**FORMAT**

**Purpose**

Format the CTRACE record header, the IP packet header, the protocol header, and the packet data. If one of the ports is a well-known port number and the SYSTCPIS supports data for the port number, the packet data is shown.

**Format**

The following command was used to obtain the example of this report.

```plaintext
CTRACE COMP((SYSTCPIS)) SUB((TCPPCS)) SHORT DSN('IBMUSER.CTRACE1') OPTIONS((OPT FORMAT))
```

```
COMPONENT TRACE SHORT FORMAT
SYSTYPE(MVS118)
COMP((SYSTCPIS)) SUBNAME((TCPPCS))
OPTIONS((OPT FORMAT))
DSNAME('IBMUSER.CTRACE1')

OPTIONS((Both Bootp(67,68) Cleanup(500) DelayAck(200,200) Domain(53)
Finger(79) Flags() Format(Detail) Ftp(20,21) Gain(125,250) Gopher(70)
Limit(999999999) GmtNtp(123) Option Noreasembly Router(520) Rpc(111)
Segment Smtp(25) Smmp(161,162) Speed(10,10) Telnet(23) Tftp(69) Time(37)
Userexit() WwW(80)))

1  **** 2002/11/20
RcdNr Sysname Mnemonic Entry Id   Time Stamp    Description
----- -------- -------- -------- --------------- --------------------------------
-------------------------------------------------------------------------------
2   4521 MVS118   SCAN     03030000 17:38:32.175560 Scan-Normal packet
3 From Link    : ETH1            Device: LCS Ethernet    Full=40
   Tod Clock   : 2002/11/20 17:38:32.175559 Module: EZBIPICM
   Job Name    : TCPCS            Asid: 01F7              Tcb: 00000000
   Cid         : 00000000         Correlator: 10
   Policy      : ScanEventIcmp-rule
   IpHeader: Version : 4                Header Length: 20
   Tos         : 00               QOS: Routine Normal Service
   Packet Length: 40               ID Number: 0000
   Fragment    : DONTFragment     Offset: 0
   TTL         : 62               Protocol: ICMP           CheckSum: 5914 FFFF
   Source      : 9.42.105.71       Destination : 9.42.104.38
5   ICMP
   Type/Code        : ECHO             CheckSum: 5592 FFFF
   Id               : 0B3F             Seq: 0
6    Echo Data        : 12
000000 AEBCDB3D 03340A00 00000000                                  |...=.4......|
-------------------------------------------------------------------------------
4522 MVS118   SCAN     03030026 17:38:32.175560 Scan-Normal-TCP SYN dropped
5 From Link    : UNKNOWN          Device: Unknown:0       Full=40
   Tod Clock   : 2002/11/20 17:38:32.175559 Module: EZBTCPCN
   Job Name    : FTPD1            Asid: 01F7              Tcb: 00000000
   Cid         : 00000020         Correlator: 11
   Policy      : ScanEventHigh-rule
   IpHeader: Version : 4                Header Length: 20
   Tos         : 00               QOS: Routine Normal Service
   Packet Length: 40               ID Number: 163F
   Fragment    :                  Offset: 0
   TTL         : 253              Protocol: TCP           CheckSum: 681C FFFF
   Source      : 9.2.197.34       Destination : 9.42.104.38
TCP
Source Port   : 46911 ()       Destination Port: 21    (ftp)
Sequence Number: 2397868413   Ack Number: 0
Header Length : 20             Flags: Syn
Window Size   : 242            CheckSum: 4E53 B695 Urgent Data Pointer: 0000

//

SYSTCPIS Trace Statistics
2,623 ctrace records processed
0 segmented trace records read
0 segmented trace records were lost
2,623 trace records read
0 records could not be validated
2,623 records passed filtering
```
The following describes numbered areas of the example.

1. The date of the trace records.

2. A summary line indicating the source of the trace record showing:
   - The record number.
   - The system name.
   - The group name.
   - The probe ID value (in hexadecimal).
   - The time the record was moved to the trace buffer, or with the TOD option the time the trace data was captured.
   - The description of the IDS event associated with the probe.

3. The trace header with these fields:
   - The direction of the trace record: From or To.
   - The link name.
   - The device type.
   - Full or Abbrev with amount of trace data available.
   - The time the trace record was captured.
   - The module that triggered the probe.
   - The job name associated when the probe was triggered.
   - The ASID of the address space when the probe was triggered.
   - The system tcb pointer when the probe was triggered (or zero if in SRB mode).
   - The CID (communications ID) of the session.
   - The Event identifier, the upper 2 bytes of the PROBEID.
   - The Correlator identifier.
   - The name of the current policy. This might be the policy that triggered the probe or the name of the policy the session was using at the time the probe was triggered.

4. The IP header showing fields from the IPv4 header. The header length is the number of bytes for the header. The offset field is the number of bytes from the end of the IP header where the fragment appears. With the REASSEMBLY option active, this field always displays zeros.

5. The protocol header. In this example, it is an ICMP header.

6. Depending on the port number, the trace data might be formatted.

**Guideline:** If possible, the check sum of the packet is calculated. If the calculated value is X'FFFF', then the check sum is correct. If the calculated value is X'0000', then the check sum could not be calculated. The packet was incomplete or fragmented. Other values indicate a check sum error.

Using the protocol numbers and the well known port numbers, format routines are invoked to format standard packet data records. The port number for the PORT keywords define the port numbers to be used to invoke a format routine.

**Port**

  - **Keyword**
Purpose
Format the IP header, protocol header and packet data in hexadecimal. The data can also be translated into EBCDIC, ASCII or both.

Format
The following command was used to obtain the example of this report.

```
CTRACE COMP(SYSCTPIS) SUB((TCPCS)) DSNAME('IBMUSER.CTRACE1') SHORT OPTIONS((OPT DUMP))
```

```
COMPONENT TRACE SHORT FORMAT
SYSNAME(MVS118)
  COMP(SYSCTPIS)SUBNAME((TCPCS))
  OPTIONS((OPT DUMP))
  DSNAME('IBMUSER.CTRACE1')

  OPTIONS((Both Bootp(67,68) Cleanup(500) DelayAck(200,200) Domain(53)
              Dump(55535) Finger(79) Flags() Ftp(20,21) Gain(125,250) Gopher(70)
              Limit(999999999) Gmt Ntp(123) Option Noreassembly Router(520) Rpc(111)
              Segment Smtp(25) Smmp(161,162) Speed(10,10) Telnet(23) Tftp(69) Time(37)
              Userexit() Www(80))

**** 2002/11/20
RcdNr Sysname  Mnemonic Entry Id   Time Stamp    Description
----- -------- -------- -------- --------------- --------------------------------
-------------------------------------------------------------------
4521 MVS118   SCAN     03030000 17:38:32.175560 Scan-Normal packet
From Link : ETH1  Device: LCS Ethernet  Full=40
Tod Clock : 2002/11/20 17:38:32.175559  Module: EZBIPICM
Job Name : TCPCS  Asid: 01F7  Tcb: 00000000
Cid : 00000000  Correlator: 10
```
The following describes numbered areas of the example.

1

The IP header is dumped with no translation.

2

The protocol header is dumped with no translation.

3

The packet data is dumped with the translation specified by the ASCII, BOTH, EBCDIC, or HEX keyword. The default is BOTH. The amount of data dumped can be limited by the value specified with the DUMP keyword. The default is 65535 bytes.

**SNIFTER**

**Purpose**

This report shows information that is written to the SNIFTER data set.

**Restriction:** Do not use the SNIFTER option when the CTRACE subcommands are used with the IPCS MERGE subcommand. The SNIFTER data file is written over by the multiple CTRACE commands that specify the SNIFTER option.
**Format**

The following command was used to obtain the example of this report.

```
ALLOC F(SNIFFER) DATASET(SNIFFER.TRC) LRECL(1600) RECFM(V B) +
REUSE TRACK SPACE(15 15)

CTRACE COMP(SYSTCPIS) DSN('MWS.PQ33208.PTRACE4')+
OPTION((OPT  TALLY SNIFFER NOREASSEMBLY))
```

```
COMPONENT TRACE SHORT FORMAT
SYSNAME(MVS142)
COMP(SYSTCPIS)
OPTIONS((OPT  TALLY SNIFFER(4000) NOREASSEMBLY))
DSNAME('MWS.PQ33208.PTRACE4')
PTRPT041 SNIFFER(ETHERNET) option selected

OPTIONS((Both Bootp(67,68) Checksum(Summary) Cleanup(500) Datasize(0)
DelayAck(200,200) Domain(53) EE(12000:12004) Finger(79) First Flags(All )
Ftp(20,21) Gain(125,250) Gopher(70) Ike(500) Limit(999999999) Gmt
Nat(4500) Ntp(123) Option Noreassembly Router(520) Rpc(111) Sasp(3860)
Segment Smtp(25) Sniffer(4000, Ethernet) Snmp(161,162) Speed(10,10)
Statistics(Detail) Telnet(23,80,) Tftp(69) Time(37) Tod Userexit() Www(80)
))

Sniffer Report
3,385 records written to MWS.SNIFFER.ETH
639,789 bytes written
2121 packets were abbreviated
2024 is the maximum data size
3375 packets were truncated from 1843 bytes
```

Following are descriptions for some areas of the example.

**108 records written to SNIFFER**
This record count includes the two header records and one trailer record that were written to the SNIFFER data set.

**46000 bytes written to SNIFFER**
The number of data bytes written to the SNIFFER data set. This should be close to the amount of data to be downloaded.

**22 records were truncated to 1600 bytes**
Because the logical record length was 1,600 bytes, 22 records were truncated. This can be avoided by increasing the logical record length. The maximum logical record length is 32,763 or the size of physical disk blocks, whichever is smaller.

**3.385 records written to MWS.SNIFFER.ETH**
This record count includes the two header records and one trailer record that were written to the SNIFFER data set.

**639,789 bytes written**
The number of data bytes written to the SNIFFER data set. This should be the amount of data to be downloaded.

**2121 packets were abbreviated**
The number of packets that were abbreviated when the trace data was collected.

**2024 is the maximum data size**
The size of the largest record written to the SNIFFER data set.

**3375 packets were truncated from 1843 bytes**
Because the logical record length was 2,048 bytes, 3375 records were truncated. This can be avoided by increasing the logical record length. The maximum logical record length is 32,763 or the size of physical disk blocks, whichever is smaller.
STATISTICS

Purpose
The records are counted by probe ID, device type, interface, interface address, job name, Asid, QOS, TCP port number, UDP port number, connection identifier, group identifier, type identifier, correlator, protocol summary, and session summary.

Format
The following command was used to obtain the example of this report.

CTRACE COMP(SYSTCPIS) SUB((TCPCS)) SHORT OPTIONS((OPT STATISTICS(DETAIL)))
### 64 Interface Address(s) found

#### 6 JobName Report

<table>
<thead>
<tr>
<th>JobName Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>JobName</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 JobName(s) found</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 7 Asid Report

<table>
<thead>
<tr>
<th>Asid Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>Asid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Asid(s) found</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 8 Protocol Report

<table>
<thead>
<tr>
<th>Protocol Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Protocol(s) found</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 9 IP Address Report

<table>
<thead>
<tr>
<th>IP Address Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>518 IP Address(s) found</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 10 Qos Report

<table>
<thead>
<tr>
<th>Qos Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>Qos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Qos(s) found</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 11 Tcp Port Report

<table>
<thead>
<tr>
<th>Tcp Port Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>Tcp Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1742 Tcp Port(s) found</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 12 Udp Port Report

<table>
<thead>
<tr>
<th>Udp Port Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>Udp Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Udp Port(s) found</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 13 CID Report

<table>
<thead>
<tr>
<th>CID Report</th>
<th>Data Output</th>
<th>Data First</th>
<th>Last yyyy/mm/dd hh:mm:ss</th>
<th>CID</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 CID Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TCP/IP services traces and IPCS support 155
The following describes numbered areas of the example.

The standard statistics shown with all executions of the SYSTCPIS packet trace formatter.

2,623 ctrace records processed
The total number of CTRACE records given to the SYSTCPIS packet trace formatted.

0 segmented trace records read
The total number of packets that spanned multiple CTRACE records.

0 segmented trace records were lost
The total number of packets records that could not be put back together.

2,623 trace records read
The total number of complete trace records.

0 records could not be validated
The number of incomplete CTRACE records that could not be used.
2,623 records passed filtering
The number of records that were successfully formatted.

2,623 packet trace records processed
The number of records that were packet trace records.

0 data trace records processed
The number of records that were data trace records.

2
Probe report, which is the total by ProbeID.

3
Device type report, which is the totals by device type.

4
Interface report, which is the totals by interface.

5
Interface address report, which is the totals interface address.

6
Jobname report, which is the totals by jobname.

7
ASID report, which is the totals address space identifier.

8
Protocol report, which is the totals by protocol.

9
IP address report, which is the totals by IP address. Both the destination and source IP addresses are counted, except when they are the same in a record.

10
QOS report, which is the totals by QOS.

11
TCP port report, which is the totals by TCP port number. Both the destination and source port numbers are counted, except when they are the same in a record.

12
UDP port report, which is the totals by UPD port number. Both the destination and source port numbers are counted, except when they are the same in a record.

13
CID report, which is the totals by connection identifier.

14
Group report, which is the totals by group, first byte PROBEID.

15
Type report, which is the totals by type, first two bytes of PROBEID.

16
Correlator report, which is the totals by correlator.

17
Protocol summary report, which is the summary based on protocol.

18
Session summary report, which is the summary based on session.

STREAM

Purpose
There are times when messages span multiple packets. TELNET and DNS are examples. The STREAM report (with the DUMP or FORMAT keywords) captures the entire stream of data.
Format

The following command was used to obtain the example of this report.

```
CTRACE COMP(SYSTCPIS) SUB((TCPCS)) SHORT DSN('IBMUSER.CTRACE1') OPTIONS((OPT STREAM DUMP ASCII))
```

```
COMPONENT TRACE SHORT FORMAT
SYSNAME(MVS118)
COMP(SYSTCPIS)SUBNAME((TCPCS))
OPTIONS((OPT STREAM DUMP ASCII))
DSNAME('IBMUSER.CTRACE1')
OPTIONS((Ascii Bootp(67,68) Cleanup(500) DelayAck(200,200) Domain(53)
Dump(16384) Finger(79) Flags() Ftp(20,21) Gain(125,250) Gopher(70)
Limit(999999999) Gmt Ntp(123) Option Noreassembly Router(520) Rpc(111)
Segment Smtp(25) Snmp(161,162) Speed(10,10) Streams(131072,Summary)
Telnet(23) Tftp(69) Time(37) Userexit() Www(80)
))

**** 2002/11/20
RcdNr Sysname Mnemonic Entry Id   Time Stamp    Description
----- -------- -------- -------- --------------- --------------------------------

===============================================================================
1 Streams Report
2618 Streams found
348160 bytes of storage for the session report was allocated
348160 bytes of storage for buffers was allocated
-------------------------------------------------------------------------------
.
.
.
-------------------------------------------------------------------------------
2 Session: 9.32.74.253-0 9.42.104.38-0 ICMP
From: 2002/11/20 18:00:06.827658 to: 2002/11/20 18:00:07.149355
2 packets found
Stream buffer at 16743000 for 20480 bytes. 56 bytes were used
2 packets moved for 56 bytes
I - Inbound packet
O - Outbound packet

3 D Rcd #            Time           Delta      Seq #   Position Length    End_Pos
I  5870 18:00:06.827658 00:00:00.000000          0          0     28         28
000000 45000028 1F9B0000 0106EC56 092A6826 09A032EF 0015E644 7F6CBB58 |E..(....V..h&..2....D..X...
I  5892 18:00:07.149355 00:00:00.321697         28         28     28         56
000000 4500002C |                            E..,|
000020 1FDC0000 0106EC11 092A6826 09A032EF 00154446 809241F5              |.........*h&..2...DF..A.        |

.
.
.
===============================================================================
SYSTCPIS Trace Statistics
2,623 ctrace records processed
0 segmented trace records read
0 segmented trace records were lost
2,623 trace records read
0 records could not be validated
2,623 records passed filtering
2,623 packet trace records processed
0 data trace records processed

OSAENTA trace (SYSTCPOT)

TCP/IP Services component trace is also available for use with the OSA-Express Network Traffic Analyzer (OSAENTA) trace facility. The OSAENTA trace is a diagnostic method for obtaining frames flowing to and from an OSA adapter. You can use the OSAENTA statement to copy frames as they enter or leave an OSA adapter for an attached host. The host can be an LPAR with z/OS, VM, or Linux. You can then examine the contents of the copied frames. To be traced, the frame must meet all the conditions specified on the OSAENTA statement or the OSAENTA command.

The OSAENTA trace process

Trace data is collected as frames enter or leave an OSA adapter for a connected host. The actual collection occurs within the device drivers of OSA cards, capturing the data at the point where it has just been received from or sent to the network.
Frames that are captured have extra information added to them before they are stored. This extra information, such as timestamps, is used during the packet formatting. The captured data reflects exactly what the network sees. For example, the trace contains the constituent packets of a fragmented packet exactly as they are received or sent.

The selection criteria for choosing packets to trace are specified through the OSAENTA statement or OSAENTA command. See z/OS Communications Server: IP Configuration Reference for more information about the OSAENTA statement and see z/OS Communications Server: IP System Administrator’s Commands for more information about the OSAENTA command.

The OSAENTA trace can have performance implications if you do not specify sufficient trace filters before enabling the trace. OSAENTA can reduce the amount of traffic the OSA-Express feature can process and the amount of traffic that can be accelerated through that OSA-Express. Also, host processing to collect the OSAENTA trace records can increase host CPU consumption. Specify sufficient filters to limit the amount of traffic that is traced to only what is necessary for problem diagnosis.

Figure 25 on page 159 illustrates the overall control and data flow in the OSAENTA tracing facility.

Starting OSAENTA trace

You can start an OSAENTA trace in one of the following ways:

- Using the V TCPIP,OSAENTA command
  
  ```
  V TCPIP,tcpprocname,OSAENTA,ON,PORTNAME=OSA4,IPADDR=9.1.27.2
  ```

- Using the OSAENTA statement in TCPIP.PROFILE

  ```
  OSAENTA ON PORTNAME=OSA4 IPADDR=9.1.27.2
  ```

Security Rule: To use any VARY command, the user must be authorized in RACF. The OPERCMDS RACF profile for each user must have access for a resource of the form MVS.VARY.TCPIP.OSAENTA.

Traces are placed in an internal buffer, which can then be written out using a CTRACE external writer. The MVS TRACE command must also be issued for component SYSTCPOT to activate the OSAENTA trace.

After starting OSAENTA trace, you can display the status using the Netstat command, as shown in the following example:

```
D TCPIP,TCPCS,NETSTAT,DEV
   DEVNAME: OSA4 DEVTYPE: MPCIPA
```
If you are a TSO user, use the NETSTAT DEVlinks command.

Modifying options with VARY commands

After starting an OSAENTA trace, you can change the trace using the VARY command. For example, if you want to change the trace to abbreviate the data being traced, use the following command:

```
V TCPIP,tcpproc,OSAENTA,ON,ABBREV=480
```

You can display the results of the VARY command using Netstat:

```
netstat -p TCPCS -d
```

If you are a TSO user, use the NETSTAT DEVlinks option.

You can use the VARY TCPIP,tcpproc,OBEYFILE command to make temporary dynamic changes to system operation and network configuration without stopping and restarting the TCP/IP address space. For
example, if you started the address space TCPIPA and created a sequential data set USER99.TCPIP.OBEYFIL2 containing OSAENTA statements, issue the following command:

```
VARY TCPIP, TCPIPA, CMD=OBEYFILE, DSN=USER99.TCPIP.OBEYFIL2
```

The VARY TCPIP,OSAENTA command is cumulative. You can trace all packets for specified IP addresses by entering multiple OSAENTA commands. In the following example, the five commands disable the current trace, clear any previous trace filters, trace all the frames received and all the frames sent for the specified IP addresses, and activate the OSAENTA trace facility.

```
VARY TCPIP,,OSAENTA,OFF, PORTNAME=OSA4
VARY TCPIP,,OSAENTA,CLEAR, PORTNAME=OSA4, ABBREV=200, FRAMES=8000
VARY TCPIP,,OSAENTA,PORTNAME=OSA4, IPADDR=10.27.142.44
VARY TCPIP,,OSAENTA,PORTNAME=OSA4, IPADDR=10.27.142.45
VARY TCPIP,,OSAENTA, ON, PORTNAME=OSA4
```

**Formatting OSA traces using IPCS**

The IPCS CTRACE command parameters are described in “Formatting component traces” on page 51. The following notes apply to the IPCS CTRACE parameters with regard to the OSAENTA trace formatter:

- **JOBLIST, JOBNAME**
  - The LINKNAME and JOBNAME keywords in the OPTIONS string can also be used to select records.

- **TALLY**
  - Equivalent to the STATISTICS(DETAIL) option.

- **START, STOP**
  - The time is set when the record was moved to the trace buffer, not when the OSA card recorded the data.

- **LIMIT**
  - See the RECORDS keyword in the OPTIONS string.

- **USEREXIT**
  - The packet trace formatter calls the CTRACE USEREXIT before testing the records with the filtering criteria. If it returns a nonzero return code, then the record is skipped. The USEREXIT can also be used in the OPTIONS string. It is called after the record has met all the filtering criteria in the OPTIONS string.

- **COMP**
  - Must be SYSTCPOT.

- **SUB**
  - The SUB must name the TCP/IP procedure that created the CTRACE records when the input is a dump data set.

- **EXCEPTION**
  - Since there are no EXCEPTION records for OSAENTA trace, the EXCEPTION keyword must not be specified.

- **ENTIDLIST**
  - The following values are the valid values for OSAENTA trace:

    - 7  Link Frame trace records

The CTRACE OPTIONS string provides a means of entering additional keywords for record selection and formatting OSA traces (COMP=SYSTCPOT). See “Syntax” on page 52 for the complete syntax of CTRACE.

The same program is used to format OSA traces as well as packet traces. See “OPTIONS syntax” on page 91 for the values specified for the OPTIONS keyword.
Network security services (NSS) server trace (SYSTCPNS)

TCP/IP Services component trace is also available for use with the network security services server. See “TCP/IP services component trace for the network security services (NSS) server” on page 356.

Defense Manager daemon (DMD) trace (SYSTCPDM)

TCP/IP Services component trace is also available for use with the Defense Manager daemon (DMD). See “TCP/IP services component trace for the Defense Manager daemon” on page 657.

OMPROUTE trace (SYSTCPRT)

TCP/IP Services component trace is also available for use with the OMPROUTE application. See “TCP/IP services component trace for OMPROUTE” on page 712.

RESOLVER trace (SYSTCPRE)

TCP/IP Services component trace is also available for use with the RESOLVER application. See Chapter 37, “Diagnosing resolver problems,” on page 767.

Configuration profile trace

You can use the ITRACE statement in the PROFILE.TCPIP data set to activate TCP/IP run-time tracing for configuration, the TCP/IP SNMP subagent, commands, and the autolog subtask. ITRACE should only be set at the direction of an IBM Support Center representative.

Following are descriptions of the ITRACE parameters:

ON
Select ON to establish run-time tracing. ITRACE ON commands are cumulative until an ITRACE OFF is issued.

OFF
Select OFF to terminate run-time tracing.

CONFig
Turn internal trace for configuration ON or OFF.
**SUBAgent**

Turn internal trace for TCP/IP SNMP subagent ON or OFF.

**COMMAND**

Turn internal trace for command ON or OFF.

**AUTODAEMON**

Turn internal trace for the autolog subtask ON or OFF.

**level**

Indicates the tracing level to be established. Levels are as follows:

**Levels for CONFIG**

1. ITRACE for all of `config`
2. General level of tracing for all of `config`
3. Tracing for configuration set commands
4. Tracing for configuration get commands
5. Tracing for syslog calls issued by `config`

100. Tracing for the parser

200. Tracing for scanner

300. Tracing for mainloop

400. Tracing for commands

**Levels for SUBAGENT**

1. General subagent tracing
2. General subagent tracing, plus DPI traces
3. General subagent tracing, plus extended storage dump traces
4. All trace levels

**Level for COMMAND**

1. ITRACE for all commands

Following is an example illustrating how to use the ITRACE command:

```
ITRACE ON CONFIG 3
ITRACE OFF SUBAGENT
```

Trace output is sent to the following locations:

- Subagent trace output is directed to the syslog daemon. This daemon is configured by the `/etc/syslog.conf` file and must be active.
- AUTOLOG trace output goes to ALGPRINT.
- Trace output for other components goes to SYSPRINT.
Chapter 6. IPCS subcommands for TCP/IP

Use the IPCS subcommands for TCP/IP to format data from IPCS system dumps. This topic describes the subcommands (including description, syntax, parameters, and sample output), installation, entering, and execution, and includes the following subtopics:

- “TCPIPCS command” on page 168
- “TCPIPCS subcommands” on page 171
- “ERRNO command” on page 259
- “IPHDR command” on page 262
- “RESOLVER command” on page 264
- “SETPRINT command” on page 283
- “SKMSG command” on page 283
- “TCPHDR command” on page 285
- “TOD command” on page 286
- “UDPHDR command” on page 287
- “Installing TCP/IP IPCS subcommands by using the panel interface” on page 289
- “Entering TCP/IP IPCS subcommands” on page 289

Types of subcommands

There are two types of subcommands. These are described as follows:

- Many of the TCP/IP subcommands work on a specific stack or Telnet instance. These subcommands are grouped under the TCPIPCS subcommand to share the TCP (to select the stack or Telnet) and TITLE options. A subset of these commands are available for work with an instance of Telnet. If available, “Available for Telnet” appears at the end of the description in Table 15 on page 165.
- The remaining TCP/IP IPCS subcommands do not require a TCP/IP stack, and they are not under the TCPIPCS subcommand.

Restriction: The TCP/IP IPCS commands are not supported for IPCS "active."

Table 15 on page 165 lists all the IPCS subcommands. The TCPIPCS commands are shown first, followed by the general commands.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Alias</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCPIPCS ALL</td>
<td>Equivalent to TCPIPCS STATE TSEB TSDB TSDX DUAF CONFIG ROUTE SOCKET STREAM RAW TCB UDP LOCK TIMER STORAGE</td>
<td>NA</td>
<td>“TCPIPCS API” on page 171</td>
</tr>
<tr>
<td>TCPIPCS API</td>
<td>Display control blocks for Sockets Extended Assembler Macro and Pascal APIs</td>
<td>“TCPIPCS API” on page 171</td>
<td>“TCPIPCS Config” on page 172</td>
</tr>
<tr>
<td>TCPIPCS CONFIG</td>
<td>Display device configuration information</td>
<td>TCPIPCS CNFG</td>
<td>“TCPIPCS Config” on page 172</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td>Alias</td>
<td>See</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------------</td>
<td>------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display active or all connections</td>
<td>TCPIPCS CONN</td>
<td>“TCPIPCS CONNECTION” on page 174</td>
</tr>
<tr>
<td>CONNECTION</td>
<td>Display information about TCP/IP internal execution</td>
<td></td>
<td>“TCPIPCS COUNTERS” on page 175</td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Equivalent to TCPIPCS TSEB</td>
<td>TCPIPCS CBS</td>
<td>NA</td>
</tr>
<tr>
<td>COUNTERS</td>
<td>TSDB TSDX DUAF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Equivalent to TCPIPCS DUAF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DETAIL</td>
<td>DUAF</td>
<td>TCPIPCS CBS</td>
<td>NA</td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Summarize DUCBs Available for Telnet.</td>
<td>TCPIPCS DUCBS</td>
<td>“TCPIPCS DUAF” on page 177</td>
</tr>
<tr>
<td>DU</td>
<td>Find and format DUCBs Available for Telnet.</td>
<td></td>
<td>“TCPIPCS DUCB” on page 180</td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display state information about FRCA connections and</td>
<td></td>
<td>“TCPIPCS FRCA” on page 183</td>
</tr>
<tr>
<td>FRCA</td>
<td>objects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display TCP/IP data stored in hash tables</td>
<td></td>
<td>“TCPIPCS HASH” on page 185</td>
</tr>
<tr>
<td>HASH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display dump Header info</td>
<td>TCPIPCS HDR</td>
<td>“TCPIPCS HEADER” on page 188</td>
</tr>
<tr>
<td>HEADER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display syntax help for TCPIPCS command</td>
<td>TCPIPCS ?</td>
<td>“TCPIPCS HELP” on page 190</td>
</tr>
<tr>
<td>HELP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display information about IP security filters and</td>
<td></td>
<td>“TCPIPCS IPSEC” on page 191</td>
</tr>
<tr>
<td>IPSEC</td>
<td>tunnels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display locks Available for Telnet.</td>
<td>TCPIPCS LOCKSUM</td>
<td>“TCPIPCS LOCK” on page 193</td>
</tr>
<tr>
<td>LOCK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display storage map</td>
<td></td>
<td>“TCPIPCS MAP” on page 195</td>
</tr>
<tr>
<td>MAP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display module table</td>
<td></td>
<td>“TCPIPCS MTABLE” on page 197</td>
</tr>
<tr>
<td>MTABLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display service policy data</td>
<td></td>
<td>“TCPIPCS POLICY” on page 199</td>
</tr>
<tr>
<td>POLICY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Display TCP/IP configuration data in the format of a</td>
<td>TCPIPCS PROF</td>
<td>“TCPIPCS PROFILE” on page 200</td>
</tr>
<tr>
<td>PROFILE</td>
<td>profile dataset Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPCS</td>
<td>Invokes RAW, TCB, UDP</td>
<td></td>
<td>“TCPIPCS PROTOCOL” on page 204</td>
</tr>
<tr>
<td>PROTOCOL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
<td>Alias</td>
<td>See</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>TCPIPICS RAW</td>
<td>Display RAW control blocks</td>
<td>TCPIPICS MRCB</td>
<td>“TCPIPICS RAW” on page 207</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPICS RAWSUM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPICS RCB</td>
<td></td>
</tr>
<tr>
<td>TCPIPICS ROUTE</td>
<td>Display routing information</td>
<td>TCPIPICS RTE</td>
<td>“TCPIPICS ROUTE” on page 209</td>
</tr>
<tr>
<td>TCPIPICS SOCKET</td>
<td>Display socket information</td>
<td>TCPIPICS SCB</td>
<td>“TCPIPICS SOCKET” on page 212</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPICS SOCKSUM</td>
<td></td>
</tr>
<tr>
<td>TCPIPICS STATE</td>
<td>Display general stack information</td>
<td>TCPIPICS</td>
<td>“TCPIPICS STATE” on page 213</td>
</tr>
<tr>
<td>TCPIPICS STORAGE</td>
<td>Display TCP/IP storage usage</td>
<td>TCPIPICS STOR</td>
<td>“TCPIPICS STORAGE” on page 231</td>
</tr>
<tr>
<td>TCPIPICS STREAM</td>
<td>Display streams information</td>
<td>TCPIPICS SKSH</td>
<td>“TCPIPICS STREAM” on page 233</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPICS STREAMS</td>
<td></td>
</tr>
<tr>
<td>TCPIPICS SUMMARY</td>
<td>Equivalent to TCPIPICS DUAF CONFIG SOCKET</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>TCPIPICS TCB</td>
<td>Display TCP protocol control blocks</td>
<td>TCPIPICS MTCB</td>
<td>“TCPIPICS TCB” on page 235</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPICS TCBSUM</td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TELNET</td>
<td>Display Telnet information</td>
<td></td>
<td>“TCPIPICS TELNET” on page 237</td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TIMER</td>
<td>Display information about timers</td>
<td>TCPIPICS TIMESUM</td>
<td>“TCPIPICS TIMER” on page 239</td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TRACE</td>
<td>Display TCP/IP CTRACE, real-time TCP/IP network monitoring NMI (TMI), and</td>
<td>TCPIPICS TCA</td>
<td>Table 3 on page 8</td>
</tr>
<tr>
<td></td>
<td>real-time application-controlled TCP/IP trace NMI information</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TREE</td>
<td>Display information about data stored in Patricia trees</td>
<td>TCPIPICS TREESUM</td>
<td>“TCPIPICS TREE” on page 244</td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TSDB</td>
<td>Format TSDB</td>
<td></td>
<td>“TCPIPICS TSDB” on page 247</td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TSDX</td>
<td>Format TSDX</td>
<td></td>
<td>“TCPIPICS TSDX” on page 249</td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCPIPICS TSEB</td>
<td>Format TSEB</td>
<td></td>
<td>“TCPIPICS TSEB” on page 250</td>
</tr>
<tr>
<td></td>
<td>Available for Telnet.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 15. TCP/IP IPCS commands (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Alias</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCPIPCS TTLS</td>
<td>Display state information about AT-TLS connections and groups</td>
<td></td>
<td>“TCPIPCS TTLS” on page 251</td>
</tr>
<tr>
<td>TCPIPCS UDP</td>
<td>Display UDP control blocks</td>
<td>TCPIPCS MUCB</td>
<td>“TCPIPCS UDP” on page 254</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPCS UCB</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TCPIPCS UDPSUM</td>
<td></td>
</tr>
<tr>
<td>TCPIPCS VMCF</td>
<td>Display information about VMCF and IUCV users</td>
<td></td>
<td>“TCPIPCS VMCF” on page 256</td>
</tr>
<tr>
<td>TCPIPCS XCF</td>
<td>Display information about XCF links and dynamic VIPA</td>
<td></td>
<td>“TCPIPCS XCF” on page 257</td>
</tr>
<tr>
<td>ERRNO</td>
<td>Interpret error numbers</td>
<td></td>
<td>“ERRNO command” on page 259</td>
</tr>
<tr>
<td>ICMPHDR</td>
<td>Format an ICMP header</td>
<td></td>
<td>“ICMPHDR command” on page 261</td>
</tr>
<tr>
<td>IPHDR</td>
<td>Format an IP header</td>
<td></td>
<td>“IPHDR command” on page 262</td>
</tr>
<tr>
<td>RESOLVER</td>
<td>Format and summarize resolver control blocks and cache information</td>
<td></td>
<td>“RESOLVER command” on page 264</td>
</tr>
<tr>
<td>SETPRINT</td>
<td>Set destination so the IPCS subcommand output is sent to a user ID or the printer</td>
<td></td>
<td>“SETPRINT command” on page 283</td>
</tr>
<tr>
<td>SKMSG</td>
<td>Format a stream message</td>
<td></td>
<td>“SKMSG command” on page 283</td>
</tr>
<tr>
<td>TCPHDR</td>
<td>Format a TCP header</td>
<td></td>
<td>“TCPHDR command” on page 285</td>
</tr>
<tr>
<td>TOD</td>
<td>Convert an S/390® 64-bit time-of-day timestamp to a readable date and time</td>
<td></td>
<td>“TOD command” on page 286</td>
</tr>
<tr>
<td>UDPHDR</td>
<td>Format UDP header</td>
<td></td>
<td>“UDPHDR command” on page 287</td>
</tr>
</tbody>
</table>

### TCPIPCS command

This topic describes the TCPIPCS command.

### Syntax

The command syntax for all TCPIPCS subcommands includes an option to specify the TCP stack and to specify whether the title is displayed.
Parameters

The parameters for the TCPIPCS command are described below.

**subcommand**
Default is STATE.

**parameters**
Each subcommand has its own parameters.

- If a command has variable parameters, they can be omitted, specified as a single variable, or specified as a list. If no variable parameters are specified, an asterisk must be used as a placeholder if any keyword parameters are specified. If two or more variable parameters are specified, they must be enclosed in parentheses.
- To distinguish between the variable parameters, a parameter is assumed to be one of the following:
  - An index or small number if it is four digits or less, begins with zero to nine, and contains only hexadecimal digits (0–9, a–f, A–F). If a command accepts multiple indices or small numbers, both are compared to the values and the first matching field is used.
  - An address if it is more than four digits, begins with zero to nine, and contains only hexadecimal digits. For example, for the TCPIPCS DUAF command, both the DUCB and ASCB addresses of each DUCB are compared to the address parameter, and the first matching field is used to select the DUCB to display.
  - An IPCS symbol name can also be specified for an address.
  - Otherwise, the parameter is assumed to be a character string variable (such as TCP/IP procedure or job name, user ID, and command name).
- Keyword parameters can be in any order.
- If there are both keyword and variable parameters, all variable parameters must precede the keywords.

**TCP**
Specifies which TCP/IP stack or Telnet instance. When issuing commands for Telnet, the Telnet procedure name must be specified in the tcp_proc_name variable. The stack can be specified directly or indirectly. A stack can be specified directly by coding the TCP parameter with either tcp_proc_name or tcp_index. If no stack is specified directly, the output is reported for the stack with the lowest index matching the release of the TCPIPCS command. After a particular stack is specified (whether specified directly or indirectly), that stack becomes the default. The stack index is saved as a symbol and is used as the default in future invocations of the TCPIPCS command. An alias for the TCP option is PROC.

*Note:* All eight stack indices are available when TCP/IP or Telnet starts, so any stack index can be selected. The existence of an index does not necessarily mean this stack can be formatted. If the stack was not included in the dump, then most of the information about a stack cannot be formatted.
Most TCP/IP control blocks are in the private TCP address space. All Telnet control blocks are in the private Telnet address space.

The fact that an index exists does not necessarily mean this stack index has ever been used. If you specify a stack index that has not been used, the version and release fields for this stack are zero, so you receive a message indicating the stack is not the same version and release as the TCPIPCS command:

\texttt{tcp\_proc\_name}

TCP/IP procedure name or the Telnet procedure name (when the TN3270E Server is running in its own address space).

\texttt{tcp\_index}

TCP/IP stack index (1-8) or Telnet index (9-16).

\textbf{TITLE}

The title contains information about the dump and about the TCPIPCS command. By default, the title information is displayed.

The title contains the following information.

- TCPIPCS command input parameters.
- Dump data set name.
- Dump title.
- TSAB address.
- Table listing all TCP/IP stacks used in the dump and their
  - TSEB address
  - Stack index
  - Procedure name
  - Stack version
  - TSDB address
  - TSDX address
  - ASID
  - Trace option bits
  - Stack status
- Count of the number of TCP/IP stacks defined (used).
- Count of the number of active TCP/IP stacks found.
- Count of the number of active TCP/IP stacks matching the TCPIPCS command version and release.
- Procedure name and index of the stack being reported.

\textbf{NOTITLE}

Suppress the title lines. This is useful when you are processing many commands on the same dump and do not want to see the title information repeated.

\textbf{Rule:} If you specify multiple keywords from the set \{TITLE, NOTITLE\}, only the last one is used.

\textbf{Symbols defined}

TCPIPCS defines the following IPCS symbols:

\textbf{TSEBPTR}

The address of the first TSEB control block.

\textbf{TSEBn}

The address of the TSEB control block corresponding to the stack index \(n\).
TCPIPCS subcommands

This topic describes the TCPIPCS subcommands.

TCPIPCS API

Use this subcommand to display information about the connections in the Sockets Extended Assembler Macro Application Programming Interface (Macro API) and the Pascal API.

Note: The Macro API is the base for the CALL Instruction API, the CICS C API, and the CICS EZACICAL API. See the z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference for more information about the native TCP/IP APIs.

Some API control blocks are in the application address space, which might not be available in the dump. If the application address space is available, the API control blocks are formatted.

Syntax

```
TCPIPCS API (

  * variable_item

  ( variable_list )

  TCP ( tcp_proc_name tcp_index )

  TITLE

  NOTITLE

) MACRO SUMMARY DETAIL
```

Parameters

If no parameters are specified, only information about the Macro API is summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

variable_item

Any one of the following variable parameters.

variable_list

You can repeat from 1 – 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

jobname

Displays only the API control blocks for this job name. The job name can be a TCP/IP application name or a stack name. Must contain from 1-8 characters.

ASCB_address

Displays the API control blocks with this address space control block (ASCB) address. An IPCS symbol name can be specified for the address. The address is specified as 1-8 hexadecimal digits. If an address begins with digit A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.
**ASID_number**
Displays the API control blocks with this address space identifier (ASID). The ASID is a hexadecimal number containing 1 - 4 digits.

In addition to the variable parameters, you can specify the following keyword parameters:

**MACRO**
Displays only information for Macro APIs. MACRO is the default.

**PASCAL**
Displays only information for Pascal APIs.

**ALL**
Displays information for both APIs.

**SUMMARY**
Displays the addresses of the control blocks and other data in tables. SUMMARY is the default.

**DETAIL**
Also displays the contents of the control blocks in addition to the SUMMARY display.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rules:**
- If you specify multiple keywords from the set {MACRO, PASCAL, ALL}, only the last one is used.
- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPPCS API subcommand**
The following example is sample output of the TCPIPPCS API subcommand.

The contents of the SDST control blocks are formatted by the TCPIPPCS API subcommand if the DETAIL option is coded on the command (SUMMARY is the default and only the address of the SDST will be displayed in this case).

R14 Output:

```
-- Array elements --
::
+00B2  SDST_LOCAL_IPADDRLEN. 00
+00B3  SDST_REMOTE_IPADDRLEN. 00
+00B4  SDST_LOCAL_IPADDR. 00000000 00000000 00000000 00000000
+00C4  SDST_REMOTE_IPADDR. 00000000 00000000 00000000 00000000
::
-- End of array --
```

**TCPIPPCS CONFIG**
Use this subcommand to display each device interface, physical interface, and logical interface. The configuration summary table shows each logical interface with the name of its associated device and link.

**Syntax**

```
TCPIPPCS CONFIG (SUMMARY)
```

Use this subcommand to display each device interface, physical interface, and logical interface. The configuration summary table shows each logical interface with the name of its associated device and link.
**Parameters**

**SUMMARY**
Displays each device, physical interface, and logical interface, and summarizes them all in one cross-reference table. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows the interface cross-reference reports.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPCS CONFIG subcommand**

The following example is sample output of the TCPIPCS CONFIG subcommand.

```plaintext
TCPIPCS CONFIG
Dataset: IPCS.R450697.V6TCBD1
Title:  TCPCS2 CLIENT SIDE

The address of the TSAB is: 090BE1A0

<table>
<thead>
<tr>
<th>Tseb</th>
<th>SI Procedure Version</th>
<th>Tsdb</th>
<th>Tsdx</th>
<th>Asid</th>
<th>TraceOpts</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>090BE1E0</td>
<td>1 TCPCS</td>
<td>V1R5</td>
<td>096C4000</td>
<td>096C40C8</td>
<td>0033</td>
<td>10841004</td>
</tr>
<tr>
<td>090BE260</td>
<td>2 TCPCS2</td>
<td>V1R5</td>
<td>096C9000</td>
<td>096C90C8</td>
<td>0034</td>
<td>10841004</td>
</tr>
</tbody>
</table>

2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS  V1R5 found

Analysis of Tcp/Ip for TCPCS2. Index: 2

Configuration control block summary

IPv4 Lif@ LinkName  DeviceName       DevR DevW Protocol
7F1ED008  LOPPBACK  00000000 7F6972E8 ::1
7F6972E8  LOPPBACK  00000000 7F1ED008 9.67.115.82

Configuration Summary

IPv4 Lif@ LinkName  DeviceName       DevR DevW IpAddr
7F1ED008  LOPPBACK  00000000 7F6972E8 ::1
7F6972E8  LOPPBACK  00000000 7F1ED008 9.67.115.82

Analysis of Tcp/Ip for TCPCS2 completed
```
TCPIPCS CONNECTION

Use this subcommand to display information about TCP, UDP, and raw connections. The information includes the following:

- User ID
- Connection ID
- Local IP address
- Foreign IP address
- Connection state (for TCP connections only)
- Protocol name (for raw connections only)

Syntax

```
TCPIPCS CONNECTION [ACTIVE] [ALL] TCP [tcp_proc_name] [tcp_index] [TITLE] [NOTITLE]
```

Parameters

**ACTIVE**

Display only active connections. This is the default.

**Tip:** The number of connections reported for each protocol includes both inactive and active connections; therefore, the total might be higher than the number of displayed (active) connections.

**ALL**

Display all connections, regardless of state.

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {ACTIVE, ALL}, only the last one is used.

Sample output of the TCPIPCS CONNECTION subcommand

The following is a sample output of the TCPIPCS CONNECTION subcommand. In this sample, the default option is ACTIVE, so only active connections are shown. There are six active TCP connections, four active UDP connections, and three active RAW connections.

```
TCPIPCS CONNECTION
Dataset: IPCS.RBA0723.RASDUMP
Title: EZRPE005
The address of the TSAB is: 098221F0
Tseb SI Procedure Version Tsdb Tsdx Asid TraceOpts Status
09822230 1 TCPCS V1R5 08E85000 08E850C8 001E 9FFF7E7F Active
098222B0 2 TCPCS2 V1R5 08937000 089370C8 01F6 9FFF7E7F Active
2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS V1R5 found
================================================================================
Analysis of Tcp/IP for TCPCS. Index: 1
TCP IPv4 Connections:
Userid Conn Conn State Local Socket Foreign Socket
TCPCS 00000012 Listening 127.0.0.1..1024 0.0.0.0
BPXOINIT 00000019 Listening 127.0.0.1..1024 127.0.0.1..1025
```

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TCPCS 00000016 Established Local Socket : 127.0.0.1..1024
Foreign Socket: 127.0.0.1..1025
TCPCS 00000014 Established Local Socket : 127.0.0.1..1024
Foreign Socket: 127.0.0.1..1025

4 TCP IPv4 connections

Active TCP IPv6 Connections:
Userid Conn State Socket
FTPUNIX1 00000051 Listening Local ::0..21
Foreign ::0..0
FTPMVS1 00000049 Listening Local ::0..1821
Foreign ::0..0
2 TCP IPv6 connections

Active UDP Unicast IPv4 Connections:
Userid Conn Socket
PORTMAP 00000027 Local 0.0.0.0..111
Foreign 0.0.0.0..0
OSNMPD 00000030 Local 0.0.0.0..161
Foreign 127.0.0.1..162
MISCSRV 00000039 Local 198.11.98.124..7
Foreign 0.0.0.0..0
MISCSRV 0000003E Local 198.11.98.124..9
Foreign 0.0.0.0..0
4 UDP Unicast IPv4 connections

Active UDP Unicast IPv6 Connections:
Userid Conn Socket
0 UDP Unicast IPv6 connections

Active UDP Multicast IPv4 Connections:
Userid Conn Socket
0 UDP Multicast IPv4 connections

Active UDP Multicast IPv6 Connections:
Userid Conn Socket
0 UDP Multicast IPv6 connections

Active RAW Connections:
Userid Conn Protocol Socket
TCPCS 00000006 IP Local 0.0.0.0
Foreign 0.0.0.0
TCPCS 00000008 RAW Local 0.0.0.0
Foreign 0.0.0.0
TCPCS 0000000E IP Local ::0
Foreign ::0
3 RAW connections

Analysis of Tcp/Ip for TCPSVT completed

**TCPIPCS COUNTERS**

Use this subcommand to display information about TCP/IP internal execution statistics.
Syntax

```
TCPIPCS — COUNTERS — ( ALL )
```

```
TCP — ( tcp_proc_name )
```

```
TITLE
```

```
NOTITLE
```

Parameters

**ALL**
Display all statistics. This is the default.

**DEVICE**
Display only device statistics.

**IF**
Display only IF layer statistics.

**IP**
Display only IP layer statistics.

**LOCK**
Display only lock statistics.

**RAW**
Display only RAW layer statistics.

**TCP**
Display only TCP layer statistics.

**UDP**
Display only UDP layer statistics.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

Sample output of the TCPIPCS COUNTERS subcommand for IP UDP

The following is sample output of the TCPIPCS COUNTERS subcommand for IP UDP.

```
TCPIPCS COUNTERS (IP UDP)
Dataset: SYS1.DUMP00
Title:   LINKDOWN

The address of the TSAB is: 15136000
Tseb     SI Procedure Version Tsdb     Tsdx     Asid TraceOpts          Status
15136040  1 TCPCS     V1R7    1511E000 1511E0C8 002F 9FFF767F 00000000  Active

1 defined TCP/IP(s) were found
1 active  TCP/IP(s) were found
1 TCP/IP(s) for CS     V1R7  found
```
Analysis of Tcp/Ip for TCPCS. Index: 1

IP Statistics

- nonbat .............. 3
- batch .............. 0
- batnum .............. 0
- nonrsm .............. 0
- batrsm .............. 0
- rsmnum .............. 0
- rteadd .............. 28
- rtedel .............. 0
- rteinc .............. 11
- rtedec .............. 8
- rtpadd .............. 14
- rtpdel .............. 0
- rtechg .............. 86
- trredr .............. 0
- trsus .............. 0
- trsust .............. 0
- dupfrg .............. 0
- dataadj1 .............. 0
- dataadj2 .............. 0

IP6 Statistics

- nonbat .............. 32
- batch .............. 0
- batnum .............. 0
- nonrsm .............. 0
- batrsm .............. 0
- rsmnum .............. 0
- rteadd .............. 0
- rtedel .............. 0
- rteinc .............. 0
- rtedec .............. 0
- rtpadd .............. 11
- rtpdel .............. 0
- rtechg .............. 43
- trredr .............. 0
- trsus .............. 0
- trsust .............. 0
- dupfrg .............. 0
- dataadj1 .............. 0
- dataadj2 .............. 0
- lifdel .............. 0
- noreclaim .............. 0
- hdrpullup .............. 0
- dadfailtot .............. 0
- dadfailtot .............. 0

UDP Statistics

- rd .............. 7
- rdnr .............. 7
- batch .............. 0
- nonbat .............. 7

Analysis of Tcp/Ip for TCPCS completed

TCP/IPCS DUAF

Use this subcommand to display a summary of each dispatchable unit control block (DUCB). Each entry in the dispatchable unit allocation table (DUAT) points to a DUCB. The DUAT entry contains the status of the DUCB and identifies the ASID with which the DUCB is associated. If no parameters are specified, the output contains a summary of the DUAT, followed by a summary of each DUCB.

The status of each DUCB is abbreviated as follows:

Ab

The DUCB has ABENDed.
Iu

The DUCB is in use.

Re

The DUCB is in resume state.

Su

The DUCB has been suspended.

The DUCB status might be followed by the recovery stack. There is one line for each register save area (RSA) found in the DUCB (and its DUSA extension, if present). The address of each RSA, its previous pointer, its next pointer, and the module name are shown.

A register save area displayed as RSA* indicates that the RSA is not in the active chain. If all RSAs are shown like this, the DUCB is not in use.

Syntax

TCPIPCS DUAF

Parameters

If no parameters are specified, all active DUCBs are summarized.

*  

An asterisk is used as a placeholder if no variable parameters are specified.

variable_item

Any one of the following variable parameters.

variable_list

You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

jobname

Displays only the DUCBs with this job name. The job name can be a TCP/IP application name or a stack name. Must contain from 1-8 characters.

DUCB_address

Displays the DUCB with this address. An IPCS symbol name can be specified for the address. The address is specified as 1-8 hexadecimal digits. If an address begins with characters A–F, prefix the address with a 0 to avoid the address being interpreted as a symbol name or as a character string.

DUCB_index

Displays this DUCB with this index. The index is a hexadecimal number containing one to four digits. The lowest index is 0.
**ASCB_address**
Displays the DUCB with this address space control block (ASCB) address. An IPCS symbol name can be specified for the address. The address is specified as 1-8 hexadecimal digits. If an address begins with characters A–F, prefix the address with a 0 to avoid the address being interpreted as a symbol name or as a character string.

**ASID_number**
Displays the DUCB with this ASID. The ASID is a hexadecimal number containing one to four digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:

**ALL**
Display information for all active DUCBs. This is the default.

**ABEND**
Display only information for DUCBs that ABENDed.

**INUSE**
Display only information for DUCBs currently being used

**RESUME**
Display only information for DUCBs that are resumed.

**SUSPEND**
Display only information for DUCBs that are suspended.

**NORSA**
Do not display the contents of the DUCBs' register save areas (RSA). By default, the RSA contents are displayed.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {ALL, ABEND, INUSE, RESUME, SUSPEND}, only the last one is used.

**Sample output of the TCPIPCS DUAF subcommand**
The following example is a sample output of the TCPIPCS DUAF subcommand:

```
TCPIPCS DUAF( (0876C000  OB) INUSE )
Dataset: IPCS.A594094.DUMPK
Title: TCP/IPC V2R10: Job(USER15 ) EZBITRAC(HTCP50A 99.266)+000304 S0C4/00000004 TCB P=0029,S=000E,H=0019
The address of the TSAB is: 08D138C0
Tseb SI Procedure Version Tsdb Tsdx Asid TraceOpts Status
08D13900 1 TCP/IPC V2R10 0885A000 0885A0C8 0029 9FFFFF7F Active
1 defined TCP/IP(s) were found
1 active TCP/IP(s) were found
1 TCP/IP(s) for CS V2R10 found
================================================================================
Analysis of Tcp/Ip for TCP/IPC. Index: 1
Dispatchable Unit Summary
INDEX DUADE DUCB DUSA ASCB ASID JOBNAME ABEND STATUS
10900003 08859040 0876C000 0876C100 008B7080 0029 TCP/IPC 00000000 Iu
RSA 0876C3F8 Prev 00005098 Next 0876C8C0 Mod EZBIEOER
RSA* 0876C8C8 Prev 0876C3F8 Next 00000000 Mod EZBITSTO
1384 bytes were used
1090000B 08859080 08784000 08784100 008B7980 0019 USER15 000C4000 Ab Iu
RSA 087843F8 Prev 09BB9798 Next 087846B8 Mod EZBPFSOC
```

IPCS subcommands for TCP/IP 179
TCPIPCS DUCB

Use this subcommand to display the contents of each dispatchable unit control block (DUCB). Each entry in the dispatchable unit allocation table (DUAT) points to a DUCB. The DUAT entry contains the status of the DUCB and identifies the ASID with which the DUCB is associated. The DUAT is summarized in the output. The contents of each DUCB are then displayed, followed by each DUSA for the DUCB. The first dispatchable unit stack area (DUSA) is followed by information from each register save area (RSA). Each register from the RSA is listed, showing its address and offset from the other registers in the register save area. The address of the parameter list (pointed to by R1) and the first five words at that address are also given. Each RSA is formatted. The recovery stack is also displayed.

Syntax

```
TCPIPCS DUCB
```

```
TCP (tcp_proc_name tcp_index)
```

```
TITLE
NOTITLE
```

Parameters

If no parameters are specified, all DUCBs are displayed.

*  
An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

**jobname**

Displays only the DUCBs with this job name. The job name can be a TCP/IP application name or a stack name. Must contain from 1-8 characters.

**DUCB_address**

Displays the DUCB with this address. An IPCS symbol name can be specified for the address. The address is specified as 1-8 hexadecimal digits. If an address begins with digit A–F, prefix the
address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**DUCB_index**

Displays this DUCB with this index. The index is a hexadecimal number containing one to four digits. The lowest index is zero.

**ASCB_address**

Displays the DUCB with this address space control block address (ASCB). An IPCS symbol name can be specified for the address. The address is specified as 1-8 hexadecimal digits. If an address begins with digit A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**asid_number**

Displays the DUCB with this ASID. The ASID is a hexadecimal number containing one to four digits.

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

**Sample output of the TCPIPCS DUCB subcommand**

In the following sample, some lines have been deleted in order to shorten the sample. Deleted lines are indicated with the following:

```
.
.
.
```

The following is sample output of the TCPIPCS DUCB subcommand:

```
TCPIPCS DUCB
Dataset: IPCS.R8A0723.RASDUMP
Title: EZRPED05
Tseb  S1 Procedure Version Task  Task  Asid TraceOpts Status
09B222B0 1 TCP5  V1R5  08E85000 08E850CB 001E 9FFF7E7F Active
09B222B0 2 TCP52 V1R5 08937000 089370CB 01F6 9FFF7E7F Active

2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS V1R5 found
================================================================================
Analysis of Tcp/IP for TCPCS.  Index: 1
DUCB Detail Analysis
Dispatchable Unit Allocation Table: 08E83010
+0000  DUAT0      EYE...... DUAT      NEXT..... 00000000
+0018  DUAE0      DUCB..... 08D8D010  FLAGS.... 0014001E
+0020  DUAE1      DUCB..... 08D90000  FLAGS.... 0034001E
+0028  DUAE2      DUCB..... 08D93000  FLAGS.... 0050001E
+0030  DUAE3      DUCB..... 08D96000  FLAGS.... 0014001E
+0038  DUAE4      DUCB..... 08D99000  FLAGS.... 5490001E
+0280  DUAE77     DUCB..... 08E74000  FLAGS.... 00000000
+0288  DUAE78     DUCB..... 08E77000  FLAGS.... 00000000
+0290  DUAE79     DUCB..... 08E7A000  FLAGS.... 00000000
+0298  DUAE80     DUCB..... 08E7D000  FLAGS.... 00000000
+02A0  DUAE81     DUCB..... 08E80000  FLAGS.... 00000000
Dispatchable Unit Control Block: DUCB0
EZBDUCB: 08E83010
+0000  DUCB_EYE................ DUCB
+0004  DUCB_LENGTH............... 0100
+0008  DUCB_VERSION............ 0002
+000C  DUCB_TOKEN............. 08E83010  0014001E  10000000  00000000
+0010  DUCB_DUSA............ 08D8D110
+0014  DUCB_AVAIL_CHAIN....... 00000000
+0020  DUCB_DUAEP........... 08E83028
+0026  DUCB_ASID............. 001E
+0028  DUCB_ASCB............. 00FA4400
+0030  DUCB_ATCB............. 007EC920
+0034  DUCB_TICVT........... 08E835CB
+0038  DUCB_LOCKS_TABLE...... 08D8D194
+003C  DUCB_LOCKS_SUSPENDED.. 00000000
+0040  DUCB_LOCKS_SUSPENDED_NEXT 7FFAFAF1
+0044  DUCB_SUSPENDTOKEN...... 00000000  40000000
+0050  DUCB_JOBNAME.......... TCPCS
+0054  DUCB_TSAB............ 09822230
+0058  DUCB_TSEB........... 09822230
+005C  DUCB_TSDB........... 08E85000
+0060  DUCB_TSDX........... 08E850CB
+0064  DUCB_TCP_ASCB....... 09FA4400
+0068  DUCB_STREAMHEAD...... 00000000
+006C  DUCB_CREATE_FLAGS.... 00000000
+0070  DUCB_CREATE_TSDB..... 00000000
+0074  DUCB_CID.............. 00000000
+0078  DUCB_PORT............ 0000
+007C  DUCB_IPADDR_LEN...... 00
```

IPCS subcommands for TCP/IP 181
### TRR_REGS
- 00000000

### TRR_DATA
- 00000000

### TRR_ROUTINE
- 00000000

### TRR_DUMPPARM
- 00000000

### TRR_REGS
- 08CFF190

### TRR_PARM
- 00000000

### TRR_ROUTINE
- 08E8875E

### TRR_DUMPPARM
- 00000000

### TRR_DATA
- 80000000

### TRR_ROUTINE
- 08E8875E

### TRR_DUMPPARM
- 00000000

### TRR_REGS
- 08D8D5B8

### TRR_PARM
- 00000000

### TRR_ROUTINE
- 08E8875E

### TRR_DUMPPARM
- 00000000

### TRR_DATA
- 80000000

### TRR_ROUTINE
- 08E8875E

### TRR_DUMPPARM
- 00000000

### TRR_REGS
- 08D8D128

### TCPIP Recovery Routine

### DTRR: 08D8D128

### TCPIP Recovery Routine

### -- Array elements --

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0004</td>
<td>TRR_MAX_INDEX</td>
</tr>
<tr>
<td>+0000</td>
<td>TRR_CURRENT_INDEX</td>
</tr>
</tbody>
</table>

### Dynamic Area of RSA01

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08D8D458</td>
<td>DUSA_EYE</td>
</tr>
</tbody>
</table>

### Register Save Area: RSA02

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08CFF010</td>
<td>RSA_DUSA</td>
</tr>
</tbody>
</table>

### Dynamic Area of RSA02

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08CFF030</td>
<td>RSA_DUSA</td>
</tr>
</tbody>
</table>

### Register Save Area: RSA03

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08CFF010</td>
<td>RSA_DUSA</td>
</tr>
</tbody>
</table>

### Dynamic Area of RSA03

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08CFF030</td>
<td>RSA_DUSA</td>
</tr>
</tbody>
</table>

### Module: EZBCTRCD

### Dynamic Area of RSA02

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>08CFF030</td>
<td>RSA_DUSA</td>
</tr>
</tbody>
</table>

---

**z/OS Communications Server: IP Diagnosis Guide**
TCPIPICS FRCA

Use this subcommand to display information about the Fast Response Cache Accelerator (FRCA) connections or about cached objects.

Syntax

```plaintext
TCP (ASID, TCB_address, UWSE_address)
```

Parameters

If no parameters are specified, only FRCA connections are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

**ASID**

Displays only the FRCA information for this address space. The address space ID is 1 - 4 hexadecimal digits in length. If the ASID value begins with digit a - f or A - F, prefix the value with a 0 so that the address is not interpreted as a symbol name or as a character string.

**TCB_address**

Displays the FRCA connection with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a-f or A-F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**UWSE_address**

Displays the FRCA shared cache with this address. An address is 1 - 8 hexadecimal digits in length. An IPCS symbol name can be specified for an address. If an address begins with digit a-f or A-F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.
**UWSX_address**
Displays the FRCA server connection with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a - f or A - F, prefix the address with a 0 so that the address is not interpreted as a symbol name or as a character string.

**jobname**
Displays only the FRCA information for this job name. The job name can be a TCP/IP application name or a stack name. The job name contains 1-8 alphanumeric characters.

**connection_id**
Displays the FRCA information with this connection ID. An ID is specified as 1-8 hexadecimal digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:

**CONNECTIONS**
Display only information for FRCA connections that use either a shared or an exclusive FRCA cache. CONNECTIONS is the default.

**EXCLUSIVE**
Display only information for connections that use an exclusive FRCA cache.

**SHARED**
Display only information for connections that use a shared FRCA cache.

**OBJECTS**
Display only information for FRCA cached objects.

**ALL**
Display information for all FRCA connections and cached objects.

**SUMMARY**
Displays the addresses of the control blocks and other data in tables. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows the contents of the control blocks.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rules:**

- If you specify multiple keywords from the set {CONNECTIONS, EXCLUSIVE, SHARED, OBJECTS, ALL}, only the last one is used.

- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPCS FRCA subcommand**

The following is sample output of the TCPIPCS FRCA subcommand:

```
1 'IPCSFRCA'                                                1  12:03:17 01/21/08
+______________________________________________________________________________
0 {{{{ tcpipcs frca(* all) }}}}
1 'IPCSFRCA'                                                2  12:03:17 01/21/08
+______________________________________________________________________________
0TCPPIPCS FRCA(* ALL)                                       0159270000
Dataset: IPCS.MVS054.IPSCSFRCA.DUMP
Title: 'IPCSFRCA'
The address of the TSAB is: 15927000
Tseb SI Procedure Version Tsdv Tsdx Asid TraceOpts Status
015927040 1 TCP/IP  V1R10 1590A000 1590A0C8 002A 9FFF767F 00000000 Active
0 1 defined TCP/IP(s) were found
0 1 active TCP/IP(s) were found
0 1 TCP/IP(s) for CS VIR10 found
0==============================================================================
0Analysis of Tcp/Ip for TCPCS.  Index: 1
0FRCA Server Connections
0UWSX@ Tcb@ Cache@ References Flags Use@  
1642D728 7F6FD410 00000000  3 4080 16649368
16427118 7F103900 00000000  2 4080 16649368
```

184 z/OS Communications Server: IP Diagnosis Guide
TCP/IPCS HASH

Use this subcommand to display information about the structure of TCP/IP hash tables.

Syntax

TCP/IPCS → HASH →

Parameters

ALL
Display structure of all TCP/IP hash tables. ALL is the default.

ICMPV6
Display only the structure of ICMPV6 hash tables.

IPSEC
Display only the structure of IPSecurity hash tables.

NETACC
Display only the structure of NetAccess hash tables.

POLICY
Display only the structure of Service Policy hash tables.
TCP
Display only the structure of TCP hash tables.

TTLs
Display only the structure of AT-TLS hash tables.

UDP
Display only the structure of UDP hash tables.

XCF
Display only the structure of XCF hash tables.

HEADER
Display hash table header information. Not displayed by default.

SUMMARY
Displays the addresses of the control blocks and other data in tables. SUMMARY is the default.

DETAIL
In addition to the SUMMARY display, DETAIL also shows the search key values.

BOTH
Display both active and logically deleted table elements. BOTH is the default.

ACTIVE
Display only the active table elements.

DELETE
Display only the logically deleted table elements.

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Rules:
• If you specify multiple keywords from the set {ALL, ICMPV6, IPSEC, NETACC, POLICY, TCP, TTLs, UDP, XCF}, all of the keywords that you specify are used.
• If you specify multiple keywords from the set {BOTH, ACTIVE, DELETE}, only the last one is used.
• If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS HASH subcommand
The following is sample output of the TCPIPCS HASH subcommand.

TCPIPCS HASH (DETAIL ALL)
Dataset: D74L.KWDEV03A.DUMP
Title:   ICMP HASHTAB
The address of the TSAB is: 0999D6F8
Tseb    SI Procedure Version Tsdb    Tsdx    Asid TraceOpts Status
0999D738  1 TCPCS2    V1R5    08FE9000 08FE90C8 0013 00000000  Active
0999D7B8  2 TCPCS     V1R5    08FB2000 08FB20C8 002D 00000000  Active
2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS     V1R5  found
================================================================================
Analysis of Tcp/Ip for TCPCS2.  Index: 1
TCPIP Hash Table Analysis
Policy ID Port Table
Hash Table Header at 7F65E008
Instance : 1
Active entries : 0
Hash buckets : 1,999
User free routine : 00000000
Element queue : 08FE9E48
0 elements in Policy Id Port Table
Table Summary:
Active buckets : 0
Inactive buckets : 0
Unused buckets : 1,999
Max active q length : 0
Max active q index : 0
Max active q seqnum : 0
Max delete q length : 0
Max delete q index : 0
Total seqnum : 0

ICMPV6 Table
Hash Table Header at 7F699C08
Instance : 4
Active entries : 7
Hash buckets : 1,024
User free routine : 00000000
Element queue : 08FE9E50
Bucket# Bucket@ Element@ Status User@ KeyValue
  2 7F699C28 7F2F8E80 Active 0AA6BF0F EC000000 00000000 00000000 00000000
      Clock Ticks...... 00000003
      Tokens........... 00
      Token Tenths..... 00
  5 7F699C58 7F2F9100 Active 0AA6BF98 00000000 00000000 00000000 00000000
      Clock Ticks...... 00000008
      Tokens........... 00
      Token Tenths..... 00
  6 7F699C68 7F2F9080 Active 0AA6BF98 00000000 00000000 00000000 00000000
      Clock Ticks...... 00000011
      Tokens........... 00
      Token Tenths..... 00
7 elements in ICMPV6 Table
Table Summary:
  Active buckets : 6
  Unused buckets : 0
  Max active q length : 2
  Max active q index : 6
  Max active q seqnum : 2
  Max delete q length : 0
  Max delete q index : 0
  Total seqnum : 7

TCP V4 Index Table
Hash Table Header at 7F528B88
Instance : 2
Active entries : 6
Hash buckets : 62,533
User free routine : 88D9523E
Element queue : 08FE9E4B
Bucket# Bucket@ Element@ Status User@ KeyValue
  0 7F528B88 7F507FE0 Active 7F510108 00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000
  530 7F52AC88 7F5080C0 Active 7F51B988 00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
  39479 7F55F020 7F508020 Active 7F51A088 7F000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      35181 7F55F2258 7F5080A0 Active 7F51A788 00000000 00000000 00000000 00000000
      27170000
      30977 7F5C7F08 7F508040 Active 7F511308 7F000001 00000000 00000000 00000000
      04000400
      00000000 00000000 00000000 00000000
      49773 7F5C7F08 7F508060 Active 7F510E88 7F000001 7F000001 04010400
      04000400
6 elements in TCP V4 Index Table
Table Summary:
  Active buckets : 6
  Unused buckets : 1
  Max active q length : 1
  Max active q index : 1
  Max active q seqnum : 1
  Max delete q length : 0
  Max delete q index : 0
  Total seqnum : 8

TCP V6 Index Table
Hash Table Header at 7F2FDB88
Instance : 5
Active entries : 2
Hash buckets : 62,533
User free routine : 88D9523E
Element queue : 08FE9E50
Bucket# Bucket@ Element@ Status User@ KeyValue
  0 7F2FDB88 7F2FC080 Active 7F510588 00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000
  530 7F2FFCA8 7F2F8F00 Active 7F51B988 00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      520 7F2FDB88 7F2FC080 Active 7F510588 00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
2 elements in TCP V6 Index Table
Table Summary:
  Active buckets : 2
  Inactive buckets : 0

IPCS subcommands for TCP/IP 187
TCPIPCS HEADER

Use the TCPIPCS HEADER command to display information from the system dump header and, in some cases, if a DUCB has ABENDED, the DUCB is displayed. The IPCS command STATUS System Cpu Registers Worksheet Faildata is used to display the system dump header.
Depending on the error recovery routine, the DUCB address might or might not be available. If the DUCB address is available, the DUCB is displayed. To find DUCBs that ABENDed, use the TCPIPCS DUAF (*ABEND) command.

**Syntax**

```
TCPIPCS HEADER
TCP (tcp_proc_name tcp_index)
```

**Parameters**

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

**Sample output of the TCPIPCS HEADER subcommand**

The following is sample output of the TCPIPCS HEADER subcommand:

```
TCPIPCS HEADER
Dataset: IPCS.MV21381.DUMPA
Title: SLIP DUMP ID=TC

The address of the TSAB is: 13391BC0

Tseb    SI Procedure Version Tsdb    Tsdx    Asid TraceOpts Status
13391C00 1 TCPSVT    V2R10   1323B000 1323B0C8 07DE 04041405 Active
13391C80 2 TCPSVT2   V2R10   00000000 00000000 07E8 00000000 Down Stopping
13391D00 3 TCPSVT1   V2R10   12FC3000 12FC30C8 0080 94FF755F Active
13391D80 4 TCPSVT3   V2R10   00000000 00000000 0059 00000000 Down Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found
```

Analysis of Tcp/Ip for TCPSVT. Index: 1

```
STATUS SUBCOMMAND

MVS Diagnostic Worksheet

Dump Title: SLIP DUMP ID=TC

CPU Model 9672 Version AC Serial no. 041018 Address 00
Date: 03/22/2000     Time: 07:36:57.297123 Local
Original dump dataset: SYS1.DUMP93
Information at time of entry to SVCDUMP:
HASID 000B  PASID 000B  SASID 000B  PSW  440C0000 81584B1C
CML ASCB address 00000000 Trace Table Control Header address 7F45D000
Dump ID: 007
Error ID: N/A
SDWA address N/A

CPU STATUS:
PSW=440C0000 81584B1C (RUNNING IN PRIMARY, KEY 0, AMODE 31, DAT ON)
DISABLED FOR I/O EXT
ASID(X'000B') 01584B1C. IEANUC09.IEAVEDS0+1C IN READ ONLY NUCLEUS
```
TCPIPCS HELP

Use this subcommand to display TCPIPCS usage and syntax information.

Syntax

TCPIPCS HELP

Parameters

If no parameters are specified, the function, operand, and syntax information are displayed for all TCPIPCS commands.

* An asterisk is used as a placeholder if no variable parameters are specified.

variable_item
Any one of the TCPIPCS subcommand names.

In addition to the variable parameters described above, you can specify the following keyword parameters:

ALL
Display information for all TCPIPCS commands. ALL is the default.

FUNCTION
Display only function information.

OPERANDS
Display only operand information.

SYNTAX
Display only syntax information.

Rule: If you specify multiple keywords from the set {ALL, FUNCTION, OPERANDS, SYNTAX}, all of the keywords that you specify are used.

Sample output of the TCPIPCS HELP subcommand

The following is sample output of the TCPIPCS HELP subcommand:

tcpcis help (config function)

Function:

The TCPIPCS command displays selected information about a specific TCP/IP address space.

CONFIG - Produce device configuration report.
**TCPIPCS CONFIG**

Display information about device, physical, and logical interfaces.

**Syntax:**

TCPIPCS CONFIG(<{SUMMARY|DETAIL}>)

**Operands:**

SUMMARY - Display summary report.

DETAIL - Display summary and interface cross-reference reports.

***

**TCPIPCS IPSEC**

Use this subcommand to display information about IP security filters or tunnels, IP security translated ports, or defensive filters.

**Syntax**

TCPIPCS IPSEC

Syntax diagram:

```
TCPIPCS IPSEC

( * )

(variable_item)

(variable_list)

( ALL SUMMARY DETAIL )

(TITLE NOTITLE)

TCP ( tcp_proc_name )

tcp_index
```

**Parameters**

If you do not specify any parameters, all IP security filters, tunnels, NAT translated ports, and all defensive filters are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

The following variable parameters can be repeated up to 32 times, separated by a blank space, within parentheses:

**filter_address**

Displays the IP security filter or defensive filter that has this address. An address is specified as 1 - 8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with a - f or A - F, prefix the address with a 0 so that the address is not interpreted as a symbol name or as a character string.

**tunnel_address**

Displays the IP security tunnel that has this address. An address is specified as 1 - 8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with a - f or A -
F, prefix the address with a 0 so that the address is not interpreted as a symbol name or as a character string.

**source IP address**
Displays the IPSecurity NAT SourceIP table entry with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a-f or A-F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**translated port address**
Displays the IPSecurity NAT Port Translation table entry with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a-f or A-F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

In addition to the variable parameters previously described, you can specify the following keyword parameters:

**ALL**
Display information for IP security filters, tunnels, NAT traversal remote port translations, and defensive filters. ALL is the default.

**FILTERS**
Display only information for IP security filters.

**TUNNELS**
Display only information for IP security tunnels.

**XLPORTS**
Display only information for IP security NAT-translated ports.

**DFILTERS**
Display only information for defensive filters.

**SUMMARY**
Displays the addresses of the control blocks and other data in tables. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows the contents of the control blocks.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rules:**

- If you specify multiple keywords from the set {ALL, FILTERS, TUNNELS, XLPORTS, DFILTERS}, only the last one is used.
- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Restriction:** The TCPIPCS IPSEC subcommand works only on stacks configured for IP security.

**Sample output of the TCPIPCS IPSEC subcommand**
The following is sample output of the TCPIPCS IPSEC subcommand:

```
TCPIP Ipsecurity Analysis
IPSEC on ZIIP No
FWE_GDA at 7F283430
FILTER_DA at 7F172C10
DEFENSIVE_FILTER_DA at 7F172BB0
TUNNEL_DA at 7F172530
ENCYP_DA at 7F282890
Filter set active : Policy
Filter logging : No
Pre-decap filtering : No
Defense Filter Mode : Active
IPv4 Defensive filter inbound list: 00000000
IPv4 Defensive filter inbound count: 0
```
IPV4 Defensive filter outbound list: 00000000
IPV4 Defensive filter outbound count: 0
IPV6 Defensive filter inbound list: 00000000
IPV6 Defensive filter inbound count: 0
IPV6 Defensive filter outbound list: 00000000
IPV6 Defensive filter outbound count: 0

IPv4 Filters

<table>
<thead>
<tr>
<th>Filter@</th>
<th>Action</th>
<th>SPrt1</th>
<th>SPrt2</th>
<th>DPrt1</th>
<th>DPrt2</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>7C553110</td>
<td>Permit</td>
<td>500</td>
<td>0</td>
<td>500</td>
<td>0</td>
<td>17 (UDP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0.0.0/0</td>
<td>0.0.0.0/0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7B8BD90</td>
<td>Permit</td>
<td>0</td>
<td>0</td>
<td>623</td>
<td>0</td>
<td>6 (TCP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>197.11.107.1</td>
<td>197.11.236.12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IPv6 Filters

<table>
<thead>
<tr>
<th>Filter@</th>
<th>Action</th>
<th>SPrt1</th>
<th>SPrt2</th>
<th>DPrt1</th>
<th>DPrt2</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>7B8D1610</td>
<td>Permit</td>
<td>500</td>
<td>0</td>
<td>500</td>
<td>0</td>
<td>17 (UDP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>::/0</td>
<td>::/0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7DA22D90</td>
<td>Permit</td>
<td>623</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6 (TCP)</td>
</tr>
</tbody>
</table>

IPv4 Tunnels

<table>
<thead>
<tr>
<th>Tunnel@</th>
<th>Policy</th>
<th>Format</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>7C514010</td>
<td>000000A5 00000033 Y 1589</td>
<td>DVA-linux</td>
<td></td>
</tr>
<tr>
<td></td>
<td>197.11.235.9</td>
<td>16.11.16.126</td>
<td></td>
</tr>
</tbody>
</table>

IPv6 Tunnels

<table>
<thead>
<tr>
<th>Tunnel@</th>
<th>Policy</th>
<th>Format</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>7E5AF010</td>
<td>00000014A 0000001C</td>
<td>M 1 IPMVAospfAH03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>::/0</td>
<td>::/0</td>
<td></td>
</tr>
</tbody>
</table>

**TCPIPCS LOCK**

Use this subcommand to scan the dump for information about the current locks that are defined and held. Only nonzero statistics are reported.

**Tip:** The DUCB lock table entries might conflict with the lockword counters. This is because DUCB lock table entries and lockword counters are not updated in one operation, therefore they can be out of sync. At the time the dump was obtained, the lockword counters might have been updated, but the DUCB has not yet been updated.
Syntax

```
TCPIPCS  LOCK  [SUMMARY]  [DETAIL]  TCP  [tcp_proc_name]  [tcp_index]
```

Parameters

**SUMMARY**
Displays each level of each class of lock, the total number of DUCBs found, and a cross-reference for each lock being used. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows lock information for each DUCB.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS LOCK subcommand

The following is sample output of the TCPIPCS LOCK subcommand:

```
TCPIPCS LOCK (DETAIL)
Dataset: IPCS.A594094.DUMPM
Title:   TCP5VT   V3R10: Job(TCP5VT) EZBITSTD(HTCP50A 99.281)+
        000177A S4C5/74BE2560 SRB P=0051,S=0051,H=0051
...     ItCvt: 12B573CB, Class_Count: 12, Level_Count: 34, Table_Size: 616
Lock statistics at 12E7B208
   Class 2 at 12E7B268 for 2 levels
      Level 0201 ITSTOR_QUE
      Suspension - Srb :           1,601
      Delays     -     :             239
      ...     
   Class 6 at 12E7B478 for 4 levels
      Level 0602 TCB
      Suspension - Srb :             146
      Suspension - Tcb :              33
      ...     
Ix   Ducb@    Lktb@    Susp@    Next@    DucbIx   Status
 0002 12A62000 12A62184 00000000 00000000 10000001 Iu
   Lock Class 02: 00000001 00000002 12A62278 00000000
   Lock Level 01: 12B57CB8 C0010201 00010000 Held Excl       ITSTOR_QUE
Ix   Ducb@    Lktb@    Susp@    Next@    DucbIx   Status
 072E 12B19000 12B19184 00000000 7FFFAF1 1000003E Iu
   Lock Class 06: 00000002 00000004 12B192F0 00000000
   Lock Level 02: 7F272D38 80010602 00020100 Held Shr        TCB
50 DUCBs found
2 DUCBs held locks
0 DUCBs were waiting for locks
Lockword Cross Reference
Lock@    Ducb@    Status    Name
12B57CB8  7F272D38  Not Held        ITSTOR_QUE
12B19000  12B19000  Held Shr        TCB
2 locks were referenced
```
TCPIPSystemService

Use this subcommand to display a mapping of TCP/IP storage. This subcommand is useful for finding overlays and abandoned storage.

Each control block referenced is listed in order by its address. Each control block eye-catcher is shown; if none is found, a mnemonic name is given in quotation marks. The size is the number of bytes (in decimal) in the control block. The key is the storage key. The base and offset are the address of a TCP/IP control block and the offset within it that contains the CbAddr in the far left column. Multiple references can exist, so additional references are continued on a separate line.

Note: Large dumps with many control blocks can take considerable time to process.

Syntax

TCPIPService MAP

TCP (tcp_proc_name tcp_index)

TITLE
NOTITLE

IPCS subcommands for TCP/IP 195
Parameters

ALL
Display storage usage information for all components.

CACHE
Display only CACHE storage usage information.

DUCB
Display only DUCB storage usage information.

ICMP
Display only ICMP storage usage information.

IF
Display only IF/IP storage usage information.

IP
Display only IF/IP storage usage information.

IPSEC
Display only IPSEC storage usage information.

NETACC
Display only NETACC storage usage information.

POLICY
Display only POLICY storage usage information.

RAW
Display only RAW storage usage information.

SOCKETS
Display only SOCKETS storage usage information.

STREAMS
Display only STREAMS storage usage information.

TCP
Display only TCP storage usage information.

TELNET
Display only TELNET storage usage information.

TIMERS
Display only TIMERS storage usage information.

TTLS
Only display AT-TLS storage usage information.

UDP
Display only UDP storage usage information.

XCF
Display only XCF storage usage information.

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Rule: If you specify multiple keywords from the set {ALL, CACHE, DUCB, ICMP, IF, IP, IPSEC, NETACC, POLICY, RAW, SOCKETS, STREAMS, TCP, TELNET, TIMERS, TTLS, UDP, XCF}, all of the keywords that you specify are used.

Sample output of the TCPIPCS MAP subcommand

The following is sample output of the TCPIPCS MAP subcommand:

TCPIPCS MAP
Dataset: IPCS.MV20767.DUMPA
Title: VERIFY MV20758

The address of the TSAB is: 08DD36F8
Analysis of Tcp/Ip for TCPCS.  Index: 1
CbIds enclosed in quotes e.g. "CBID" are not true eyecatchers.
Found 847 References and 1037 Cross-references

Analysis of Tcp/Ip for TCPCS completed

TCP/IPCS MTABLE

Use this subcommand to access the module tables and display the following information:

- Module entry point address
- Name
- Compile date and time
- PTF number
- Load module name

The entries are listed first in entry-point-address order, and then listed again in module-name order.
Syntax

```
TCPIPCS MTABLE

(*) variable_item

(*) variable_list

BOTH
BYADDR
BYNAME

TCP (tcp_proc_name tcp_index)

TITL

NOTITLE
```

Parameters

If no parameters are specified, all displayable modules are displayed.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

You can repeat from 1 –32 of the following variable parameters, each separated by a blank space, within parentheses:

- **address**
  
  Locates the TCP/IP module where this address appears and displays the name and offset. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

- **name**
  
  Locates the TCP/IP module with this name. A name is specified as 1-8 characters.

In addition to the variable parameters previously described, you can specify the following keyword parameters:

**BOTH**

Display modules sorted by address and by name.

**BYADDR**

Display only modules sorted by address.

**BYNAME**

Display only modules sorted by name.

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

Sample output of the TCPIPCS MTABLE subcommand

The following is a sample output of the TCPIPCS MTABLE subcommand:

```
TCPIPCS MTABLE (12DE3800 12D9B858)
Dataset: IPCS.A594094.DUMPM
Title: TCPSVT V2R10: Job(TCPSVT ) EZBITSTO(HTCP50A 99.281)+
  00077A S4C5/74BE2500 SRB P=0051,S=0051,H=0051

The address of the TSAB is: 12E89BB8
```
TCPIPCS POLICY

Use this subcommand to display policy information.

Syntax

```
TCPIPCS POLICY (SUMMARY) (DETAIL) TCP tcp_proc_name tcp_index
```

Parameters

**SUMMARY**
Displays the policy table addresses. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows control block contents.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS POLICY subcommand

The following is sample output of the TCPIPCS POLICY subcommand:

```
TCPIPCS POLICY TCP(1) Dataset: IPCS.MV23046.DUMPA Title: BOTSWANA HUNG RUNNING PAGENT DIFFSERV SETTINGS.

The address of the TSAB is: 12EFD818
```
TCPIPCS PROFILE

Use this subcommand to show the active configuration information at the time of the dump, in the form of profile data set statements. This profile does not necessarily match the profile used to start TCP/IP because the startup profile might not include the dynamic changes, additions, or deletions made by using commands. All the defaults that are in effect are displayed in addition to explicit settings.

Syntax

```plaintext
TCPIPCS PROFILE

TCPIPCS (tcp_proc_name tcp_index)

TCPIPCS ALL

ALL (TCPIP TELNET CONVERT)

TCPIPCS NOTITLE

TCPIPCS TITLE
```

Use this subcommand to show the active configuration information at the time of the dump, in the form of profile data set statements. This profile does not necessarily match the profile used to start TCP/IP because the startup profile might not include the dynamic changes, additions, or deletions made by using commands. All the defaults that are in effect are displayed in addition to explicit settings.

Syntax

```plaintext
TCPIPCS PROFILE

TCPIPCS (tcp_proc_name tcp_index)

TCPIPCS ALL

ALL (TCPIP TELNET CONVERT)

TCPIPCS NOTITLE

TCPIPCS TITLE
```

Use this subcommand to show the active configuration information at the time of the dump, in the form of profile data set statements. This profile does not necessarily match the profile used to start TCP/IP because the startup profile might not include the dynamic changes, additions, or deletions made by using commands. All the defaults that are in effect are displayed in addition to explicit settings.

Syntax

```plaintext
TCPIPCS PROFILE

TCPIPCS (tcp_proc_name tcp_index)

TCPIPCS ALL

ALL (TCPIP TELNET CONVERT)

TCPIPCS NOTITLE

TCPIPCS TITLE
```
Parameters

**ALL**
Display all profile statements.

**TCPIP**
Display only TCP/IP profile statements.

**TELNET**
Display only Telnet profile statements.

**CONVERT**
Display converted profile statements. This parameter can be useful as an aid to convert older profile statements to equivalent strategic profile statements.

For TCPIP, the following are the converted profile statements.

- The DEVICE, LINK, and HOME statements for the following interface types are converted to INTERFACE statements:
  - IPAQENET
  - IPAQIDIO
  - VIRTUAL

  In addition, corresponding changes are made to the BSDROUTINGPARMS, START, and STOP statements if present.

- The SMFPARMS statement is converted to an SMFCONFIG statement.

**Rule:** The SMFPARMS statement is converted to an SMFCONFIG statement even if the CONVERT parameter is not specified.

For TELNET, there are no converted profile statements.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

Sample output of the TCPIPCS PROFILE subcommand

The following is sample output of the TCPIPCS PROFILE subcommand:

```
TCPIPCS PROFILE
Dataset: IPCS.TCPIPCS.DUMP
The address of the TSAB is: 162E9000
Tseb SI Procedure Version Tsd Tsdx  Asid TraceOpts Status
162E9040  1 TCPCS5 V2R1 15951000 159510C8 0032 9FFF777F 00000000  Active
162E90C0  2 TCPCS8 V2R1 14FEB000 14FEB0C8 002E 9FFF777F 00000000  Active
2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS V2R1 found
================================================================================
Analysis of Tcp/Ip for TCPCS5.  Index: 1
; Profile generated on 2015/01/30 at 17:34:03
; Dump Dataset : IPCS.TCPIPCS.DUMP
; Dump Time : 2015/01/30 12:33:18.247759
; TCP/IP Jobname: TCPCS5
;
; For informational purposes, only SMFCONFIG will be generated in this reconstructed profile.
; Either an SMFCONFIG or an SMFPARMS statement is specified in an initial profile data set, or in a data set referenced by the VARY TCPIP,,OBEYFILE command. SMFCONFIG is the recommended way to define SMF processing options.

ARPAGE 20
```
PORT 3017 TCP DCICSTS DELAYAcks
PORT 3016 TCP DCICSTS DELAYAcks
PORT 3015 TCP DCICSTS DELAYAcks
PORT 3014 TCP DCICSTS DELAYAcks
PORT 3013 TCP DCICSTS DELAYAcks
PORT 3012 TCP DCICSTS DELAYAcks
PORT 3011 TCP DCICSTS DELAYAcks
PORT 3010 TCP DCICSTS DELAYAcks
PORT 3009 TCP DCICSTS DELAYAcks
PORT 3008 TCP DCICSTS DELAYAcks
PORT 3007 TCP DCICSTS DELAYAcks
PORT 3006 TCP DCICSTS DELAYAcks
PORT 3005 TCP DCICSTS DELAYAcks
PORT 3004 TCP DCICSTS DELAYAcks
PORT 3003 TCP DCICSTS DELAYAcks
PORT 3002 TCP DCICSTS DELAYAcks
PORT 3001 TCP DCICSTS DELAYAcks
PORT 3000 TCP DCICSTS DELAYAcks
PORT 520 UDP * DELAYAcks
PORT 161 UDP OSNMPD DELAYAcks
PORT 53 UDP OMVS DELAYAcks
PORT 53 TCP OMVS DELAYAcks
PORT 23 TCP TCPCSS DELAYAcks
PORT 21 TCP OMVS DELAYAcks
PORT 19 TCP MISCserv DELAYAcks
PORT 19 UDP MISCserv DELAYAcks
PORT 9 TCP MISCserv DELAYAcks
PORT 9 UDP MISCserv DELAYAcks
PORT 7 TCP MISCserv DELAYAcks
PORT 7 UDP MISCserv DELAYAcks
SACONfig COMMUNity public AGENT 161 SACACHETime 30 ENABled SETSDISAbled
OSADISabled
SMFCONfig TYPE118 NOTCPINIT NOTCPTERM NOFTPCLIENT NOTN3270CLIENT
NOTTCPipSTATISTICS TYPE119 NOTCPINIT NOTCPTERM NOFTPCLIENT
NOTN3270CLIENT NOTTCPipSTATISTICS NOTSOPTStatistics
NOPORTStatistics NOTTCPSTACK NOUDPterm NOIPSECURITY
PROFILE DVIPA
SOMAXCONN 10
START IUTSAMEH
START IUTSAMEH6
STOP MPC4115
STOP MPC6115
STOP MPC4145
STOP MPC4185
STOP MPC6185
STOP QDIO4105
STOP I4HIPERSOCKA
STOP QDIO6105
STOP MPC6245

TCP CONfig INTrval 120 DELAYAcks RESTRICTLowports TCPRCVbufsize 16384
TCPSENDBufsize 16384 TCPMAXRCVbufsize 262144 FINWAIT2TIME
600 SENDGarbage FALSE TCPgettimeout NOTTLS SECTIVEACK
EPHEMERALPORTS 01024 - 65535
UDPCONfig RESTRICTLowports UDPCRCVbufsize 65535
UDPSNDBufsize 65535 UDPQueueLimit EPHEMERALPORTS 01024 - 65535
BEGIN Routes
ROUTE 10.81.4.0 255.255.255.0 10.11.5.4 MPC4145L MTU DEFAULTsize
MAXimumretransmittime 120 MINimumretransmittime 0.5
ROUNDTRIPGain 0.125 VARIANCEGain 0.25 VARIANCEMultiplier 2
DELAYAcks NOREPLACEable
ROUTE 10.81.2.0 255.255.255.0 10.11.5.4 MPC4145L MTU DEFAULTsize
MAXimumretransmittime 120 MINimumretransmittime 0.5
ROUNDTRIPGain 0.125 VARIANCEGain 0.25 VARIANCEMultiplier 2
DELAYAcks NOREPLACEable
ROUTE 10.51.8.0 255.255.255.0 10.11.5.4 MPC4145L MTU DEFAULTsize
MAXimumretransmittime 0.5 ROUNDTRIPGain 0.125 VARIANCEGain 0.25
VARIANCEMultiplier 2 DELAYAcks NOREPLACEable
ROUTE 10.11.5.1 HOST = TOVTAM MTU DEFAULTsize MAXimumretransmittime
120 MINimumretransmittime 0.5 ROUNDTRIPGain 0.125 VARIANCEGain 0.25
VARIANCEMultiplier 2 DELAYAcks NOREPLACEable
ROUTE 10.11.5.4 HOST = MPC4115L MTU 4096 MAXimumretransmittime 120
MINimumretransmittime 0.5 ROUNDTRIPGain 0.125 VARIANCEGain 0.25
VARIANCEMultiplier 2 DELAYAcks REPLACable
ROUTE 10.11.5.4 HOST = MPC4145L MTU 4096 MAXimumretransmittime 120
MINimumretransmittime 0.5 ROUNDTRIPGain 0.125 VARIANCEGain 0.25
VARIANCEMultiplier 2 DELAYAcks REPLACable
ROUTE 10.11.5.4 HOST = MPC4185L MTU 4096 MAXimumretransmittime 120
MINimumretransmittime 0.5 ROUNDTRIPGain 0.125 VARIANCEGain 0.25
VARIANCEMultiplier 2 DELAYAcks REPLACable
ROUTE 10.81.8.0 255.255.255.0 10.11.5.4 MPC4185L MTU DEFAULTsize
MAXimumretransmittime 120 MINimumretransmittime 0.5
ROUNDTRIPGain 0.125 VARIANCEGain 0.25 VARIANCEMultiplier 2
DELAYAcks NOREPLACEable
TCP/IPCS PROTOCOL

Use this subcommand to display information from TCP, UDP, and RAW protocol control blocks.

Syntax

```
TCPIPICS PROTOCOL (SUMMARY) (DETAIL) TITLE NOTITLE
```

Parameters

**SUMMARY**

Formats the MTCB, MUDP, and MRCB contents. Lists all the TCBs, UCBs, and RCBs in separate cross-referenced tables. SUMMARY is the default.

**DETAIL**

In addition to the SUMMARY display, DETAIL formats the contents of the TCBs, UCBs, and RCBs.

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.
Sample output of the TCPIPCS PROTOCOL subcommand

The following is sample output of the TCPIPCS PROTOCOL subcommand:

```
TCPIPCS
PROTOCOL

Dataset: IPCS.MV21381.DUMPA

Title:   SLIP DUMP

ID=TC

The address of the TSAB is:
13391BC0

Tseb    SI Procedure Version Tsdb    Tsdx    Asid TraceOpts
Status

13391C00  1 TCPSVT    V2R10  1323B000 1323B0C8 07DE 04041405
Active

13391C80  2 TCPSVT2   V2R10   00000000 00000000 07E8 00000000  Down
Stopping

13391D00  3 TCPSVT1   V2R10   12FC3000 12FC30C8 0080 94FF755F
Active

13391D80  4 TCPSVT3   V2R10   00000000 00000000 0059 00000000  Down
Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found

4 TCP/IP(s) for CS    V2R10
found

==========================================================================

Analysis of Tcp/IP for TCPSVT.  Index:
1

TCPIP Raw Control Block
Analysis
Master Raw Control Block (MRCB)
MRAWCBCB:
7F75B048

+0000  RMRCBEYE. MRCB  MRCMUTEX. 00000000 00000000 00000000
D7D60501  RSTKDOWN. 00
+0021  RSTKLNKD. 01  RDRVSTAT. 01  RSBCAST.. 00000000
RSDNTRTE. 00000000  RSRCVBUF. 0000FFFF
+0030  RSSNDBUF. 0000FFFF  RDIPTOS.. 00
+0030  RDIPTTL.. 00
RIPWRQ@.. 7F61D3E8  RPRDQ@.. 7F61D3A8
+0040  RHASH@
7F75B08C
```
Raw Hash Table Entries

<table>
<thead>
<tr>
<th>ID</th>
<th>First</th>
<th>Last</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>7F5513C8</td>
<td>7F5513C8</td>
</tr>
<tr>
<td>15</td>
<td>7F712088</td>
<td>7F712088</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RCB</th>
<th>ResrcID</th>
<th>ResrcNm</th>
<th>TpiState</th>
<th>DestAddr</th>
<th>ProtocolId</th>
</tr>
</thead>
<tbody>
<tr>
<td>7F5513C8</td>
<td>0000000062</td>
<td>OMPROUTE</td>
<td>WLOIDLE</td>
<td>129.11.208.108</td>
<td>89</td>
</tr>
<tr>
<td>7F712088</td>
<td>0000000008</td>
<td>TCPSVT</td>
<td>WLOIDLE</td>
<td>0.0.0.0</td>
<td>255</td>
</tr>
</tbody>
</table>

2 RCB(s) FOUND
2 RCB(s) FORMATTED

TCP/IP Analysis

TCP/IP Main TCP Control Block (MTCB)

MTCB: 1338E350
+0080 M_MAIN_EYE......... TCP MAIN
+0088 M_TCP_LWRITE_Q..... 7F781868
+008C M_TCP_LREAD_Q...... 7F781828
+0014 M_TCP_DRIVER_STATE. 01
+0018 MTCPTX............. 00000000 00000000 00000000 D7D6601
+0028 MTCPAOMX............ 00000000 00000000 00000000 D7D6604
+0038 MTCB_LIST_LOCK..... 00000000 00000000 00000000 D7D6604
+0048 M_PORT_CEILING..... 000000FF
+004C M_TPI_SQ4.........   00000000
+0050 M_PORT_ARRAY....... 7F712FC8
+0054 M_LAST_PORT_NUM.... 00000045

TCB

<table>
<thead>
<tr>
<th>Port</th>
<th>ResrcID</th>
<th>ResrcNm</th>
<th>TcpState</th>
<th>TpiState</th>
<th>Flag1234</th>
<th>UseCount</th>
<th>IPAddr</th>
</tr>
</thead>
<tbody>
<tr>
<td>7F607108</td>
<td>00000002</td>
<td>TCPSVT</td>
<td>Closed</td>
<td>WLOIDLE</td>
<td>00000001</td>
<td>0.0.0.0</td>
<td></td>
</tr>
<tr>
<td>7F60A908</td>
<td>000033D7</td>
<td>FTPUNIX1</td>
<td>Listening</td>
<td>WLOIDLE</td>
<td>00200080</td>
<td>0.0.0.0</td>
<td></td>
</tr>
<tr>
<td>7F606008</td>
<td>00000133</td>
<td>TCPSVT</td>
<td>Listening</td>
<td>WLOIDLE</td>
<td>00000000</td>
<td>0.0.0.0</td>
<td></td>
</tr>
<tr>
<td>7F617508</td>
<td>00000198</td>
<td>CICSRU</td>
<td>Listening</td>
<td>WLOIDLE</td>
<td>00200080</td>
<td>0.0.0.0</td>
<td></td>
</tr>
<tr>
<td>7F615108</td>
<td>00000144</td>
<td>INETD5</td>
<td>Listening</td>
<td>WLOIDLE</td>
<td>00200080</td>
<td>0.0.0.0</td>
<td></td>
</tr>
</tbody>
</table>

User Datagram Protocol Control Block

Summary

MUCB: 7F7812A8
**TCP/IPCS RAW**

Use this subcommand to display the Master Raw Control Block (MRCB) and any Raw protocol Control Blocks (RCBs) defined in the MRCB hash table.

**Syntax**

```
TCPIP CS RAW
```

**Parameters**

If no parameters are specified, all raw connections are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

```
*variable_list* DATAQ SUMMARY DETAIL TITLE NOTITLE
```

---

<table>
<thead>
<tr>
<th>CBU</th>
<th>ResrcID</th>
<th>ResrcNm</th>
<th>TpiState</th>
<th>IPAddr</th>
<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>7F5F6108</td>
<td>00000004</td>
<td>TCPSVT</td>
<td>WLOUNBND</td>
<td>0.0.0.0</td>
<td>0.0.0.0</td>
</tr>
<tr>
<td>7F5FCD08</td>
<td>00000086</td>
<td>USNMFD</td>
<td>WLOIDLE</td>
<td>127.0.0.1</td>
<td>161</td>
</tr>
<tr>
<td>7F5FD008</td>
<td>00000056</td>
<td>DHCP1</td>
<td>WLOIDLE</td>
<td>129.11.32.1</td>
<td>67</td>
</tr>
<tr>
<td>7F5FCF08</td>
<td>00000055</td>
<td>DHCP1</td>
<td>WLOIDLE</td>
<td>198.1.11.25.104</td>
<td>1027</td>
</tr>
<tr>
<td>7F5FD008</td>
<td>00000058</td>
<td>NAMED</td>
<td>WLOIDLE</td>
<td>129.11.176.87</td>
<td>53</td>
</tr>
<tr>
<td>7F5FD108</td>
<td>00000059</td>
<td>DHCP3</td>
<td>WLOIDLE</td>
<td>0.0.0.0</td>
<td>6001</td>
</tr>
<tr>
<td>7F5FC908</td>
<td>00000048</td>
<td>MISCSCRV</td>
<td>WLOIDLE</td>
<td>0.0.0.0</td>
<td>19</td>
</tr>
<tr>
<td>7F5FC708</td>
<td>00000047</td>
<td>MISCSCRV</td>
<td>WLOIDLE</td>
<td>0.0.0.0</td>
<td>19</td>
</tr>
<tr>
<td>7F5F6B08</td>
<td>00000017</td>
<td>MISCSCRV</td>
<td>WLOIDLE</td>
<td>0.0.0.0</td>
<td>7</td>
</tr>
<tr>
<td>7F5F6908</td>
<td>00000014</td>
<td>PORTMAP</td>
<td>WLOIDLE</td>
<td>0.0.0.0</td>
<td>111</td>
</tr>
</tbody>
</table>

56 UCB(s) FOUND
56 UCB(s) FORMATTED

Analysis of Tcp/IP for TCPSVT completed
**variable_list**
You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

**jobname**
Displays only the RCB for this job name. The job name can be a TCP/IP application name or a stack name, and it must contain from 1-8 characters.

**RCB_address**
Displays only the RCB with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**connection_id**
Displays the RCB with this connection ID. A connection ID is specified as 1 - 8 hexadecimal digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:

**DATAQ**
Formats RCBs which have data queued on the RECEIVE queue.

**SUMMARY**
Formats the MRCB contents and lists all the RCBs in one cross-reference table. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL formats the contents of the RCBs.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPCS RAW subcommand**

The following is sample output of the TCPIPCS RAW subcommand:

```
TCPIPCS RAW
Dataset: IPCS.R8A0723.RASDUMP
Title: EZRPE005
The address of the TSAB is: 098221F0
Tseb     SI Procedure Version Tsdx Asid TraceOpts Status
09822230  1 TCPCS     V1R5    08E85000 08E850C8 001E 9FFF7E7F  Active
098222B0  2 TCPCS2    V1R5    08937000 089370C8 01F6 9FFF7E7F  Active
2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS V1R5 found

Analysis of Tcp/Ip for TCPCS. Index: 1
TCPIP Raw Control Block Analysis
Master Raw Control Block (MRCB)
MRAWCB: 7F407208
+0000  RMRCBEVE. MRCB    RSTKLNKD. 01    RDRVSTAT. 01
+0000  RMRCBEVE. MRCB    RSTKLNKD. 01
+0000  R6STKLNKD.       01
+0000  R6DRVSTAT.       01
+0010  MRMCUTEX. 00000000 00000000 00000000 00000000  D7D60501
+0020  RSBCAST. 00000000 00000000 00000000 00000000  RSRC 00
+0026  RSBCAST. 00000000 00000000 00000000 00000000  RSBRTC 00
+0030  RSBCAST. 00000000 00000000 00000000 00000000  RSBRC 00
+0035  RIPWRQ@.. 7F621DA8 RIPRDQ@.. 7F621D68  RPHAS
+0040  RIP6WRQ@. 7F686468 RIP6RDQ@.. 7F686428  R6HASB.. 7F407374
+0044  R6DDFLRT. 7F781FFF FFFFFFFF FFFFFFFF 003FFFFF

IPv4 Raw Hash Table Entries
ID  First    Last
  0  7F52C390 7F52C390
 15  7F52C110 7F52C110

IPv6 Raw Hash Table Entries
ID  First    Last
  0  7F2673BC 7F2673BC
```

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IPv4 RAW Connections
RCB    ResrcID  ResrcNm  TpiState  ProtocolId  DestAddr
7F52C388 00000006 TCPCS    WLOIDLE    0           0.0.0.0
7F52C108 00000008 TCPCS    WLOIDLE    255         0.0.0.0

IPv6 RAW Connections
RCB    ResrcID  ResrcNm  TpiState  ProtocolId  DestAddr
7F207208 0000000E TCPCS    WLOIDLE    0           ::0

3 RCB(s) FOUND
3 RCB(s) FORMATTED
Analysis of Tcp/Ip for TCPCS completed

TCPIPICS ROUTE

Use this subcommand to display the routing control blocks. Each routing table entry is formatted to display the:

• Route control block address
• Device name
• Type
• Protocol
• Destination IP address
• Gateway IP address
• Physical interface control block address

Syntax

```
TCPIPICS ROUTE
```

Parameters

ALL
Display structure of all route table information (including all active and to-be-deleted policy-based routing tables). ALL is the default.

IPV4
All IPv4 search tree and update tree routes in the main route table.

IPV6
All IPv6 search tree and update tree routes in the main route table.
IQDIO
All QDIO Accelerator and HiperSockets Accelerator search tree and update tree routes.

PD
All policy-based routing tables that are marked for deletion.

PR
All search tree and update tree routes for all policy-based routing tables. Also, list configured routes that use interfaces that are not defined in the stack and list dynamic routing parameters for all policy-based routing tables.

QDIOACCEL
All QDIO Accelerator and HiperSockets Accelerator search tree and update tree routes.

RADV
All IPv6 routes added based on information that was received in router advertisement messages are displayed without regard to whether they are currently being used in the active routing table.

RSTAT
All defined replaceable static routes are displayed without regard to whether they are currently being used in the active routing table.

TCP, TITLE, NOTITLE
For a description of these parameters, see “Parameters” on page 169.

Rule: If you specify multiple keywords from the set {ALL, IPV4, IPV6, IQDIO, PD, PR, QDIOACCEL, RADV, RSTAT}, all of the keywords that you specify are used.

Sample output of the TCPIPCS ROUTE subcommand
The following is sample output of the TCPIPCS ROUTE subcommand:

TCPIPCS ROUTE
Dataset: IPCS.P414001.PUBDUMPA
Title: DUMP OF TCP STACKS

The address of the TSAB is: 3A467000

<table>
<thead>
<tr>
<th>Tseb</th>
<th>SI Procedure</th>
<th>Version</th>
<th>Tsdb</th>
<th>Tsdx</th>
<th>Asid</th>
<th>TraceOpts</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A467040</td>
<td>1 TCPSVT</td>
<td>V1R9</td>
<td>3A449000</td>
<td>3A4490C8</td>
<td>006A</td>
<td>97BF749F</td>
<td>C0000000</td>
</tr>
<tr>
<td>3A4670C0</td>
<td>2 TCPSVT1</td>
<td>V1R9</td>
<td>397CD000</td>
<td>397CD0C8</td>
<td>007B</td>
<td>97BF749F</td>
<td>C0000000</td>
</tr>
<tr>
<td>3A467140</td>
<td>3 TCPSVT2</td>
<td>V1R9</td>
<td>38669000</td>
<td>386690C8</td>
<td>007C</td>
<td>97BF749F</td>
<td>C0000000</td>
</tr>
</tbody>
</table>

3 defined TCP/IP(s) were found
3 active TCP/IP(s) were found

3 TCP/IP(s) for CS V1R9 found

Analysis of Tcp/Ip for TCPSVT. Index: 1
TCP/IP Route Analysis

Replaceable Static Routes Configured
IPv4 Route Table Name=EZBMAIN ID=0 Ref=0 Flags=08000000

<table>
<thead>
<tr>
<th>Rtiocl0</th>
<th>LinkName</th>
<th>IP Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>7F453150</td>
<td>LOGETH2</td>
<td>Destination: 174.33.84.237</td>
</tr>
<tr>
<td>7F452BB0</td>
<td>LOGETH2</td>
<td>Destination: 197.0.0.0</td>
</tr>
</tbody>
</table>

IPv6 Route Table Name=EZBMAIN ID=0 Ref=0 Flags=08008000

<table>
<thead>
<tr>
<th>Rtiocl6</th>
<th>InterfaceName</th>
<th>IP Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>7F452750</td>
<td>LV60GETH2</td>
<td>Destination: 2000:176:11:48::237</td>
</tr>
</tbody>
</table>

IPv6 Router Advertisement Routes
IPv6 Route Table Name=EZBMAIN ID=0 Ref=0 Flags=08008000

Routes in IPv4 Route Tables
### IPv4 Route Table

<table>
<thead>
<tr>
<th>Rte@</th>
<th>LinkName</th>
<th>Type/State</th>
<th>Protocol</th>
<th>Pi@</th>
<th>IP Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>7DCABB50</td>
<td>LOGETH2</td>
<td>Host</td>
<td>OSPF</td>
<td>7F850490</td>
<td>Destination: 202.77.232.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Subnet Mask: 255.255.255.255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 174.33.84.237</td>
</tr>
<tr>
<td>7DFC25D0</td>
<td>LOGETH8</td>
<td>Host</td>
<td>OSPF</td>
<td>7F850090</td>
<td>Destination: 202.77.232.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Subnet Mask: 255.255.255.255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 174.33.84.237</td>
</tr>
<tr>
<td>7DCABE90</td>
<td>LOGETH2</td>
<td>Host</td>
<td>OSPF</td>
<td>7F850490</td>
<td>Destination: 202.77.230.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Subnet Mask: 255.255.255.255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 174.33.84.237</td>
</tr>
<tr>
<td>7DCABCF0</td>
<td>LOGETH8</td>
<td>Host</td>
<td>OSPF</td>
<td>7F850090</td>
<td>Destination: 202.77.230.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Subnet Mask: 255.255.255.255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 174.33.84.237</td>
</tr>
<tr>
<td>7F453350</td>
<td>LOGETH2</td>
<td>Host</td>
<td>Configuration</td>
<td>7F850490</td>
<td>Destination: 174.33.84.237</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Subnet Mask: 255.255.255.255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 0.0.0.0</td>
</tr>
<tr>
<td>7F452E70</td>
<td>LOGETH2</td>
<td>Subnetwork</td>
<td>Configuration</td>
<td>7F850490</td>
<td>Destination: 197.0.0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Subnet Mask: 255.255.255.255</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 174.33.84.237</td>
</tr>
</tbody>
</table>

### IPv6 Route Table

<table>
<thead>
<tr>
<th>Rte@</th>
<th>InterfaceName</th>
<th>Type/State</th>
<th>Protocol</th>
<th>Pi@</th>
<th>IP Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>7DCA7730</td>
<td>LV6OGETH2</td>
<td>Host</td>
<td>OSPF</td>
<td>7F4554650</td>
<td>Destination: fec0:197:11:104:20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Prefix: 124</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: fe80::11:176:50:104</td>
</tr>
<tr>
<td>7EBFB450</td>
<td>LV6IUTIQD00</td>
<td>Host</td>
<td>Configuration</td>
<td>7F455250</td>
<td>Destination: fe80::2440:ff:4ec:2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Prefix: 128</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 0</td>
</tr>
<tr>
<td>7EBFB280</td>
<td>LV6IUTIQD02</td>
<td>Host</td>
<td>Configuration</td>
<td>7F4567F0</td>
<td>Destination: fe80::2440:2ff:10c:42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Prefix: 128</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 0</td>
</tr>
<tr>
<td>7EB95ED0</td>
<td>EZ6SAMEMWS</td>
<td>Host</td>
<td>Configuration</td>
<td>7EB91010</td>
<td>Destination: fe80::11:199:80:104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Prefix: 128</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td></td>
<td></td>
<td>Prefix: 128</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gateway: 0</td>
</tr>
</tbody>
</table>

Analysis of Tcp/Ip for TCPSVT completed

IPCS subcommands for TCP/IP 211
TCPIPCS SOCKET

Use this subcommand to display information from TCP/IP socket control blocks.

Syntax

```
TCPIPCS SOCKET
```

Parameters

If no parameters are specified, all sockets are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

You can repeat from 1–32 of the following variable parameters, each separated by a blank space, within parentheses:

**SCB_address**

Displays only the socket control block (SCB) with this address. An address is specified as 1-16 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**connection_id**

Displays the SCB with this connection ID. A connection ID is specified as 1-8 hexadecimal digits.

In addition to the variable parameters described above, the following keyword parameters can be specified:

**SUMMARY**

Summarizes the sockets. SUMMARY is the default.

**DETAIL**

In addition to the SUMMARY display, DETAIL formats the contents of the SCBs.

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS SOCKET subcommand

The following is sample output of the TCPIPCS SOCKET subcommand:

```
TCPIPCS SOCKET
Dataset: IPCS.MV21381.DUMPA
```

212 z/OS Communications Server: IP Diagnosis Guide
Title: SLIP DUMP ID=TC

The address of the TSAB is: 13391BC0

<table>
<thead>
<tr>
<th>Tseb</th>
<th>SI Procedure</th>
<th>Version</th>
<th>Tsdb</th>
<th>Tsdx</th>
<th>Asid</th>
<th>TraceOpts</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>13391C00</td>
<td>1 TCPSVT</td>
<td>V2R10</td>
<td>1323B000</td>
<td>1323B0C8</td>
<td>07DE</td>
<td>04041405</td>
<td>Active</td>
</tr>
<tr>
<td>13391C00</td>
<td>2 TCPSVT2</td>
<td>V2R10</td>
<td>00000000</td>
<td>00000000</td>
<td>07E8</td>
<td>00000000</td>
<td>Down Stopping</td>
</tr>
<tr>
<td>13391D00</td>
<td>3 TCPSVT1</td>
<td>V2R10</td>
<td>12FC3000</td>
<td>12FC30C0</td>
<td>0080</td>
<td>94FF755F</td>
<td>Active</td>
</tr>
<tr>
<td>13391D80</td>
<td>4 TCPSVT3</td>
<td>V2R10</td>
<td>00000000</td>
<td>00000000</td>
<td>0059</td>
<td>00000000</td>
<td>Down Stopping</td>
</tr>
</tbody>
</table>

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found

4 TCP/IP(s) for CS V2R10 found

Analysis of Tcp/Ip for TCPSVT. Index: 1

TCP/IP Socket Analysis

<table>
<thead>
<tr>
<th>SCB</th>
<th>CID</th>
<th>Protocol</th>
<th>SockOpts</th>
<th>ScbFlags</th>
<th>ResrcNm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000000112D42120</td>
<td>00000008</td>
<td>RAW</td>
<td>00000000</td>
<td>00280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D422A0</td>
<td>0000000B</td>
<td>UDP</td>
<td>00000000</td>
<td>00280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D42420</td>
<td>0000000C</td>
<td>TCP</td>
<td>00020000</td>
<td>C0280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D425A0</td>
<td>0000000E</td>
<td>UDP</td>
<td>00000000</td>
<td>00280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D42720</td>
<td>0000000F</td>
<td>TCP</td>
<td>00000000</td>
<td>B0280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D428A0</td>
<td>00000010</td>
<td>TCP</td>
<td>00020000</td>
<td>90280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D42A0</td>
<td>00000011</td>
<td>UDP</td>
<td>00000000</td>
<td>00280000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D42B20</td>
<td>00000013</td>
<td>TCP</td>
<td>00400000</td>
<td>C0000000</td>
<td>TCPSVT</td>
</tr>
<tr>
<td>0000000112D42D20</td>
<td>00000014</td>
<td>UDP</td>
<td>00000000</td>
<td>80280000</td>
<td>PORTMAP</td>
</tr>
<tr>
<td>0000000112D43020</td>
<td>00000015</td>
<td>TCP</td>
<td>00000000</td>
<td>C0280000</td>
<td>PORTMAP</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

79 Socket control blocks were found
79 Socket control blocks were formatted

Analysis of Tcp/Ip for TCPSVT completed

TCP/IPCS STATE

Use this subcommand to provide an overall view of TCP/IP. The following information is displayed:

- Major control block addresses
- Subtasks
- Storage usage
- Dispatchable units
- Trace
- Configuration
Syntax

TCPIPCS STATE

Parameters

ALL
Display all state information. ALL is the default.

CONFIG
Display only configuration state information.

DUCB
Display only DUCB state information.

SNMP
Display only SNMP and CONFIG information. (SNMP information makes sense only in the context of the configuration, so the configuration information is also displayed.)

TRACE
Display only trace state information.

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Rule: If you specify multiple keywords from the set {ALL, CONFIG, DUCB, SNMP, TRACE}, all of the keywords that you specify are used.

Sample output of the TCPIPCS STATE subcommand

The following is sample output of the TCPIPCS STATE subcommand:

Dataset: IPCS.X370812.TRAK0006.STEP2B.DUMP
Title: TRAK0006 STEP1

The address of the TSAB is: 15137000

<table>
<thead>
<tr>
<th>Tseb</th>
<th>SI Procedure Version Tsdb</th>
<th>Tsdx</th>
<th>Asid</th>
<th>TraceOpts</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>15137040</td>
<td>TCPCS</td>
<td>V1R8</td>
<td>14F5A000</td>
<td>14F5A0C8</td>
<td>0030 9FFF767F 00000000</td>
</tr>
</tbody>
</table>

1 defined TCP/IP(s) were found
1 active TCP/IP(s) were found
1 TCP/IP(s) for CS V1R8 found

Analysis of Tcp/Ip for TCPCS. Index: 1
TCPIP State

TCPIP Status:
Procedure:     TCPCS
Version:       V1R8
Status:        Active
Asid:          0030
Started:       2005/08/24 16:21:15
Ended:         2005/08/24 16:38:29
Active:        00:17:13.628105 hours

Major Control Blocks
TSEB:          15137040       TSDB:          14F5A000
TSDX:          14F5A0CB       TCA:           15A5941B
ITCVF:         14F5A39B       ITSTOR:        14F5A608
DUAf:          14F561B8       MRCB:          7F41D0F0
MTCB:          15C602F8       MUCB:          7F3F30F0
IPMAIN:        14E6739B       Streams_root:  7F5DAD10
TosMains:      15AA3C48       M1BZ:         15A5925B
CdB:           15D92260       User:          15DA6000
Conf:          15A56A9B       Stks:          15D981A0
IPMAIN6:       15AA384B

IPCS subcommands for TCP/IP 215
**Device Interface: 7F50C410**

**Device:** LOOPBACK  
**Devtype:** LOOPBACK  
**State:** Active

**Address:** **** ****

**Physical Interface: 7F50A230**

**Name:** LOOPBACK  
**Protocol:** LOOPBACK  
**State:** Active

**NetNum:** 0  
**QueSize:** 0  
**Bytein:** 13,554  
**Byteout:** 13,554

**Index:** 2

**Bsd Routing Parameters:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTU Size</td>
<td>65535</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>0.0.0.0</td>
</tr>
<tr>
<td>Dest Addr</td>
<td>0.0.0.0</td>
</tr>
</tbody>
</table>

**SNMP Input Counters:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octets</td>
<td>13,554</td>
</tr>
<tr>
<td>Non Unicast</td>
<td>214</td>
</tr>
<tr>
<td>Discarded</td>
<td>0</td>
</tr>
<tr>
<td>Error</td>
<td>0</td>
</tr>
<tr>
<td>Broadcast</td>
<td>0</td>
</tr>
</tbody>
</table>

**SNMP Output Counters:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octets</td>
<td>13,554</td>
</tr>
<tr>
<td>Non Unicast</td>
<td>214</td>
</tr>
<tr>
<td>Discarded</td>
<td>0</td>
</tr>
<tr>
<td>Error</td>
<td>0</td>
</tr>
<tr>
<td>Broadcast</td>
<td>0</td>
</tr>
</tbody>
</table>

**IPv4 Search Patricia tree**

**Address:** 7F55CF10

**Search Ptree Reader Count:** 0

**Route:** 7F50C270

**Name:** LOOPBACK  
**Type:** Host  
**State:** Active

**Subnet Mask:** 255.255.255.255  
**Addr:** 127.0.0.1

**Protocol:** Configuration  
**Gate:** 0.0.0.0

**IPv6 Search Patricia tree**

**Address:** 7F55C370

**Search Ptree Reader Count:** 0

**Logical Interface: 7F55C110**

**Name:** LOOPBACK  
**Protocol:** LOOPBACK  
**State:** Active

**Subnet Mask:** 255.255.255.255  
**Addr:** 127.0.0.1

**Mtu Size:** 65535

**Physical Interface: 7F3E2510**

**Name:** LOOPBACK6  
**Protocol:** LOOPBACK6  
**State:** Active

**NetNum:** 0  
**QueSize:** 0  
**Bytein:** 0  
**Byteout:** 0

**Index:** 3

**Bsd Routing Parameters:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTU Size</td>
<td>65535</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>0.0.0.0</td>
</tr>
<tr>
<td>Dest Addr</td>
<td>0.0.0.0</td>
</tr>
</tbody>
</table>

**SNMP Input Counters:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octets</td>
<td>0</td>
</tr>
<tr>
<td>Non Unicast</td>
<td>0</td>
</tr>
<tr>
<td>Discarded</td>
<td>0</td>
</tr>
<tr>
<td>Error</td>
<td>0</td>
</tr>
<tr>
<td>Broadcast</td>
<td>0</td>
</tr>
</tbody>
</table>

**SNMP Output Counters:**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octets</td>
<td>0</td>
</tr>
<tr>
<td>Non Unicast</td>
<td>0</td>
</tr>
<tr>
<td>Discarded</td>
<td>0</td>
</tr>
<tr>
<td>Error</td>
<td>0</td>
</tr>
<tr>
<td>Broadcast</td>
<td>0</td>
</tr>
</tbody>
</table>

**IPv4 Search Patricia tree**

**Address:** 7F55CF10

**Search Ptree Reader Count:** 0

**IPv6 Search Patricia tree**

**Address:** 7F55C370

**Search Ptree Reader Count:** 0

**Route:** 7F3B4730

**Name:** LOOPBACK6  
**Type:** Host  
**State:** Active

**Subnet Prefix:** 128  
**Addr:** ::1

**Protocol:** Configuration  
**Gate:** ::0
Logical Interface: 7F3B4A90
Name: LOOPBACK6 Protocol: LOOPBACK6 State: Active
Subnet Prefix: 128 Addr: ::1
Mtu Size: 65535

Device Interface: 7F271410
Device: VIPA16 Devtype: VIRTual State: Active
Address: **** ****

Physical Interface: 7F3E2D10
Name: VIPA16 Protocol: VIRTUAL6 State: Active
NetNum: 0 QueSize: 0 Bytein: 0 Byteout: 0
Index: 5
Bsd Routing Parameters:
MtuSize: 0 Metric: 0
SubnetMask: 0.0.0.0 DestAddr: 0.0.0.0
SNMP Input Counters:
Octets: 0 Unicast: 0
NonUnicast: 0 Discarded: 0
Error: 0 Unk Type: 0
Broadcast: 0 Multicast: 0
SNMP Output Counters:
Octets: 0 Unicast: 0
NonUnicast: 0 Discarded: 0
Error: 0 Queue Len: 0
Broadcast: 0 Multicast: 0

IPv4 Search Patricia tree Address: 7F55CF10
Search Ptree Reader Count: 0
IPv6 Search Patricia tree Address: 7F55C370
Search Ptree Reader Count: 0
Route: 7F3D32B0
Name: VIPA16 Type: Host State: Active
Protocol : Configuration Gate: ::0
Mtu Size: 65535 Ref Cnt: 0 Tos: 0
Metric1: 0 Metric2: -1
Metric3: -1 Metric4: -1
Metric5: -1 Age: 2005/08/24 20:21:23

Logical Interface: 7F2791A8
Name: VIPA16 Protocol: VIRTUAL6 State: Active
Subnet Prefix: 0 Addr: 50c9:c2d4::a:9:42:130:161
Mtu Size: 65535

Device Interface: 7F26F410
Device: IUTSAMEH Devtype: MPCPTP State: Setup
Address: **** ****
SAP:
UserID: 10010000 TransId: 00010140 ProviderId: 00010148
Data@: 85B99378 ReqSignal@: 85B99378 RspSignal@: 85B99378
State: Unknown Retry: 0 Restart: 0 Xstatus: 0

Physical Interface: 7F3E3110
Name: IUTSAMEH6 Protocol: MPCPTP6 State: Inactive
NetNum: 0 QueSize: 0 Bytein: 0 Byteout: 0
Index: 7
Bsd Routing Parameters:
MtuSize: 0 Metric: 0
SubnetMask: 0.0.0.0 DestAddr: 0.0.3.232
SNMP Input Counters:
Octets: 0 Unicast: 0
NonUnicast: 0 Discarded: 0
Error: 0 Unk Type: 0
Broadcast: 0 Multicast: 0
SNMP Output Counters:
Octets: 0 Unicast: 0
NonUnicast: 0 Discarded: 0
Error: 0 Queue Len: 0
Broadcast: 0 Multicast: 0
IPv4 Search Patricia tree     Address: 7F55CF10
Search Ptree Reader Count: 0

IPv6 Search Patricia tree     Address: 7F55C370
Search Ptree Reader Count: 0

Route: 7F2697F0
Name: IUTSAMEH6     Type: Host     State: Inactive
Subnet Prefix: 128     Addr: fe80::b47d:2e3f:c8c2:9117
Protocol : Configuration     Gate: ::0
MtU Size: 65535     Ref Cnt: 0     Tos: 0
Metric1: 0     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/24 20:21:23

Route: 7F3D64A8
Name: IUTSAMEH6     Type: Host     State: Inactive
Subnet Prefix: 128     Addr: fec0::42:105:75:161
Protocol : Configuration     Gate: ::0
MtU Size: 65535     Ref Cnt: 0     Tos: 0
Metric1: 0     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/24 20:21:23

Logical Interface: 7F269AD0
Name: IUTSAMEH6     Protocol: MPCPTP6     State: Inactive
Subnet Prefix: 128     Addr: fe80::b47d:2e3f:c8c2:9117
MtU Size: 65535

Logical Interface: 7F27A100
Name: IUTSAMEH6     Protocol: MPCPTP6     State: Inactive
Subnet Prefix: 0     Addr: fec0::42:105:75:161
MtU Size: 65535

Device Interface: 7F26E410
Device: OSAQDIO2     Devtype: MPCIPA     State: Active
Address: **** ****
SAP:
UserID: 10020000     TransId: 00010141     ProviderId: 00010145
Data@: 94EE174C     ReqSignal@: 85B99378     RspSignal@: 85B99378
State: Unknown     Retry: 0     Restart: 0     Xstatus: 0
Connection 2:
UserID: 00000000     ProviderId: 90020001
Data@: 00000000     ReqSignal@: 00000000     RspSignal@: 00000000
State: Reset     linknum: 00     flags 00

Physical Interface: 7F3E3510
Name: OSAQDIO26     Protocol: IPAQENET6     State: Active
NetNum: 0     QueSize: 0     Bytein: 1,008     Byteout: 1,304
Index: 9
Bsd Routing Parameters:
MtU Size: 0     Metric: 0
SubnetMask: 0.0.0.0     DestAddr: 0.0.0.0.232

SNMP Input Counters:
Octets: 1,008     Unicast: 0
NonUnicast: 0     Discarded: 0
Error: 0     Unkn Type: 0
Broadcast: 0     Multicast: 6

SNMP Output Counters:
Octets: 1,304     Unicast: 3
NonUnicast: 0     Discarded: 0
Error: 0     Queue Len: 0
Broadcast: 0     Multicast: 10

IPv4 Search Patricia tree     Address: 7F55CF10
Search Ptree Reader Count: 0

IPv6 Search Patricia tree     Address: 7F55C370
Search Ptree Reader Count: 0

Route: 7F24D270
Name: OSAQDIO26     Type: Host     State: Active
Subnet Prefix: 128     Addr: fe80::9:6b00:f71a:422
Protocol : Configuration     Gate: ::0
MtU Size: 9000     Ref Cnt: 0     Tos: 0
Metric1: 0     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/24 20:21:23
Route: 7F1C2090  
Name: OSAQDIO26  Type: Host  State: Active  
Protocol : Configuration  Gate: ::0  
Mtu Size: 9000  Ref Cnt: 0  Tos: 0  
Metric1: 0  Metric2: -1  
Metric3: -1  Metric4: -1  
Metric5: -1  Age: 2005/08/24 20:21:27  

Route: 7F1D0BB0  
Name: OSAQDIO26  Type: Direct  State: Active  
Subnet Prefix: 64  Addr: 50c9:c2d4::1:0:0:0:0  
Protocol : ICMP  Gate: ::0  
Mtu Size: 9000  Ref Cnt: 0  Tos: 0  
Metric1: 0  Metric2: -1  
Metric3: -1  Metric4: -1  
Metric5: -1  Age: 2005/08/24 20:21:25  

Route: 7F1D0830  
Name: OSAQDIO26  Type: Direct  State: Active  
Subnet Prefix: 64  Addr: 50c9:c2d4::1a:0:0:0:0  
Protocol : ICMP  Gate: ::0  
Mtu Size: 9000  Ref Cnt: 0  Tos: 0  
Metric1: 0  Metric2: -1  
Metric3: -1  Metric4: -1  
Metric5: -1  Age: 2005/08/24 20:21:25  

Logical Interface: 7F24D550  
Name: OSAQDIO26  Protocol: IPAQENET6  State: Active  
Subnet Prefix: 128  Addr: fe80::9:6b00:f71a:422  
Mtu Size: 9000  

Logical Interface: 7F3B4190  
Name: OSAQDIO26  Protocol: IPAQENET6  State: Active  
Subnet Prefix: 0  Addr: 50c9:c2d4::1a:0:0:0:0  
Mtu Size: 9000  

Device Interface: 7F26DA10  
Device: OSAQDIO4  Devtype: MPCIPA  State: Active  
Address: **** ****  
SAP:  
UserID: 10030000  TransId: 00010142  ProviderId: 00010146  
Data@: 94EE174C  ReqSignal@: 85B99378  RspSignal@: 85B99378  
State: Unknown  Retry: 0  Restart: 0  Xstatus: 0  
Connection 2:  
UserID: 00000000  ProviderId: 90030001  
Data@: 00000000  RspSignal@: 00000000  
State: Reset  linknum: 00  flags 00  
Physical Interface: 7F3E3910  
Name: OSAQDIO46  Protocol: IPAQENET6  State: Active  
NetNum: 0  QueSize: 0  Bytein: 3,120  Byteout: 1,444  
Index: 11  
Bsd Routing Parameters:  
MtuSize: 0  SubnetMask: 0.0.0.0  DestAddr: 0.0.3.232  
SNMP Input Counters:  
Octets: 3,120  Unicast: 2  
NonUnicast: 0  Discarded: 0  
Error: 0  Unkn Type: 0  
Broadcast: 0  Multicast: 19  
SNMP Output Counters:  
Octets: 1,444  Unicast: 4  
NonUnicast: 0  Discarded: 0  
Error: 0  Queue Len: 0  
Broadcast: 0  Multicast: 10  

IPv4 Search Patricia tree  Address: 7F55CF10  
Search Ptree Reader Count: 0  

IPv6 Search Patricia tree  Address: 7F55C370  
Search Ptree Reader Count: 0  

Route: 7F2214E8  
Name: OSAQDIO46  Type: Host  State: Active  
Subnet Prefix: 128  Addr: fe80::9:6b01:f1a:684  
Protocol : Configuration  Gate: ::0  
Mtu Size: 1500  Ref Cnt: 0  Tos: 0  
Metric1: 0  Metric2: -1  
Metric3: -1  Metric4: -1
Metric5: -1            Age: 2005/08/24 20:21:24
Route: 7F1C7A10       Name: OSAQDIO46       Type: Host          State: Active
Protocol : Configuration Gate: ::0        Mtu Size: 1500 Ref Cnt: 0 Tos: 0
Metric1: 0            Metric2: -1
Metric3: -1            Metric4: -1
Metric5: -1            Age: 2005/08/24 20:21:29
Route: 7F3D3730       Name: OSAQDIO46       Type: Direct         State: Active
Subnet Prefix: 64     Addr: 50c9:c2d4::0
Protocol : Configuration Gate: ::0        Mtu Size: 1492 Ref Cnt: 0 Tos: 0
Metric1: 0            Metric2: -1
Metric3: -1            Metric4: -1
Metric5: -1            Age: 2005/08/24 20:21:23
Route: 7F1C7870       Name: OSAQDIO46       Type: Direct         State: Active
Subnet Prefix: 64     Addr: 50c9:c2d4::a:0:0:0:0
Protocol : ICMP        Gate: ::0        Mtu Size: 1500 Ref Cnt: 0 Tos: 0
Metric1: 0            Metric2: -1
Metric3: -1            Metric4: -1
Metric5: -1            Age: 2005/08/24 20:21:29
Route: 7F3D3590       Name: OSAQDIO46       Type: Default        State: Active
Subnet Prefix: 0      Addr: ::0
Protocol : Configuration Gate: 50c9:c2d4::206:2aff:fe71:4400
Mtu Size: 1492 Ref Cnt: 0 Tos: 0
Metric1: 1            Metric2: -1
Metric3: -1            Metric4: -1
Metric5: -1            Age: 2005/08/24 20:21:23
Logical Interface: 7F2217C8
Name: OSAQDIO46       Protocol: IPAQENET6        State: Active
Subnet Prefix: 128    Addr: fe80::9:6b01:f1a:684
Mtu Size: 1500
Logical Interface: 7F3B4050
Name: OSAQDIO46       Protocol: IPAQENET6        State: Active
Mtu Size: 1500
Device Interface: 7F26C410
Device: OSAQDIO7       Devtype: MPCIPA         State: Active
Address: **** ****     SAP:
UserID: 10040000     TransId: 00010143  ProviderId: 00010147
Data@: 94EE174C   ReqSignal@: 85B99378  RspSignal@: 85B99378
State: Unknown        Retry:    0  Restart:    0  Xstatus: 0
Connection 2:
UserID: 00000000 ProviderId: 90040001
Data@: 00000000  ReqSignal@: 00000000  RspSignal@: 00000000
State: Reset        linknum: 00 flags 00
Physical Interface: 7F3E3D10
Name: OSAQDIO76       Protocol: IPAQENET6        State: Active
NetNum: 0  QueSize: 0 Bytein: 3,120  Byteout: 1,430
Index: 13
Bsd Routing Parameters:
MtuSize: 0        Metric: 0         DestAddr: 0.0.3.232
SubnetMask: 0.0.0.0
SNMP Input Counters:
Octets: 3,120  Unicast: 3
NonUnicast: 0  Discarded: 0
Error: 0  Unkn Type: 0
Broadcast: 0  Multicast: 18
SNMP Output Counters:
Octets: 1,430  Unicast: 3
NonUnicast: 0  Discarded: 0
Error: 0  Queue Len: 0
Broadcast: 0  Multicast: 11
IPv4 Search Patricia tree Address: 7F55CF10
IPv6 LAN Group Summary

<table>
<thead>
<tr>
<th>LanGroup</th>
<th>IntfName</th>
<th>IntfStatus</th>
<th>NDOwner</th>
<th>VipaOwner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OSAQDI076</td>
<td>Active</td>
<td>OSAQDI076</td>
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</tr>
<tr>
<td></td>
<td>OSAQDI046</td>
<td>Active</td>
<td>OSAQDI046</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>OSAQDI026</td>
<td>Active</td>
<td>OSAQDI026</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Analysis of Tcp/IP for TCPCS completed

Dataset: IPCS.X370812.TRK0004.STEP2.DUMP
Title: TRAK0004 BEFORE

The address of the TSAB is: 1524C000

Tseb  SI Procedure Version Tsdb  Tsdx  Asid TraceOpts  Status
1524C040 1 TCPCS  V1R8  1500E000 1500E0C8 0030 9FFF767F 00000000  Active

1 defined TCP/IP(s) were found
1 active TCP/IP(s) were found
1 TCP/IP(s) for CS  V1R8  found

==============================================================================

Analysis of Tcp/IP for TCPCS.  Index: 1

IPCS subcommands for TCP/IP  221
TCPIP State

TCPIP Status:
Procedure: TCPCS
Version: V1R8
Status: Active
Asid: 0030
Ended: 2005/08/23 15:01:12
Active: 01:11:47.721301 hours

Major Control Blocks
TSEB: 1524C040
TSDB: 1500E000
TSDX: 1500E0C8
ITCVT: 1506E098
ITSTOR: 1506E098
DUAF: 1506D010
MRCB: 7F44F0F0
MTCB: 15BB53C8
MUCB: 7F4250F0
IPMAIN: 15BB53C8
Streams_root: 7F604D10
TosMains: 15BB53C8
User: 47EC2000
Conf: 15BB53C8

TCPIP Subtasks
Task Tcb FirstRB EotECB StopEcb CmpCode RsnCode RTWA
EZBTCPIP 008FF2A0 008FF218 808FD2C8 00000000 00000000 00000000
EPWPITSK 008E4E88 008DC110 00000000 00000000 00000000 00000000
EZBITTUB 008E4BF8 008E34A8 00000000 00000000 00000000 00000000
EZACDMSM 008E4B58 008FF4A8 00000000 00000000 00000000 00000000
EZBIPSUB 008E49C0 008EB608 00000000 00000000 00000000 00000000
EZBIEOER 008E4720 008E4698 008FF218 00000000 940C4000 00000004 00000000
EZBTLMST 008EB470 008E43E0 00000000 00000000 00000000 00000000
EZACFMMN 008E41E8 008E4160 00000000 00000000 00000000 00000000
EZBTZMST 008EB470 008E43E0 00000000 00000000 00000000 00000000
EZBTTSSL 008DCD90 008DCD08 00000000 00000000 00000000 00000000
EZBTMCTL 008DC8E8 008DC858 00000000 00000000 00000000 00000000
EZACFalG 008DEE88 008DEE88 00000000 00000000 00000000 00000000
EZASASUB 008DEE88 008DEE88 00000000 00000000 00000000 00000000

Storage Cache Information
Total CSA Allocated: 7,763,656
Tcp/ip CSA Limit: 2,147M
Total CSA Elements: 47
Cache Delay: 300 seconds
Scan Delay: 120 seconds
Total cache allocated: 91,760
Total cache elements: 9
Total freed elements: 0
Last cache scan time: 2005/08/23 18:59:41

CSM Status
ECSA Storage: OK
Data Space Storage: OK
Fixed Storage: OK
Alet: 01FF6014 Dspname: CSM64001
Alet: 00000000 Dspname: ..........

Dispatchable Unit Status
DUCB Initializations: 64,057
DUCB Expansions: 3,684
Percent DUCB expansions: 5%
Last DUCB scan time: 2005/08/23 19:00:44
1 DUAT control block(s) were found in the DUAF at 1506D010
124 Dispatchable units were found.
No DUs indicate abend.

CTrace Status:
Member Name : CTEZBN0
Buffer Size : 4,194,304
Options : Init Opcmds Opmgs Socket AFP XCF Access PFS
API Engine Queue RAW UDP TCP ICMP ARP CLAW
LCS Internet Message WorkUnit Config SNMP
IOCTL FireWall VtamData TelnVtam Telnet Vtam
Asid List : ()
JobNameList : ()
PortList : ()
IpAddrList : ()
Xwriter : Disconnected
Dwriter : Disconnected
Trace Count : 409,675
Lost Count   : 2
Lost Time    : 2005/08/23 17:49:25
Wrap Count   : 35
Wrap Time    : 2005/08/23 18:59:56

==============================================================================
Device Interface: 7F607410
  Device: LOOPBACK   Devtype: LOOPBACK   State: Active
  Address: **** ****

  Physical Interface: 7F604230
     Name: LOOPBACK   Protocol: LOOPBACK   State: Active
     NetNum: 0  QueSize: 0  Bytein: 43,385  Byteout: 43,385
     Index: 2
     Bsd Routing Parameters:
       SubnetMask: 0.0.0.0  DestAddr: 0.0.0.0
       SNMP Input Counters:
         Octets: 43,385  Unicast: 0
         NonUnicast: 0  Discarded: 0
         Error: 0  Unkn Type: 0
         Broadcast: 0  Multicast: 0
       SNMP Output Counters:
         Octets: 43,385  Unicast: 0
         NonUnicast: 0  Discarded: 0
         Error: 0  Queue Len: 0
         Broadcast: 0  Multicast: 0

IPv4 Search Patricia tree  Address: 7F58EF70
Search Ptree Reader Count: 0
  Route: 7F607270
    Name: LOOPBACK   Type: Host   State: Active
    Subnet Mask: 255.255.255.255  Addr: 127.0.0.1
    Protocol : Configuration  Gate: 0.0.0.0
    Mtu Size: 65535  Ref Cnt: 5  Tos: 0
    Metric1: 0  Metric2: -1
    Metric3: -1  Metric4: -1
    Metric5: -1  Age: 2005/08/23 17:49:28

Logical Interface: 7F58E110
  Name: LOOPBACK   Protocol: LOOPBACK   State: Active
  Subnet Mask: 255.255.255.255  Addr: 127.0.0.1
  Mtu Size: 65535

==============================================================================
Device Interface: 7F3DF410
  Device: IUTSAMEH   Devtype: MPCPTP   State: Setup
  Address: **** ****

  Physical Interface: 7F414510
     Name: LSAMEH     Protocol: MPCPTP     State: Inactive
     NetNum: 0  QueSize: 0  Bytein: 0  Byteout: 0
     Index: 4
     Bsd Routing Parameters:
       MtuSize: 576  Metric: 0
       SubnetMask: 255.0.0.0  DestAddr: 0.0.0.0
     SNMP Input Counters:
       Octets: 0  Unicast: 0
       NonUnicast: 0  Discarded: 0
       Error: 0  Unkn Type: 0
       Broadcast: 0  Multicast: 0
     SNMP Output Counters:
       Octets: 0  Unicast: 0
       NonUnicast: 0  Discarded: 0
       Error: 0  Queue Len: 0
       Broadcast: 0  Multicast: 0

IPv4 Search Patricia tree  Address: 7F58EF70
Search Ptree Reader Count: 0
  Route: 7F4082E8
    Name: LSAMEH     Type: Host     State: Inactive
    Subnet Mask: 255.255.255.255  Addr: 10.1.0.161
Logical Interface: 7F3DF090
Name: LSAMEH                Protocol: MPCPTP        State: Inactive
Subnet Mask: 255.255.255.255  Addr: 10.1.0.161
Mtu Size: 65535

==============================================================================

Device Interface: 7F3D0410
Device: OSAQDI02                Devtype: MPCIPA        State: Active
Address: **** ****
SAP:
UserID: 30040000       TransId: 00010145    ProviderId: 00010147
Data@: 9500474C       ReqSignal@: 83BED5E0    RspSignal@: 83BED5E0
State: Unknown       Retry: 0       Restart: 0     Xstatus: 0
Connection 2:
UserID: 000000000    ProviderId: 90040001
Data@: 00000000       ReqSignal@: 00000000    RspSignal@: 00000000
State: Reset       linnum: 0       flags 00

Physical Interface: 7F414010
Name: LOSAQDIO2                Protocol: IPAQENET      State: Active
NetNum: 0          QueSize: 0   Bytein: 297,780    Byteout: 32,736
Index: 6
Bsd Routing Parameters:
MtuSize: 576    Metric: 1
SubnetMask: 255.255.255.128  DestAddr: 0.0.0.0
SNMP Input Counters:
Octets: 297,780    Unicast: 6
NonUnicast: 0    Discarded: 0
Error: 0     Unkn Type: 0
Broadcast: 66    Multicast: 2,027

SNMP Output Counters:
Octets: 32,736    Unicast: 10
NonUnicast: 0    Discarded: 0
Error: 0     Queue Len: 0
Broadcast: 0    Multicast: 218

IPv4 Search Patricia tree     Address: 7F58EF70
Search Ptree Reader Count: 0

Route: 7F66ECDO
Name: L05AQDI02                Type: Host         State: Active
Subnet Mask: 255.255.255.128  Addr: 9.42.130.173
Protocol : OSPF          Gate: 9.42.105.139
Mtu Size: 576    Ref Cnt: 0    Tos: 0
Metric1: 2       Metric2: -1
Metric3: -1      Metric4: -1
Metric5: -1      Age: 2005/08/23 18:31:15

Route: 7F66E999
Name: L05AQDI02                Type: Host         State: Active
Subnet Mask: 255.255.255.128  Addr: 9.42.130.134
Protocol : OSPF          Gate: 9.42.105.158
Mtu Size: 576    Ref Cnt: 0    Tos: 0
Metric1: 2       Metric2: -1
Metric3: -1      Metric4: -1
Metric5: -1      Age: 2005/08/23 18:31:15

Route: 7F66E778
Name: L05AQDI02                Type: Host         State: Active
Subnet Mask: 255.255.255.128  Addr: 9.42.130.172
Protocol : OSPF          Gate: 9.42.105.139
Mtu Size: 576    Ref Cnt: 0    Tos: 0
Metric1: 2       Metric2: -1
Metric3: -1      Metric4: -1
Metric5: -1      Age: 2005/08/23 18:31:15

Route: 7F66E7F0
Name: L05AQDI02                Type: Host         State: Active
Subnet Mask: 255.255.255.128  Addr: 9.42.130.85
Protocol : OSPF          Gate: 9.42.105.136
Mtu Size: 576    Ref Cnt: 0    Tos: 0
Metric1: 2       Metric2: -1
Metric3: -1      Metric4: -1
Metric5: -1      Age: 2005/08/23 18:31:15

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Logical Interface: 7F3E71A8
Name: LOSAQDIO2 Protocol: IPAQENET State: Active
Subnet Mask: 255.255.255.255 Addr: 9.42.105.153
Mtu Size: 8992

==============================================================================
Device Interface: 7F3DC410
Device: OSAQDIO4 Devtype: MPCIPA State: Active
Address: **** ****
SAP:
UserID: 10020000 TransId: 00010131 ProviderId: 00010134
Data@: 9500474C ReqSignal@: 83BED5E0 RspSignal@: 83BED5E0
State: Unknown Retry: 0 Restart: 0 Xstatus: 0
Connection 2:
UserID: 00000000 ProviderId: 90020001
Data@: 00000000 ReqSignal@: 00000000 RspSignal@: 00000000
State: Reset linknum: 00 flags 00

Physical Interface: 7F414D10
Name: LOSAQDIO4 Protocol: IPAQENET State: Active
NetNum: 0 QueSize: 0 Bytein: 2,990 Byteout: 924
Index: 8
Bsd Routing Parameters:
MtuSize: 576 Metric: 1
SubnetMask: 255.255.255.128 DestAddr: 0.0.0.0
SNMP Input Counters:
Octets: 2,990 Unicast: 1
NonUnicast: 0 Discarded: 0
Error: 0 Unkn Type: 0
Broadcast: 11 Multicast: 0
SNMP Output Counters:
Octets: 924 Unicast: 3
NonUnicast: 0 Discarded: 0
Error: 0 Queue Len: 0
Broadcast: 0 Multicast: 0

IPv4 Search Patricia tree Address: 7F58EF70
Search Ptree Reader Count: 0

Route: 7F334E70
Name: LOSAQDIO4 Type: Host State: Active
Subnet Mask: 255.255.255.255 Addr: 9.42.130.117
Protocol: OSPF Protocol: OSPF
Mtu Size: 576 Ref Cnt: 0 Tos: 0
Metric1: 2 Metric2: -1
Metric3: -1 Metric4: -1
Metric5: -1 Age: 2005/08/23 18:16:51

Route: 7F3D7170
Name: LOSAQDIO4 Type: Host State: Active
Subnet Mask: 255.255.255.255 Addr: 9.42.130.47
Protocol: OSPF Protocol: OSPF
Mtu Size: 576 Ref Cnt: 0 Tos: 0
Metric1: 3 Metric2: -1
Metric3: -1 Metric4: -1
Metric5: -1 Age: 2005/08/23 18:16:51

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<table>
<thead>
<tr>
<th>Route: 7F338290</th>
<th>Name: LOSAQDIO4</th>
<th>Type: Host</th>
<th>State: Active</th>
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</thead>
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<tr>
<td>Subnet Mask: 255.255.255.255</td>
<td>Addr: 9.42.130.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol: OSPF</td>
<td>Gate: 9.42.105.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 3</td>
<td>Metric2: -1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
<td></td>
<td></td>
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<thead>
<tr>
<th>Route: 7F338DD0</th>
<th>Name: LOSAQDIO4</th>
<th>Type: Subnetwork</th>
<th>State: Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subnet Mask: 255.255.255.252</td>
<td>Addr: 9.42.130.8</td>
<td></td>
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<tr>
<td>Protocol: OSPF</td>
<td>Gate: 9.42.105.65</td>
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<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
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<tr>
<td>Metric1: 3</td>
<td>Metric2: -1</td>
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<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
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<tbody>
<tr>
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<td>Addr: 9.42.130.48</td>
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<tr>
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<td>Gate: 9.42.105.65</td>
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<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
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<tr>
<td>Metric1: 3</td>
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</tr>
<tr>
<td>Metric3: -1</td>
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<td>Age: 2005/08/23 18:16:51</td>
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<th>Type: Subnetwork</th>
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<tr>
<td>Protocol: OSPF</td>
<td>Gate: 9.42.105.65</td>
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<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 3</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
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<tr>
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<th>Name: LOSAQDIO4</th>
<th>Type: Host</th>
<th>State: Active</th>
</tr>
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<tbody>
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<td>Addr: 9.42.130.12</td>
<td></td>
<td></td>
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<tr>
<td>Protocol: OSPF</td>
<td>Gate: 9.42.105.65</td>
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<td></td>
</tr>
<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 3</td>
<td>Metric2: -1</td>
<td></td>
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<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
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<td></td>
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<tr>
<td>Metric5: -1</td>
<td>Age: 2005/08/23 18:16:51</td>
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<th>Type: Subnetwork</th>
<th>State: Active</th>
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<td>Subnet Mask: 255.255.255.252</td>
<td>Addr: 9.42.130.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol: OSPF</td>
<td>Gate: 9.42.105.65</td>
<td></td>
<td></td>
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<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 3</td>
<td>Metric2: -1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
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<thead>
<tr>
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<th>Name: LOSAQDIO4</th>
<th>Type: Host</th>
<th>State: Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subnet Mask: 255.255.255.255</td>
<td>Addr: 9.42.105.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol: Configuration</td>
<td>Gate: 0.0.0.0</td>
<td></td>
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<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 0</td>
<td>Metric2: -1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
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<table>
<thead>
<tr>
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<th>Name: LOSAQDIO4</th>
<th>Type: Direct</th>
<th>State: Active</th>
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<tbody>
<tr>
<td>Subnet Mask: 255.255.255.128</td>
<td>Addr: 9.42.105.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol: OSPF</td>
<td>Gate: 0.0.0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 1</td>
<td>Metric2: -1</td>
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<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
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<td>Age: 2005/08/23 18:16:51</td>
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<thead>
<tr>
<th>Route: 7F329AD0</th>
<th>Name: LOSAQDIO4</th>
<th>Type: Host</th>
<th>State: Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subnet Mask: 255.255.255.255</td>
<td>Addr: 9.42.104.188</td>
<td></td>
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<tr>
<td>Protocol: OSPF</td>
<td>Gate: 9.42.105.65</td>
<td></td>
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</tr>
<tr>
<td>Mtu Size: 576</td>
<td>Ref Cnt: 0</td>
<td>Tos: 0</td>
<td></td>
</tr>
<tr>
<td>Metric1: 1</td>
<td>Metric2: -1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric3: -1</td>
<td>Metric4: -1</td>
<td></td>
<td></td>
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<tr>
<td>Metric5: -1</td>
<td>Age: 2005/08/23 18:16:52</td>
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</tbody>
</table>
Route: 7F329450
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.189
Protocol : OSPF     Gate: 9.42.105.65
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F3227B0
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.186
Protocol : OSPF     Gate: 9.42.105.63
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F32A150
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.185
Protocol : OSPF     Gate: 9.42.105.65
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F322950
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.187
Protocol : OSPF     Gate: 9.42.105.65
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F32A930
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.180
Protocol : OSPF     Gate: 9.42.105.63
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F32B930
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.176
Protocol : OSPF     Gate: 9.42.105.65
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F32C290
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.168
Protocol : OSPF     Gate: 9.42.105.126
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52

Route: 7F32BE70
Name: LOSAQDIO4     Type: Host     State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.169
Protocol : OSPF     Gate: 9.42.105.65
Mtu Size: 576     Ref Cnt: 0     Tos: 0
Metric1: 1     Metric2: -1
Metric3: -1     Metric4: -1
Metric5: -1     Age: 2005/08/23 18:16:52
IPC$ subcommands for TCP/IP
Route: 7F32DE70
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.157
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F32EE70
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.154
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F32F4F0
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.152
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F32E9F0
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.155
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F32FE70
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.150
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F3224D0
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.149
Protocol: OSPF  Gate: 9.42.105.126
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F330190
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.146
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F33F9F0
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.151
Protocol: OSPF  Gate: 9.42.105.65
Mtu Size: 576  Ref Cnt: 0  Tos: 0
Metric1: 1  Metric2: -1
Metric3: -1  Metric4: -1
Metric5: -1  Age: 2005/08/23 18:16:52

Route: 7F33C990
Name: LOSAQDIO4  Type: Host  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.104.142
addr: 9.42.105.75  flags: C0  ttldlt: 0
retries: 0

Logical Interface: 7F3E7068
Name: LOSAQDIO4  Protocol: IPAQENET  State: Active
Subnet Mask: 255.255.255.255  Addr: 9.42.105.75
Mtu Size: 1492
==============================================================================
Device Interface: 7F30B410
  Device: OSAQDIO7  Devtype: MPCIPA  State: Active
  Address: **** ****
  SAP:
    UserID: 10030000  TransId: 00010132  ProviderId: 00010135
  Data: 950E047C  ReqSignal@: 83BED5E0  RspSignal@: 83BED5E0
  State: Unknown  Retry: 0 Restart: 0  Xstatus: 0
  Connection 2:
    UserID: 00000000  ProviderId: 90030001
    Data: 00000000  ReqSignal@: 00000000  RspSignal@: 00000000
    State: Reset  linknum: 00 flags 00

Physical Interface: 7F415110
  Name: LOSAQDIO7  Protocol: IPAQENET  State: Active
  NetNum: 0  QueSize: 0  Bytein: 583,077  Byteout: 76,876
  Index: 10
  Bsd Routing Parameters:
    MtuSize: 576
    SubnetMask: 255.255.255.128  DestAddr: 0.0.0.0
  SNMP Input Counters:
    Octets: 583,077  Unicast: 36
    NonUnicast: 0  Discarded: 0
    Error: 0  Unkn Type: 0
    Broadcast: 10  Multicast: 4,121
  SNMP Output Counters:
    Octets: 76,876  Unicast: 38
    NonUnicast: 0  Discarded: 0
    Error: 0  Queue Len: 0
    Broadcast: 0  Multicast: 482
IPv4 Search Patricia tree
  Address: 7F558EF70
  Metric5: -1
  Age: 2005/08/23 18:16:52

Address Translate Entry: 7F337030
  addr: 9.42.105.85  flags: C0  ttlldlt: 0
  retries: 0

Logical Interface: 7F3E8100
  Name: LOSAQDIO7  Protocol: IPAQENET  State: Active
  Subnet Mask: 255.255.255.255  Addr: 9.42.105.85
  Mtu Size: 1492

IPv4 LAN Group Summary
  LanGroup: 1  7F3DABD0
    LnkName  LnkStatus  ArpOwner  VipaOwner
    ------------  --------  -------  -------
    LOSAQDIO4    Active    LOSAQDIO4  Yes
    LOSAQDIO7    Active    LOSAQDIO7  No
  LanGroup: 2  7F320B90
    LnkName  LnkStatus  ArpOwner  VipaOwner
    ------------  --------  -------  -------
    LOSAQDIO2    Active    LOSAQDIO2  Yes

Analysis of Tcp/Ip for TCPCS completed

TCPIPCS STORAGE

Use this subcommand to display the TCP/IP storage summary referenced in common cached storage.

Under the heading Storage Summary, a "c" in column "c" indicates the address is on the cache queue. A "p" in column "p" indicates that the control block is part of a pool.

Cache storage has 12 bytes from offset four overlaid with a chain pointer and time stamp. This might show incorrect data for cached control blocks.

Tip: The TCPIPCS STORAGE command only reports storage found in caches in common storage. Use the TCPIPCS MAP command to report both common and TCP/IP private storage usage.
Syntax

```
TCPAPCS STORAGE

* (variable_item (variable_list))

TCP (tcp_proc_name (tcp_index))

ALL CACHE CSA CSM

TITLE NOTITLE
```

Parameters

**ALL**
Display information about all allocated storage.

**CACHE**
Display only information about cached storage.

**CSA**
Display only information about in-use CSA storage.

**CSM**
Display only information about in-use CSM storage.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**variable_item**
Any one of the following variable parameters.

**variable_list**
You can repeat from 1-32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

**storage_address**
Formats the storage headers for the TCPIP storage element at address storage_address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a-f or A-F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

When a hexadecimal address is specified as **variable_item** (or more than one address is specified as **variable_list**) the timestamp, module name, and an indication of whether the storage is allocated or freed, will be formatted.

**Rule:** If you specify multiple keywords from the set {ALL,CACHE,CSA,CSM}, all of the keywords that you specify are used.

When a BLS18100I message indicating an access failure appears in the report, any counts or analysis dependent on this information cannot be included in the TCPIPCS STORAGE output. Also, an access
failure can occur as a result of insufficient user region size. If a BLS18100I message is received for data that is included in the dump, increase the user region size and attempt the TCPIPCS STORAGE subcommand again.

**Sample output of the TCPIPCS STORAGE subcommand**

The following is sample output of the TCPIPCS STORAGE subcommand:

```
TCPIPCS STORAGE
Dataset: IPCS.A594094.DUMPM
Title:   TCPSVT   V2R10: Job(TCPSVT ) EZBITSTO(HTCP50A 99.281)+
        00077A  S4C5/74BE2500 SRB P=0051,S=0051,H=0051

TCIPP Storage Analysis

Storage Statistics
  cache_delay                  0 seconds before cache is freed
  com_totstor                 177,578,656 total storage for CSA elements
  scan_delay                   120 seconds between full scans
  stor_cache                   48,416 storage in cache after scan
  scan_time                  1999/10/24 04:06:12 time of last scan
  dsa_init                    10,375,262 # of DUCB initializations
  dsa_exp                     2,180,028 # of DUCB expansions

The control block at 008AC010 (Prev: 00000000) has already been added
... The control block at 12A26410 (Prev: 00000000) has already been added

21,907 storage elements found
177,228K bytes of storage allocated

Cached Storage
Addr       Size Key Sp Cblk Time Stamp         Index
Common non-fetch protected storage
12E6DCB0    304  6 241 CFGM B30A8EDF19BD18C3  10
12774310   3056  6 241 CFGM B30A8E3DBB1943  10 Index was 29
The control block at 0E289010 (prev: 0E289010) was not available
Unable to locate storage at 0E289010
Cache pointers are in a loop at 12774310 for index 29
The control block at 0E289010 (prev: 0E289010) was not available
Unable to locate storage at 0E289010
2 control blocks found for Common non-fetch protected storage
3376 bytes allocated in Common non-fetch
4366931 total allocations

Addr    Size Key Sp  Time Stamp (GMT)  Alloc Common PoolAddr  Module          Type
7F10A110  1264  6 249 2007/08/22 12:56:03  Y     N    7F10A010 959D13D6 private, non-fetch protected
7F115010  1264  6 249 2007/08/22 12:56:41  Y     N    7F10A010 959D13D6 private, non-fetch protected
7F112310  1264  6 249 2007/08/22 13:52:11  Y     N    7F10A010 959D13D6 private, non-fetch protected
7F10CE10  1264  6 249 2007/08/22 12:58:15 Y N    7F10A010 959D13D6 private, non-fetch protected
7F10C910  1264  6 249 2007/08/22 12:58:15 Y N    7F10A010 959D13D6 private, non-fetch protected

... Storage Summary Statistics

          All    Cache
Type    Count Size       Count Size
Common Non-fetch protected   21460 177489K   2   3392
Common Fetch protected     369   68488   141   36936
Common persistent    3  192   3  192
Common SCB pool        80  21128   32  8448
Private Non-fetch protected  492  395848  156  65192
Total       22571 178149K  334 114160

22599 blocks of storage for 1807728 bytes were obtained to create this report
Analysis of Tcp/Ip for TCPSVT completed

TCPIPCS STREAM

Use this subcommand to display the stream control blocks.
Syntax

TCP/IPCS STREAM

Parameters

If no parameters are specified, all stream control blocks are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

variable_item

Any one of the following variable parameters.

variable_list

You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

CB_address

An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string. Displays only the Stream control block associated with one of the following:

SKCB Stream context control block address.

SKQI Stream queue initialization control block address.

SKQP Stream queue pair control block address.

SKQU Stream Queue control block address.

SKSC Stream access control control block address.

SKSH Stream header control block address.

connection_id

Displays the Stream control block with this connection ID. A connection ID is specified as 1-8 hexadecimal digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:
SUMMARY
Formats the Stream control blocks in one cross-reference table. SUMMARY is the default.

DETAIL
In addition to the SUMMARY display, DETAIL formats the contents of the Stream control blocks.

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Rule: If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS STREAM subcommand

The following is a sample output of the TCPIPCS STREAM subcommand:

TCPIPCS STREAM
Dataset: IPCS.A594094.DUMPM
Title: TCPSTV V2R10: Job(TCPSVT) EZBITST0(HTCP50A 99.281)+
       00077A S4C5/74E2500 SRB P=0051,S=0051,H=0051
The address of the TSAB is: 12E89BB8
Tseb SI Procedure Version Tsdb Tsdx Asid TraceOpts Status
12E89BF8 1 TCPSTV V2R10 12B57000 12B570C8 0051 9FFFFF7F Active
   1 defined TCP/IP(s) were found
   1 active TCP/IP(s) were found
   1 TCP/IP(s) for CS V2R10 found

Analysis of Tcp/Ip for TCPSVT. Index: 1
TCPIP Stream Analysis
SKRT at 7F78BD88
Sksc@ Sksh@ CID Driver Api@ Skcb@ Ascb@ Tcb@
7F77E6C8 7F77E7C8 00000000 IP/NAM 00000000 00000000 00000000 00000000
7F78F088 7F61A088 00000000 RAW 00000000 00000000 00000000 00000000
7F78F148 7F61A608 00000000 IP/NAM 00000000 00000000 00000000 00000000
7F78F348 7F61A608 00000000 UDP 00000000 00000000 00000000 00000000
7F78F148 7F61A608 00000000 IP/NAM 00000000 00000000 00000000 00000000
7F88B0E8 7F7580E8 00000000 TCP 00000000 00000000 00000000 00000000
7F78BCC8 7F78B748 00000000 IP/NAM 00000000 00000000 00000000 00000000

7 Stream(s) found
7 Stream(s) formatted

Analysis of Tcp/Ip for TCPSVT completed

TCPIPCS TCB
Use this subcommand to display the Master Transmission Control Block (MTCB) and any Transmission protocol Control Blocks (TCBs) that are defined in the TCP hash table.
Syntax

```
TCPIPCS — TCB —
```

Parameters

If no parameters are specified, all TCP control blocks are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

**jobname**

Displays only the TCBs with this job name. The job name can be a TCP/IP application name or a stack name. A job name is 1–8 alphanumeric characters.

**TCB_address**

Displays only the TCB with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**connection_id**

Displays the TCB with this connection ID. A connection ID is specified as 1-8 hexadecimal digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:

**DATAQ**

Formats TCBs which have data queued on the SEND or RECEIVE queue.

**SUMMARY**

Formats the MTCB contents and lists all the TCBs in one cross-reference table. SUMMARY is the default.

**DETAIL**

In addition to the SUMMARY display, DETAIL formats the contents of the TCBs.

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.
Sample output of the TCPIPCS TCB subcommand

The following is sample output of the TCPIPCS TCB subcommand:

```
TCPIPCS TCB
Dataset: IPCS.MV21372.DUMPA
Title: SLIP DUMP ID=TC

The address of the TSAB is: 13180120

Tseb   SI Procedure Version Tsd  Tsdx  Asid TraceOpts Status
13180160 1 TCPSVT     V2R10  13C9F000 13C9F0CB 07D3 94FF755F Active

1 defined TCP/IP(s) were found
1 active TCP/IP(s) were found
1 TCP/IP(s) for CS V2R10 found

Analysis of Tcp/Ip for TCPSVT. Index: 1

TCP/IP Analysis
TCP/IP Main TCP Control Block (MTCB)
MTCB: 13C9E800
+0000  _M_MAIN_EYE........... TCP MAIN
+0008  _M_TCP_LWRITE_Q...... 7F782368
+000C  _M_TCP_LREAD_Q...... 7F782328
+0014  _M_TCP_DRIVER_STATE. 01
+0018  _MTCPMTX............ 00000000 00000000 00000000 D7D60601
+0028  _MTCPAQMX........... 00000000 00000000 00000000 D7D6064
+0038  _MTCB_LIST_LOCK..... 00000000 00000000 00000000 D7D6064
+0048  _M_PORT_CEILING..... 00000FFF
+004C  _M_TPI_SEQ#......... 00000000
+0050  _M_PORT_ARRAY....... 7F711FC8
+0054  _M_LAST_PORT_NUM.... 0000040C
...

TCB  ResrcID  ResrcNm  TcpState  TpiState  Local IPAddr/Port  Remote IPAddr/Port  LuName  ApplName  UserID
7F603108 00000002 TCPSVT  Closed  WLOUNBND  0.0.0.0..0  0.0.0.0..0
7F605008 0000000A TCPSVT  Listening  WLOIDLE  0.0.0.0..625  0.0.0.0..0
7F607108 0000000E TCPSVT  Established  WLOXFER  127.0.0.1..1029  127.0.0.1..1028
7F6A9508 0000000E TCPSVT  Listening  WLOIDLE  0.0.0.0..623  0.0.0.0..0
25 TCB(s) FOUND
25 TCB(s) FORMATTED

Analysis of Tcp/Ip for TCPSVT completed
```

TCPIPCS TELNET

Use this subcommand to display either the address, or address and contents, of Telnet control blocks. These include the following:

- TCMA
- TCFG
- TPDB
- Optionally, the TKCB and CVB for a selected session
- A partial TCFG that is being built is also displayed (if found)
Syntax

TCP/IPCS — TELNET —

Parameters

If no parameters are specified, all TCP control blocks are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

variable_item

Any one of the following variable parameters.

variable_list

You can repeat from 1 – 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

LUname Displays only the session control blocks for the 8-character logical unit name. If the name is less than eight characters, it is padded on the right with blanks.

CVB_address Displays only the CVB with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a-f or A-F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

token Displays only the session control blocks for the token. The token is a 16-digit hexadecimal value. If the token is less than 16 digits, it is padded on the left with hex zeros.

In addition to the variable parameters described above, you can specify the following keyword parameters:

All Display Telnet connection and XCF information.

Conn Display only Telnet connection information.

DETAIL Displays the contents of the control blocks.

SUMMARY Displays the address of the control blocks. SUMMARY is the default.

TCP, TITLE, NOTITLE

See “Parameters” on page 169 for a description of these parameters.
**Xcf**
Display only XCF information.

**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPCS TELNET subcommand**
The following is sample output of the TCPIPCS TELNET subcommand:

```
TCPIPCS TELNET
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC

The address of the TSAB is: 13391BC0
Tseb     SI Procedure Version Tsdb     Tsdx     Asid TraceOpts Status
13391C00  1 TCPSVT    V2R10   1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2   V2R10   00000000 00000000 07E8 00000000 Down Stopping
13391D00  3 TCPSVT1   V2R10   12FC3000 12FC30C8 0080 94FF755F Active
13391D80  4 TCPSVT3   V2R10   00000000 00000000 0059 00000000 Down Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found

================================================================================
Analysis of Tcp/Ip for TCPSVT.  Index: 1
TCPIP Telnet Analysis
TMCA at 7F5B1188
Tpdb@     Port Tcfg@    Prof Tkcb@    Token             Cvb@     LUname
7F59D8A0   623 7F5A6068 CURR 00000000 00000000 00000000 00000000
7F59D4E0   625 7F59D628 CURR 00000000 00000000 00000000 00000000

Analysis of Tcp/Ip for TCPSVT completed
```

**TCPIPCS TIMER**
Use this subcommand to display the timer control blocks.

**Syntax**

```
```

**Parameters**

**SUMMARY**
Displays the contents of the timer control blocks. The timer queue elements (TQEs) and timer IDs (TIDs) are presented in tabular form. SUMMARY is the default.

**DETAIL**
The timer control blocks are displayed as in the SUMMARY form of the command. In addition, each TQE and each TID is fully displayed.
TCP, TITLE, NOTITLE

See “Parameters” on page 169 for a description of these parameters.

Rule: If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS TIMER subcommand

The following is sample output of the TCPIPCS TIMER subcommand:

```
TCPIPCS TIMER
Dataset: IPCS.A594094.DUMPF
Title: CHECK NOT ADDR

The address of the TSAB is: 08CE28C0
Tseb  SI Procedure Version Tsdh  Tsdx  Asid TraceOpts Status
08CE2900 1 TCPCS  V2R10  086D8000 086D80C8 01F8 10000100  Active
  1 defined TCP/IP(s) were found
  1 active TCP/IP(s) were found
  1 TCP/IP(s) for CS  V2R10 found

Analysis of Tcp/Ip for TCPCS. Index: 1

Timer tables at 08608F80
ItTmr  Pass  Slot  Delta  Max  PopCount  Array@
08608F80  64  62   100  12800   8253 08609000

Global TQE Queue for Slot 63:
Tqe  Tid  Ecb  Mod  Parm  Msec  TqeFlag  TidFlag
08E00D58 08E00D44 00000000 EZBIFIU2 08E00D40  100   00    20
  1 TQE(s) for slot 63 with 0 msec timer offset

ItTmr  Pass  Slot  Delta  Max  PopCount  Array@
08608F40  6  58  1000  128000   825 08609400

ItTmr  Pass  Slot  Delta  Max  PopCount  Array@
08608F00  0  83 10000 1280000   82 08609800

Global TQE Queue for Slot 109:
Tqe  Tid  Ecb  Ascb  Asid  Msec  TqeFlags  TidFLags
16DEF310 166E8D68 166E8CE8 00F8E500 001A0000 300000  40    20000000
  1 TQE(s) for slot 109 with 138000 msec timer offset

Global TQE Queue for Slot 122:
Tqe  Tid  Ecb  Mod  Parm  Msec  TqeFlag  TidFlag
086C9020 7F4CEBD0 7F4CEBCC 00000000 00000000 1200000  44    20
  1 TQE(s) for slot 122 with 128000 msec timer offset

ItTmr  Pass  Slot  Delta  Max  PopCount  Array@
08608F40  0  9 108000 4294967295  8 08609C00

2 TQE(s) were found

No cancelled TQE(s) were found

Analysis of Tcp/Ip for TCPCS completed
```

TCPIPCS TRACE

Use this subcommand to display information about the component trace, the real-time TCP/IP network monitoring NMI, and the real-time application-controlled TCP/IP trace NMI functions.
Syntax

```
TCP (tcp_proc_name tcp_index)
```

Parameters

**SUMMARY**
Displays summary information for each function. SUMMARY is the default value. When used with the RCC parameter, the output is similar to the DISPLAY TCPIP,,TRACE,DETAIL command. For more information about this command and its output, see DISPLAY TCPIP,,TRACE command in z/OS Communications Server: IP System Administrator's Commands.

**DETAIL**
When used with the ALL parameter, lists detailed information about each function in addition to the SUMMARY information. When used with the RCC parameter, displays detailed information about the function.

**CTE**
Formats each CTE header in each CTRACE buffer. DETAIL must also be specified.

**ALL**
Formats all the information for all functions.

**RCC**
Formats only information about the real-time application-controlled TCP/IP trace network management interface (NMI). For more information about this NMI, see Real-time application-controlled TCP/IP trace NMI in z/OS Communications Server: IP Programmer's Guide and Reference.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

Rules:

- If you specify multiple keywords from the set {ALL, RCC}, all of the keywords that you specify are used.
- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.
- If you specify CTE, then DETAIL must also be specified.

Sample output of the TCPIPCS TRACE subcommand

```
The following is sample output of the TCPIPCS TRACE subcommand:

TCPIPCS TRACE
Dataset: IPCS.R8A0723.RASDUMP2
Title: EZRPE005

The address of the TSAB is: 09C445D0
Tseb   SI Procedure Version Tsdb   Tsdx   Asid TraceOpts Status
09C44610  1 TCPCS   V1R5   093C1000 093C10C8 0029 9FFF7E7F  Active
09C44690  2 TCPCS2  V1R5   00000000 00000000 002A 00000000  Down Stopping

2 defined TCP/IP(s) were found
1 active TCP/IP(s) were found
2 TCP/IP(s) for CS   V1R5  found
```
Analysis of Tcp/IP for TCPCS. Index: 1

Parmlib Member for SYSTCPIP Trace: CTIEZB00
Parmlib Member for SYSTCPIS Trace: CTIIDS00

Trace Control Area
TCA: 092BD410
+0000 TCAACRONYM........... TCA
+0006 TCAVERSION........... 0006
+0008 TCASIZE.............. 0000CBD0
+000C TCAFTBE.............. 092BD7E0
+0010 TACURRTBE............ 092BE5C8
+0014 TCACURRENT........... 0059C4C0
+0018 TCAUBFSZ............. 092BE5C8
+001C TCABOUTSZ........... 0000CBD0
+0020 TCANUMBF............. 00000100
+0024 TCABUFSZ............. 00000100
+0028 TCACURRTBE........... 092BE5C8
+002C TCACURRENT........... 0059C4C0
+0030 TCAACNT............. 0000
+0034 TCALCNT............. 00000000
+0038 TCAFILTER_USERID.... 0000
+0040 TCAFILTER_PORT...... 0000
+0044 TCAFILTER_USERID.... 0000
+0048 TCAFILTER_USERID.... 0000
+004C TCAFILTER_USERID.... 0000
+0050 TCAFILTER_USERID.... 0000
+0054 TCAFILTER_USERID.... 0000
+0058 TCAFILTER_USERID.... 0000
+005C TCAFILTER_USERID.... 0000
+0060 TCAFILTER_USERID.... 0000
+0064 TCAFILTER_USERID.... 0000
+0068 TCAFILTER_USERID.... 0000
+006C TCAFILTER_USERID.... 0000
+0070 TCAFILTER_USERID.... 0000
+0074 TCAFILTER_USERID.... 0000
+0078 TCAFILTER_USERID.... 0000
+007C TCAFILTER_USERID.... 0000
+0080 TCAFILTER_USERID.... 0000
+0084 TCAFILTER_USERID.... 0000
+0088 TCAFILTER_USERID.... 0000
+008C TCAFILTER_USERID.... 0000
+0090 TCAFILTER_USERID.... 0000
+0094 TCAFILTER_USERID.... 0000
+0098 TCAFILTER_USERID.... 0000
+009C TCAFILTER_USERID.... 0000
+00A0 TCAFILTER_USERID.... 0000
+00A4 TCAFILTER_USERID.... 0000
+00A8 TCAFILTER_USERID.... 0000
+00AC TCAFILTER_USERID.... 0000
+00B0 TCAFILTER_USERID.... 0000
+00B4 TCAFILTER_USERID.... 0000
+00B8 TCAFILTER_USERID.... 0000
+00BC TCAFILTER_USERID.... 0000
+00C0 TCAFILTER_USERID.... 0000
+00C4 TCAFILTER_USERID.... 0000
+00C8 TCAFILTER_USERID.... 0000
+00CC TCAFILTER_USERID.... 0000
+00DC TCAFILTER_USERID.... 0000
+00E0 TCAFILTER_USERID.... 0000
+00E4 TCAFILTER_USERID.... 0000
+00EC TCAFILTER_USERID.... 0000
+00F0 TCAFILTER_USERID.... 0000
+00F4 TCAFILTER_USERID.... 0000
+0100 TCACNT............... 00000000
+0104 TCAFILTER_PORT..... 0000
+0108 TCAFILTER_PORT..... 0000
+010C TCAFILTER_PORT..... 0000
+0110 TCAFILTER_PORT..... 0000

-- End of array --

-- Array elements --
+0000 TCAFILTER_PORT..... 0000
+0004 TCAFILTER_PORT..... 0000
+0008 TCAFILTER_PORT..... 0000
+000C TCAFILTER_PORT..... 0000
+0010 TCAFILTER_PORT..... 0000
+0014 TCAFILTER_PORT..... 0000
+0018 TCAFILTER_PORT..... 0000
+0020 TCAFILTER_PORT..... 0000
+0024 TCAFILTER_PORT..... 0000
+0028 TCAFILTER_PORT..... 0000
+0030 TCAFILTER_PORT..... 0000
+0034 TCAFILTER_PORT..... 0000
+0038 TCAFILTER_PORT..... 0000
+0040 TCAFILTER_PORT..... 0000
+0044 TCAFILTER_PORT..... 0000
+0048 TCAFILTER_PORT..... 0000
+0050 TCAFILTER_PORT..... 0000
+0054 TCAFILTER_PORT..... 0000
+0058 TCAFILTER_PORT..... 0000
+0060 TCAFILTER_PORT..... 0000
+0064 TCAFILTER_PORT..... 0000
+0068 TCAFILTER_PORT..... 0000
+0070 TCAFILTER_PORT..... 0000
+0074 TCAFILTER_PORT..... 0000
+0078 TCAFILTER_PORT..... 0000
+0080 TCAFILTER_PORT..... 0000
+0084 TCAFILTER_PORT..... 0000
+0088 TCAFILTER_PORT..... 0000
+0090 TCAFILTER_PORT..... 0000
+0094 TCAFILTER_PORT..... 0000
+0098 TCAFILTER_PORT..... 0000
+00A0 TCAFILTER_PORT..... 0000
+00A4 TCAFILTER_PORT..... 0000
+00A8 TCAFILTER_PORT..... 0000
+00B0 TCAFILTER_PORT..... 0000
+00B4 TCAFILTER_PORT..... 0000
+00B8 TCAFILTER_PORT..... 0000
+00BC TCAFILTER_PORT..... 0000
+00C0 TCAFILTER_PORT..... 0000
+00C4 TCAFILTER_PORT..... 0000
+00CC TCAFILTER_PORT..... 0000
+00DC TCAFILTER_PORT..... 0000
+00E0 TCAFILTER_PORT..... 0000
+00E4 TCAFILTER_PORT..... 0000
+00EC TCAFILTER_PORT..... 0000
+00F0 TCAFILTER_PORT..... 0000
+00F4 TCAFILTER_PORT..... 0000

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```
+0112  TCAFILTER_PORT......  0000
+0114  TCAFILTER_PORT......  0000
+0116  TCAFILTER_PORT......  0000
+0118  TCAFILTER_PORT......  0000
+011A  TCAFILTER_PORT......  0000
+011C  TCAFILTER_PORT......  0000
+011E  TCAFILTER_PORT......  0000
+0120  TCAFILTER_PORT......  0000
+0122  TCAFILTER_PORT......  0000
-- End of array --

+0124  TCAICNT.............  00000000

-- Array elements --
+0128  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0138  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0148  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0158  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0168  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0178  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0188  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0198  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0208  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0218  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0228  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0238  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0248  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0258  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0268  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0278  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0288  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0298  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+02A8  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+02B8  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+02C8  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+02D8  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+02E8  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+02F8  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
+0308  TCAFILTER_IPADDRESS.  00000000  00000000  00000000  00000000
+0318  TCAFILTER_IPSUBMASK.  00000000  00000000  00000000  00000000
-- End of array --

+0330  TCAWRAPTIME........ B6479D0  DE1B3402
+0338  TCAWRAPCOUNT........  00000001
+0340  TCAXWTRCNT..........  00000000
+0344  TCACURCUR...........  092BFFE0
+0348  TCANXTCUR...........  01004E80
+034C  TCADATSZ............  02000000
+0350  TCADATBF............  00000200
+0354  TCAWCONT............  00000068
+0358  TCATRCNT............  00000068
+0360  TCALSCNT............  00000000
+0364  TCASEQXWRT..........  00000000
+0368  TCAIWXRTQWN........  00000000  00000000
+036C  TCAISTBE............  092C4FE0
+0370  TCAISNRTBE..........  092C4FE0
+0374  TCAISBUFSZ..........  00010000
+0378  TCAISLSCNT..........  00000000
+037C  TCAISRQCNT..........  00000000
+0380  TCAISXWSEQ..........  00000000
+0384  TCAISCDTBE..........  092C4FE0
+0388  TCAISCDBUF..........  03001000
+0390  TCAISXWTKN..........  00000000  00000000
+0394  TCAISXWRTIM..........  00000000  00000000
+0398  TCAISXSTIM..........  00000000  00000000
+039C  TCADUMPSZ...........  00000000
+03A0  TCADUMPDOS.........  00000000
+03A4  TCADUMPOF..........  00000000
```

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Event Trace Statistics for SYSTCPIP

- Size of the Trace Control Area: 52176
- Size of the trace buffer: 16384K
- Size of a trace segment: 64K
- Number of trace segments: 256
- Maximum trace record size: 14,336
- Number of trace records requested: 16,643
- Number of trace records recorded: 16,643
- Number of trace segments filled: 89
- Average records per segment: 187
- Average records per table: 47,872
- Trace status: Active
- XWriter status: Disconnected
- Number of buffers written: 0
- Lost record count: 0
- Lost record time: 1900/01/01 00:00:00.000000
- Trace table wrap count: 1
- Trace table wrap time: 2001/09/05 12:41:47.461043
- Average records per wrap: 16,643

Data Trace Statistics for SYSTCPDA

- Size of the trace buffer: 32768K
- Size of a trace segment: 64K
- Number of trace segments: 512
- Number of trace records requested: 104
- Number of trace records recorded: 104
- Number of trace segments filled: 1
- Trace status: Active
- XWriter status: Connected
- Number of lost records: 0

IDSTRACE Statistics for SYSTCPIS

- Size of the trace buffer: 32768K
- Size of a trace segment: 64K
- Number of trace segments: 512
- Number of trace records requested: 0
- Number of trace records recorded: 0
- Number of trace segments filled: 1
- Trace status: Active
- XWriter status: Disconnected
- Number of lost records: 0
- Lost record time: 1900/01/01 00:00:00.000000
- Trace table wrap count: 0
- Trace table wrap time: 1900/01/01 00:00:00.000000

Tseb_Trace_Opts: 9FF7E7F

Options: Init Opcmds Opmsgs Socket AFP XCF Access PFS API
          Engine Streams Queue RAW UDP TCP ICMP ARPL CLAW LCS
          Internet Message WorkUnit Config SNMP IOCTL FireWall
          VtamData TelnetVtam Telnet Vtam

256 SYSTCPIP Trace Buffer Elements were found
0 SYSTCPIP Trace Buffer Elements were formatted
512 SYSTCPDA Trace Buffer Elements were found
0 SYSTCPDA Trace Buffer Elements were formatted
512 SYSTCPIS Trace Buffer Elements were found
0 SYSTCPIS Trace Buffer Elements were formatted

Analysis of Tcp/Ip for TCPCS completed

**TCP/IPCS TREE**

Use this subcommand to display the structure of TCP/IP Patricia trees.
Syntax

TCPIPCS → TREE →

ALL
ARP
IPSEC
IQDIO
ND
NETACC
NETACCV4
NETACCV6
POLICY
QDIOACCEL
ROUTE
ROUTEV4
ROUTEV6
TCP
TELNET
XCF

Parameters

ALL
Display structure of all TCP/IP trees. ALL is the default.

ARP
Display only structure of ARP trees.

IPSEC
Display only structure of IP security trees.

IQDIO
Display only structure of iQDIO and QDIOACCEL trees.

ND
Display only structure of Neighbor Discovery trees.

NETACC
Display only structure of NetAccess trees.

NETACCV4
Display only structure of IPv4 NetAccess trees.

NETACCV6
Display only structure of IPv6 NetAccess trees.

POLICY
Display only structure of Service Policy trees.
**QDIOACCEL**  
Display only structure of iQDIO and QDIOACCEL trees.

**ROUTE**  
Display only structure of both IPv4 and IPv6 route trees.

**ROUTEV4**  
Display only structure of IPv4 route trees.

**ROUTEV6**  
Display only structure of IPv6 route trees.

**TCP**  
Display only structure of TCP trees.

**TELNET**  
Display only structure of Telnet trees.

**XCF**  
Display only structure of XCF trees.

**HEADER**  
Display tree header information. Not displayed by default.

**SUMMARY**  
Display the addresses of the control blocks and other data in trees. SUMMARY is the default.

**DETAIL**  
In addition to the SUMMARY display, DETAIL also shows the search key values.

**BOTH**  
Display both active and logically deleted tree nodes. BOTH is the default.

**ACTIVE**  
Display only active tree nodes.

**DELETE**  
Display only logically deleted tree nodes.

**TCP, TITLE, NOTITLE**  
See “Parameters” on page 169 for a description of these parameters.

**Rules:**

- If you specify multiple keywords from the set {ALL, ARP, IPSEC, IQDIO, ND, NETACC, NETACCV4, NETACCV6, POLICY, QDIOACCEL, ROUTE, ROUTEV4, ROUTEV6, TCP, TELNET, XCF}, all of the keywords that you specify are used.

- If you specify multiple keywords from the set {BOTH, ACTIVE, DELETE}, only the last one is used.

- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPCS TREE subcommand**

The following is sample output of the TCPIPCS TREE subcommand:

```
TCPIP Tree Analysis
IPv4 NetAccess Search Tree

<table>
<thead>
<tr>
<th>Node@</th>
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<th>Parent</th>
<th>LChild</th>
<th>RChild</th>
<th>Key</th>
<th>Element</th>
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</thead>
<tbody>
<tr>
<td>2B42D678</td>
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<td>00000000</td>
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<td>7F04D6F0</td>
<td></td>
<td></td>
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<tr>
<td>7F04D230</td>
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</tr>
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</table>

11 elements in IPv4 NetAccess Search Tree
```
## IPv4 NetAccess Update Tree

<table>
<thead>
<tr>
<th>Node@</th>
<th>Bit Parent</th>
<th>LChild</th>
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<th>Key</th>
<th>Element</th>
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</thead>
<tbody>
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<td>2B21E818</td>
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<td>2B2066F8</td>
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<td>7F04C590</td>
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11 elements in IPv4 NetAccess Update Tree

## IPv6 NetAccess Search Tree

<table>
<thead>
<tr>
<th>Node@</th>
<th>Bit Parent</th>
<th>LChild</th>
<th>RChild</th>
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<th>Element</th>
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<td>2B1F4F58</td>
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<td>2B1F4F18</td>
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15 elements in IPv6 NetAccess Search Tree

## IPv6 NetAccess Update Tree

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<thead>
<tr>
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<th>Bit Parent</th>
<th>LChild</th>
<th>RChild</th>
<th>Key</th>
<th>Element</th>
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<tr>
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<td>2B1F4D18</td>
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</tr>
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<td>2B1F4F18</td>
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<td>7F0407F0</td>
<td>128</td>
<td>2B42D6D8</td>
<td>2B42D6D8</td>
<td>7F0407F0</td>
<td>2B1F4F28</td>
</tr>
</tbody>
</table>

15 elements in IPv6 NetAccess Update Tree

### TCPIPCS TSDB

Use this subcommand to display the TSDB server data block.
Syntax

TCPIPCS — TSDB

TCP ( tcp_proc_name tcp_index )

TITLE
NOTITLE

Parameters

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Sample output of the TCPIPCS TSDB subcommand

The following is sample output of the TCPIPCS TSDB subcommand:

```
TCPIPCS TSDB
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC

The address of the TSAB is: 13391BC0
Tseb SI Procedure Version Tsd Tsdx Asid TraceOpt Status
13391C00  1 TCPSVT  V2R10  1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2 V2R10  00000000 00000000 07E8 00000000 Down Stopping
13391000  3 TCPSVT1 V2R10  12FC3000 12FC30C8 0080 94FF755F Active
13391080  4 TCPSVT3 V2R10  00000000 00000000 059 00000000 Down Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found

TCPIPCS TSDB
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC
Tseb SI Procedure Version Tsd Tsdx Asid TraceOpt Status
13391C00  1 TCPSVT  V2R10  1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2 V2R10  00000000 00000000 07E8 00000000 Down Stopping
13391000  3 TCPSVT1 V2R10  12FC3000 12FC30C8 0080 94FF755F Active
13391080  4 TCPSVT3 V2R10  00000000 00000000 059 00000000 Down Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found

TCPIPCS TSDB
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC
Tseb SI Procedure Version Tsd Tsdx Asid TraceOpt Status
13391C00  1 TCPSVT  V2R10  1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2 V2R10  00000000 00000000 07E8 00000000 Down Stopping
13391000  3 TCPSVT1 V2R10  12FC3000 12FC30C8 0080 94FF755F Active
13391080  4 TCPSVT3 V2R10  00000000 00000000 059 00000000 Down Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found

TCPIPCS TSDB
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC
Tseb SI Procedure Version Tsd Tsdx Asid TraceOpt Status
13391C00  1 TCPSVT  V2R10  1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2 V2R10  00000000 00000000 07E8 00000000 Down Stopping
13391000  3 TCPSVT1 V2R10  12FC3000 12FC30C8 0080 94FF755F Active
13391080  4 TCPSVT3 V2R10  00000000 00000000 059 00000000 Down Stopping

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found

Analysis of Tcp/Ip for TCPSVT.  Index: 1

TCPIPCS TSDB
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC
Tseb SI Procedure Version Tsd Tsdx Asid TraceOpt Status
13391C00  1 TCPSVT  V2R10  1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2 V2R10  00000000 00000000 07E8 00000000 Down Stopping
13391000  3 TCPSVT1 V2R10  12FC3000 12FC30C8 0080 94FF755F Active
13391080  4 TCPSVT3 V2R10  00000000 00000000 059 00000000 Down Stopping

Analysis of Tcp/Ip for TCPSVT completed
```

Analysis of Tcp/Ip for TCPSVT completed
TCPIPCS TSDX

Use this subcommand to display the TSDX server data extension.

Syntax

```
TCPIPCS  TSDX
TCP ( tcp_proc_name )
```

Parameters

**TCP, TITLE, NOTITLE**

See “Parameters” on page 169 for a description of these parameters.

Sample output of the TCPIPCS TSDX subcommand

The following is sample output of the TCPIPCS TSDX subcommand:

```
TCPIPCS TSDX
Dataset: IPCS.MV21381.DUMPA
Title:    SLIP DUMP ID=TC

The address of the TSAB is: 13391BC0

<table>
<thead>
<tr>
<th>Tseb</th>
<th>SI Procedure Version</th>
<th>Tsd</th>
<th>Tsdx</th>
<th>Asid TraceOpts</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>13391C00</td>
<td>1 TCPSVT</td>
<td>V2R10</td>
<td>1323B000</td>
<td>1323B0C8</td>
<td>07DE 04041405</td>
</tr>
<tr>
<td>13391C80</td>
<td>2 TCPSVT2</td>
<td>V2R10</td>
<td>00000000</td>
<td>00000000</td>
<td>07E8 00000000</td>
</tr>
<tr>
<td>13391D00</td>
<td>3 TCPSVT1</td>
<td>V2R10</td>
<td>12FC3000</td>
<td>12FC30C8</td>
<td>0080 94FF755F</td>
</tr>
<tr>
<td>13391D80</td>
<td>4 TCPSVT3</td>
<td>V2R10</td>
<td>00000000</td>
<td>00000000</td>
<td>0059 00000000</td>
</tr>
</tbody>
</table>

4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found

Analysis of Tcp/IP for TCPSVT. Index: 1

TSDX control block summary

```
TSDX: 1323B0CB
+0000 TSDX_ACRONYM................ TSDX
+0004 TSDX_LENGTH................ 0300
+0008 TSDX_VERSION............... 0003
+000C TSDX_FLAGS................. 60000001
+0010 TSDX_ASCB.................. 00F7C280
+0018 TSDX_PROCNAME.............. TCPSVT
+0020 TSDX_CART.................. 00000001
+0024 TSDX_TCB................... 007EC9A8
+0028 TSDX_TCB_TOKEN............. 00001F78 00000008 00000003 007EC9A8
+0030 TSDX_TCP/IP_DS_ALET........ 01FF0011
+0034 TSDX_TCP/IP_DS_ADDR........ 00001000
+0040 TSDX_TCP/IP_DS_END.......... 19001000
+0044 TSDX_ET_TOKEN.............. 7FFD9D10

... +026C TSDX_CSMSTATAREA........... 141C7A88
+0270 TSDX_CSMSTDUMPINFO........ 141C7A90
+0288 TSDX_AUTOLOG_TASK_ECB...... 087EC758
+0296 TSDX_AUTOLOG_CB............ 1333C0A8
+029E TSDX_SAstrup_ECB............ 087EC758
+029E TSDX_XFCVT................. 13096410
+029E TSDX_XCFLOCK............... 00000000 00000000 00000000 D7D60901
```

Analysis of Tcp/IP for TCPSVT completed
TCPIPCS TSEB

Use this subcommand to display the TSEB server anchor block.

Syntax

```
TCPIPCS  TSEB
TCP  ( tcp_proc_name )
```

Parameters

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Sample output of the TCPIPCS TSEB subcommand

The following is sample output of the TCPIPCS TSEB subcommand:

```
TCPIPCS TSEB
Dataset: IPCS.MV21381.DUMPA
Title:   SLIP DUMP ID=TC
The address of the TSAB is: 13391BC0
Tseb   SI Procedure Version Tsdb   Tsdx   Asid TraceOpts Status
13391C00  1 TCPSVT   V2R10   1323B000 1323B0C8 07DE 04041405 Active
13391C80  2 TCPSVT2  V2R10   00000000 00000000 07E8 00000000 Down Stopping
13391000  3 TCPSVT1  V2R10   12FC3000 12FC30C8 0080 94FF755F Active
13391080  4 TCPSVT3  V2R10   00000000 00000000 0059 00000000 Down Stopping
4 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
4 TCP/IP(s) for CS V2R10 found
```

Analysis of Tcp/IP for TCPSVT. Index: 1

TSEB control block summary

```
TSEB: 13391C00
+0000  TSEB_ACRONYM.......... TSEB
+0004  TSEB_LENGTH........... 0080
+0006  TSEB_VERSION.......... 0003
+0008  TSEB_FLAGS............ 82000000
+0008  TSEB_STATUS........... 82
+000C  TSEB_REQUESTORS....... 00000000
+0010  TSEB_TCPIP_NAME....... TCPSVT
+0018  TSEB_SI............... 01
+0019  TSEB_IID.............. 04
+001A  TSEB_TCPIP_VERSION.... 0510
+001C  TSEB_TSDB........... 1323B000
+0020  TSEB_LX.............. 00000000
+0024  TSEB_TCA............. 11469E50
+0028  TSEB_TRACE_OPTS....... 04041405
+002C  TSEB_TRACE_OPT2....... 00000000
+0034  TSEB_SCHEDULED_EVENTS. 00000000
+0038  TSEB_ASID........... 07DE
+003C  TSEB_LPA_SADDR........ 11A719E0
+0040  TSEB_LPA_EADDR........ 11C62FFF
+0044  TSEB_QDIO_BGRP_Q@..... 1320A648
+0048  TSEB_EZBITDCR.......... 9320ACF8
+004C  TSEB_ITCVT............ 1323B3C8
+0050  TSEB_BGRP_Q@.......... 1320A608
+0054  TSEB_DUAF............. 130A4010
+0059  TSEB_TOKENID........... 000015
+005C  TSEB_TCMPTR.......... 132072F0
+0060  TSEB_EZBITCOM_LEN..... 00007D28
+0064  TSEB_CS390_VERSION.... 020A
```
TCPIPCS TTLS

Display information about Application Transparent Transport Layer Security (AT-TLS), AT-TLS groups, and AT-TLS connections.

**Syntax**

```
TCPIPCS TTLS
```

**Parameters**

If no parameters are specified, both AT-TLS connections and AT-TLS groups are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

From 1 - 32 of the following variable parameters can be repeated, each separated by a blank space, within parentheses:

Variable parameters are:

**TCB_address**

Displays AT-TLS information for the connection with this address. An address is specified as 1–8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**group_address**

Displays information for the AT-TLS group with this address. An address is specified as 1–8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**connection_id**

Displays AT-TLS information for the connection with this connection ID. An ID is specified as 1–8 hexadecimal digits.
In addition to the variable parameters described above, the following keyword parameters can be specified:

**CONN**
Display only information for AT-TLS connections.

**GROUP**
Display only information for AT-TLS groups.

**ALL**
Display information for both AT-TLS connections and groups. ALL is the default.

**SUMMARY**
Displays the addresses of the control blocks and other data in tables. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows the contents of the control blocks.

**TCP, TITLE, NOTITLE**
See “Parameters” on page 169 for a description of these parameters.

**Rules:**
- If you specify multiple keywords from the set {CONN, GROUP, ALL}, only the last one is used.
- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

### Sample output of the TCPIPCS TTLS subcommand

The following is sample output of the TCPIPCS TTLS subcommand:

```
TCPIPCS TTLS(* )
....
= Analysis of Tcp/IP for TCPCS4. Index: 2
TCP/IP Analysis
TCPIP Main TLS Control Block (EZBZTTLS)
EZBZTTLS: 7F1E16F6
+0000  TLS_ACRONYM .............. EZBZTTLS
+0004  TLS_PART_LOCK .......... 00000000 00000000 00000000 D227030A
+0008  LOCK_CDS ............... 00000000 00000000
+0008  LOCK_SUSPENDED_GLOBAL 00000000
+000C  LOCK_SUSPENDED_LOCAL 00000000
+0010  LOCK_INFO .............. D227030A
+0014  LOCK_INIT .............. D227
+0014  LOCK_INIT1 ............ D2
+0014  LOCK_INIT2 ............ 27
+0016  LOCK_CLASS ............ 03
+0017  LOCK_LEVEL ............ 0A
+0018  TLS_FLAG1 .............. E8000000
+001C  TLS_PIPIADD_CNT ....... 00
+0010  TLS_GRP_CNT ............ 0A
+0018  TLS_TCB_CMPC_OFF ...... 11
+001F  TLS_ABEND_COUNT ....... 00
+0020  TLS_1STABEND .......... 00000000
+0024  TLS_TCBPTR ............ 07061C8
+0028  TLS_RESNGR_TOKEN ....... 00000000 00000000
+0030  TLS_INBNDPART0 ...... 7E447310
+0034  TLS_OUTBDNPART0 ...... 7E447190
+0038  TLS_PCT_STATE .......... 0000000F
+003C  TLS_PCT_INSTANCEID .. 4E42929D
+0040  TLS_WORKQ .............. 00000000 00000000
+0044  ITLFPUBLIC .......... 00000000
+0044  ITLFPRIVATE .......... 00000000
+0044  ITLTF的成功 .......... 00000000
+0044  ITLTF成功 .......... 00000000
+0048  TLS_TERM_ECB .......... 807D6120
+004C  TLS_INIT_ECB .......... 00000000
+0050  TLS_EOT_ECB .......... 07FF180
+0054  TLS_WORKQ_ECB ...... 807D6120
+0058  TLS_CLEANUP_TIMER .. 00000000 00000000 00000000 00000000
+005C  TID_EYE ................. 000000
```
TID_BITS............... 00
TID_MSEC.............. 00000000
TID_CDS.............. 00000000 00000000
TID_FLAGS............. 00000000
TID_TQE.............. 00000000
TID_MODLIST........... 7F1E1184
TID_GROUPNUM........... 00000069
TID_TQE.............. 00000000
TTLS_MODLIST.......... 7F1E11B4
TTLS_GROUPNUM......... 00000069
TTLS_TGRP_HT_TOKEN... 7F54E070 00000004
TTLS_CLEANUP_ECB...... 00000000
TTLS_MAX_SRBS........ 00000005
TTLS_CURR_SRBS...... 00000000
TTLS_WE_CNT......... 00000000
TTLS_PIPI_ECB........ 807D6120
TTLS_PIPI_SUSPQ....... 00000000 00000000
TTLS_ENVNUM.......... 0000002C
TTLS_GLBLTHD......... 00000000
TTLS_SECOND_HT_TOKEN. 7F58B250 00000005
TTLS_MSGQ_CNT........ 00000002
TTLS_LATCH_SET_COUNT.. 00000006
TTLS_LATCH_QUEUE...... 7DE9C760 00000005

TTLS Secondary Map hashtable entries
Pri_TCB@ PID Local_IP..Remote_IP
7E7A1F10 0200006F ::ffff:10.81.4.4..::ffff:10.81.4.4
7E7A1F10 00000015D 7E308130 TLSv1.2 C02B USER11 USER1 7E328F18 .......
LocalSocket: 10.81.4.4..1046
RemoteSocket: 10.81.4.4..50500
Tcb_tcp_state: Established
Tcb_TtlsFlags:Ttls_Gate Ttls_Enabled Ttls_Started
TLSX_Flags_B3: v3Header Fast_Local
TLSX_Flags_B2: Check_Reset Data_Seen
TLSX_Flags_B1: LookUp_Done
TLSX_Flags_B5:
TTLSRule(7E3B1B90): ttls_ruleC
TTLSGroupAction(7E337D10): group_action2
TTLSEnvironmentAction(7E3AAF10): environment_action2
TTLSConnectionAction(7E3AB610): connection_action2

TTLS Group: group_action1
Address Group Id Conns Tasks Elements Created
7E305D70 63 2 4 0 2011/08/10 14:15:57

-----TTLS Environments----------------
TTLS Environment: environment_action1
Address Env Id Conns Rcode Env Type Idle Time(Valid for 0 Conns)
7E0FF9B0 1B 1 Master 1900/01/01 00:00:00

---- TTLS Worker Tasks----------------
TTLS Worker Task: 7E25DA50
Ducb FuncCode Rcode Busy Idle Time
14F3B000 15 0 0 2011/08/10 14:16:55
TTLS Worker Task: 7E262B90
Ducb FuncCode Rcode Busy Idle Time
14F3E000 3 0 0 2011/08/10 14:15:56
TTLS Worker Task: 7E25D890
Ducb FuncCode Rcode Busy Idle Time
1527E000 0 0 0 2011/08/10 14:15:56
TTLS Worker Task: 7E25D190
Ducb FuncCode Rcode Busy Idle Time
15296000 3 0 0 2011/08/10 14:15:56

----- TGRS Work Requests Formatted

**** Following in Reverse Order *****
TLWE@ Clock Function Parm1 Parm2 ExtLen
7E3D6C9A 14:17:15.810123 WRITE_SYSLOG 00000007 7E3D6CC8 0000007B 00000000
1 TGRP Log Requests Formatted
TCPIPCS UDP

Use this subcommand to display the Master UDP Control Block (MUCB) and any UDP Control Blocks (UCBs) in the UDP hash tables or link list.

Syntax

```
TCPIPCS — UDP —
```

Parameters

If no parameters are specified, all UDP control blocks are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**

Any one of the following variable parameters.

**variable_list**

You can repeat from 1–32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

**jobname**

Displays only the UDP control blocks with this job name. The job name can be a TCP/IP application name or a stack name. A job name is 1–8 alphanumeric characters.

**UCB_address**

Displays only the UDP control block with this address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**connection_id**

Displays the UDP control block with this connection ID. A connection ID is specified as 1–8 hexadecimal digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:

**DATAQ**

Formats UCBs which have data queued on the RECEIVE queue.
SUMMARY
Formats the MUCB contents and lists all the UDPs in one cross-reference table. SUMMARY is the default.

DETAIL
In addition to the SUMMARY display, DETAIL formats the contents of the UCBs.

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Rule: If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPICS UDP subcommand
The following is sample output of the TCPIPICS UDP subcommand:

TCPIPICS UDP
Dataset: IPCS.R8A0723.RASDUMP
Title: EZRPE005
The address of the TSAB is: 098221F0
Tseb SI Procedure Version Tsd Tsdx Asid TraceOpts Status
09822230 1 TCPCS VIR5 08E85000 08E85CB 061E 9FFF7E7F Active
098222B0 2 TCPCS2 VIR5 08937000 089370CB 01F6 9FFF7E7F Active
2 defined TCP/IP(s) were found
2 active TCP/IP(s) were found
2 TCP/IP(s) for CS VIR5 found
Analysis of Tcp/IP for TCPCS. Index: 1
User Datagram Protocol Control Block Summary
MUCB: 7F50B248
+0000 UMUCBEYE. MUCB USTKLNKD. 01 UDRVSTAT. 00
+0008 UMUCB6FLG........ 00010000
+0009 U6STKLNKD........ 01
+000B U6DRVSTAT........ 00
+000C UOPENPRT. 00000000 00000000 00000000 00000000
+0028 UDPCFG... 00000000 00000000 00000000 00000000
+0040 UDPCFG2.. 00000000 00000000 00000000 00000000
+0058 UDPMIB... 00000000 00000000 00000000 00000000
+0074 USBCAST.. 00000000 00000000 00000000 00000000
+007C USRCVBUF. 00000000 00000000 00000000 00000000
+0080 USERIAL1. 00000000 00000000 00000000 00000000
+0088 UISNDBUF. 00000000 00000000 00000000 00000000
+00A4 UIP6RDQ@. 7F607928 00000000 00000000 00000000
+00A8 UD6MULTI@.... 00000000 00000000 00000000 00000000
+00AD UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00AC UD6MULTI@.... 00000000 00000000 00000000 00000000
+00B0 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00BE UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00C0 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00C4 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00C8 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00D0 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00D4 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00D8 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00E0 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000
+00E4 UD6MULTI_TOKEN. 00000000 00000000 00000000 00000000

IPv6 Unicast Hash Table
UCB ResrcID ResrcNm TpiState Port IPAddr
7F2FC000 00000000 TCPCS WLUNBNDB ::0
1 UCB(s) FOUND
1 UCB(s) FORMATTED

IPv4 Unicast Hash Table
UCB ResrcID ResrcNm TpiState Port IPAddr
7F50C000 00000000 TCPCS WLUNBNDB 0.0.0.0
1 UCB(s) FOUND
1 UCB(s) FORMATTED

IPv6 Multicast Hash Table
0 UCB(s) FOUND
0 UCB(s) FORMATTED

IPv4 Multicast Link List
0 UCB(s) FOUND
0 UCB(s) FORMATTED

Analysis of Tcp/IP for TCPCS completed
TCPIPCS VMCF

Use this subcommand to display information about VMCF (Virtual Machine Communication Facility) and IUCV (Inter-User Communication Vehicle) users.

Syntax

```
TCPIPCS VMCF
  ( variable_item )
  SUMMARY
  DETAIL
```

```
TCP ( tcp_proc_name tcp_index )
  TITLE
  NOTITLE
```

Parameters

If no parameters are specified, all VMCF control blocks are summarized.

* An asterisk is used as a placeholder if no variable parameters are specified.

variable_item

Any one of the following variable parameters.

variable_list

You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

user_id

Displays only the VMCF control block associated with this user ID. A user_id is 1 - 8 alphanumeric characters.

ASCB_address

Displays only the VMCF control blocks associated with this address space control block address. An address is specified as 1-8 hexadecimal digits. An IPCS symbol name can be specified for an address. If an address begins with digit a–f or A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

ASID_number

Displays only the VMCF control blocks associated with this address space identifier. An ASID is specified as one to four hexadecimal digits.

In addition to the variable parameters described above, you can specify the following keyword parameters:

SUMMARY

Formats the VMCF control blocks in one cross-reference table. SUMMARY is the default.

DETAIL

In addition to the SUMMARY display, DETAIL formats the contents of selected VMCF USER control blocks.

TCP, TITLE, NOTITLE

See “Parameters” on page 169 for a description of these parameters.
**Rule:** If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

**Sample output of the TCPIPCS VMCF subcommand**

The following is sample output of the TCPIPCS VMCF subcommand:

```
TCPIPCS VMCF ((* ) SUMMARY)
Dataset: IPCS.JW11111.DUMPA
Title: IPCS VMCF DUMP

The address of the TSAB is: 08EBC180

Tseb     SI Procedure Version Tsdb     Tsdx     Asid TraceOpts Status
08EBC1C0 1 TCPCS     V2R10   089DC000 089DC0C8 01F7 9FFFFF7F Active

1 defined TCP/IP(s) were found
1 active  TCP/IP(s) were found
1 TCP/IP(s) for CS     V2R10 found

Analysis of Tcp/Ip for TCPCS. Index: 1

TCPIP VMCF Analysis

XINF at 09813000
VMCF CVT : 00A44078
User Array : 09813090
Userid Count : 1
Userid Array : 09817050
Userid : VMCF
MSGBUILD : 89802838
MVPMSGS : 8981A290
Ecb : 00000000
TNF CVT : 00A63808
VMCF QD : 00000000
VMCF QD Count : 0
TNF Manager Area : 00008FE0
SMSG Id : 0

USER at 09813C50
Userid : USER18
Asid : 005D
No UserData

Analysis of Tcp/Ip for TCPCS completed
```

**TCPIPCS XCF**

Use this subcommand to produce a cross-system coupling facility (XCF) analysis report.

**Syntax**

```
TCPIPCS XCF

ALL
CONN
DEST
WLM
SUMMARY
DETAIL
TITLE
NOTITLE
TCP (tcp_proc_name)
(tcp_index)
```

IPCS subcommands for TCP/IP  257
Parameters
If no parameters are specified, the dynamic VIPA hash table and partner tables are summarized.

CONN
Display only connection hash table optional information.

DEST
Display only destination hash table optional information.

WLM
Display only workload manager optional information.

ALL
Display all optional information. ALL is the default.

SUMMARY
Formats the XCF control blocks in one cross-reference table. SUMMARY is the default.

DETAIL
In addition to the SUMMARY display, DETAIL formats the contents of XCF control blocks.

TCP, TITLE, NOTITLE
See “Parameters” on page 169 for a description of these parameters.

Rules:
• If you specify multiple keywords from the set {ALL, CONN, DEST, WLM}, all of the keywords that you specify are used.
• If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.

Sample output of the TCPIPCS XCF subcommand
The following is sample output of the TCPIPCS XCF subcommand:

TCPIPCS XCF
Dataset: IPCS.MV20603.DUMPA
...---XFCVT information-----
XFCVT@ 12CC7410 Member Name RUSSIATCPSVT
Local PTB 12CC752C PTB Chain 1276A410
DVIPAHashT@ 13239408 IPHashT@ 12A9C010
ConnRteHashT@ 12A9B010 DPTHashT@ 1277D010
WLMData@ 00000000 PolicyPart@ 7F635108
================================================================================
----DVIPA Hash Table----
DVIPA Hash Table at 13239408
Hash table has size 2056 bytes

DVIPA address 197.11.200.2 index 3
MVSName/TCPName Status/Rank/@ of BackEle
RUSSIA/TCPSVT Active/255/7C0B2B30
GERMANY/TCPSVT Backup/10/7E53C6B0

...Found 9 entries in the DVIPA Hash Table.
================================================================================

Local Partner Table
================================================================================
----Partner Table Control Block----
Partner Table at 12CC752C
NextPtr: 00000000
MVSName: RUSSIA CPName: RUSSIA
TCName: TCPSVT IPTable: 12D6F140
IPCount: 21 IEntries@: 1322D0E8
...---Dynamic VIPA Table----
Sending Partner@: 128E1410 GERMANY/TCPSVT
Current Dynamic Home Address: 199.11.87.104
Table Address: 12A98C10 Table Length: 8208
Number of Table Entries: 7
ERRNO command

Use the ERRNO command to search for the name and description of constants used for ERRNO, ErrnoJr, module ID, reason code, and ABEND reason code.

Syntax

```
ERRNO
   type    value
   name
```

Parameters

**type**

The optional type of value provided:

- **A**
  - Abend code
- **E**
  - Errno
- **J**
  - ErrnoJr
- **M**
  - Module ID
- **R**
  - Reason code (default)

**value**

The decimal or hexadecimal value to be converted. By default, the value is assumed to be a hexadecimal number. If the value is less than the maximum size for its type, the value is padded on the left with zeros. Choices are:

- **hhhhhhhh**
  - An address consisting of 1-8 hexadecimal digits ending with a period. The value at that address is interpreted.
- **hhhhhhhh**
  - An ERRNO, ERRNO junior, reason code, ABEND code, or module ID consisting of 1-8 hexadecimal digits.
- **hhhhhhhhx**
  - An ERRNO, ERRNO junior, or a module ID consisting of 1-8 hexadecimal digits followed by the letter x.
An ERRNO, ERRNO junior, or a module ID consisting of 1-8 decimal digits followed by the letter n.

The name of a module, an ERRNO, an ErrnoJr, or an ABEND reason code.

Note: If the name is not found, ERRNO attempts to interpret the name as a hexadecimal value.

Sample output of the ERRNO command

This section shows sample outputs of the ERRNO command.

For reason code by hexadecimal value output, code the following:

```
Command ===>  errno r 74be72e9
```

ReasonCode: 74BE72E9
Module: EZBITSTO  ErrnoJr: 29417 JRCMNOSCM
Description: Cache Manager encountered a CSM storage shortage

For reason code by address, where the value at address 07093f98 is 74717273, code the following. Type R (reason code) is the default.

```
Command ===> errno 7093f98.
```

ReasonCode: 74717273
Module: EZBPFWRT  ErrnoJr: 29299 JRARPNOTDEFINED
Description: The ATMARPsv name specified is not defined

For reason code by Errno in decimal, code the following:

```
Command ===> errno e 129n
```

Errno: 00000001(129) : ENOENT
Description: No such file, directory, or IPC member exists

For reason code by ErrnoJr in hexadecimal, code the following:

```
Command ===> errno j 6c
```

ErrnoJr: 0000006C(108) : JRFILENOTTHERE
Description: The requested file does not exist

For reason code by abend code in decimal, code the following:

```
Command ===>  errno a 9473n
```

Abend Reason Code: 000002501
Module: Unknown  Reason: TcpitStorNoCSMstorage
Description: No CSM storage available

For reason code by module ID in hexadecimal, code the following:

```
Command ===> errno m 74be
```

ModuleId: 74BE(29886) : EZBITSTO EZBTIINI

For reason code by module name, code the following:

```
Command ===> errno ezbifinb
```

ModuleId: 7418(29720) : EZBIFINB EZBTIINI

For reason code by ERRNO name, code the following:

```
Command ===> errno ebadf
```
Errno: 00000071(113) : EBADF
Description: The file descriptor is incorrect

For reason code by ErrnoJr name, code the following:

Command ===> errno  jrmxuuids
ErrnoJr: 00000013(19) : JRMXUUIDS
Description: The maximum number of OpenMVS user IDs is exceeded

For reason code by ABEND reason name, code the following:

Command ===> errno tcpbadentrycode
Abend Reason Code: 00000401
Module: Unknown  Reason: TcpBadEntryCode
Description: Bad Entry code to module

ICMPHDR command

This section describes the ICMPHDR command.

Use the ICMPHDR command to display the ICMP header fields.

Syntax

![ICMPHDR syntax diagram]

Parameters

*  
To omit this positional parameter when using the HELP keyword.

icmp_address  
The address of an ICMP header or the symbol for the address.

skdb_address  
The address of an SKDB control block or the symbol for the address.

skmb_address  
The address of an SKMB control block or the symbol for the address.

size  
The amount of data to display. If the size is greater than the size of the header, the variable portion of the header is displayed if it exists. Must be one to three hexadecimal digits.

HELP  
Display IPHDR usage and syntax information instead of the control blocks.
ALL
Display function, operands, and syntax information for the IPHDR command. ALL is the default.

FUNCTION
Display only function information.

OPERANDS
Display only operand information.

SYNTAX
Display only syntax information.

Rule: If you specify multiple keywords from the set {ALL, FUNCTION, OPERANDS, SYNTAX}, all of the keywords that you specify are used.

Sample output of the ICMPHDR command
Following is sample output of the ICMPHDR command.

```
ICMPHDR 9D77428 256
ICMPv6
Type/Code : ECHO Request    CheckSum: 4F51 0000
Id       : 0028            Seq: 0
Time     : 2002/05/23 18:43:00.332756
Echo Data: -8
          000000 3CED3834 000513D4 08090A0B 0C0D0E0F |<.84............|
          000010 10111213 14151617 18191A1B 1C1D1E1F |................|
          000020 20212223 24252627 28292A2B 2C2D2E2F | !"#$%&'()*+,-./|
          000030 30313233 34353637 38393A3B 3C3D3E3F |0123456789:;<=>?|
          000040 40414243 44454647 48494A4B 4C4D4E4F |@ABCDEFGHIJKLMNO|
          000050 50515253 54555657 58595A5B 5C5D5E5F |PQRSTUVWXYZ._^| |
          000060 60616263 64656667 68696A6B 6C6D6E6F |abcdefghijklmnopqrstuvwxyz|
          000070 70717273 74757677 78797A7B 7C7D7E7F |................|
          000080 80818283 84858687 88898A8B 8C8D8E8F |................|
          000090 90919293 94959697 98999A9B 9C9D9E9F |................|
          0000A0 A0A1A2A3 A4A5A6A7 A8A9AAAB ACACACAC AF|
          0000B0 B0B1B2B3 B4B5B6B7 B8B9BABB BCBDBEBF|
          0000C0 C0C1C2C3 C4C5C6C7 CBC9CABC CCECCECF|
          0000D0 D0D1D2D3 D4D5D6D7 D8D9DADB DCDDDEDF|
          0000E0 E0E1E2E3 E4E5E6E7 E8E9EAEB ECEDEEEF|
          0000F0 F0F1F2F3 F4F5F6F7 F8F9FAFB FCDFDEFF|
          Protocol Header: 8
          000000 80004F51 00280000
          Data: 590 Data Length: 0
          000000 3CED3834 000513D4 08090A0B 0C0D0E0F |........M........|
          000010 10111213 14151617 18191A1B 1C1D1E1F|................|
          000020 20212223 24252627 28292A2B 2C2D2E2F|................|
```

IPHDR command
Use the IPHDR command to display the IP header fields.
### Syntax

```
IPHDR ip_header_address
  rcb_address
  tcb_address
  ucb_address
  skmb_address
  skdb_address
  size
```

HELP

```
HELP ( FUNCTION OPERANDS SYNTAX )
```

### Parameters

* To omit this positional parameter when using the HELP keyword.

**ip_header_address**

The address of an IP header or the symbol for the address.

**rcb_address**

The address of a raw control block or the symbol for the address.

**tcb_address**

The address of a TCP/IP TCB control block or the symbol for the address.

**ucb_address**

The address of a UDP control block or the symbol for the address.

**skmb_address**

The address of an SKMB control block or the symbol for the address.

**skdb_address**

The address of an SKDB control block or the symbol for the address.

**size**

The amount of data to display. If the size is greater than the size of the header, additional protocol headers (if any) are displayed. Must be one to three hexadecimal digits.

**HELP**

Display IPHDR usage and syntax information instead of the control blocks.

**ALL**

Display function, operands, and syntax information for the IPHDR command. ALL is the default.

**FUNCTION**

Display only function information.

**OPERANDS**

Display only operand information.

**SYNTAX**

Display only syntax information.

**Rule:** If you specify multiple keywords from the set {ALL, FUNCTION, OPERANDS, SYNTAX}, all of the keywords that you specify are used.
The following is a sample output of the IPHDR command:

```
IPHDR 09D77400 300

IP Header: 09D77400
IpHeader: Version : 6 Header Length: 40
Class:           : 00 Flow: 000000
Payload Length  : 264 Protocol: ICMPv6
Hops             : 255
Source           : ::1
Destination      : ::1

ICMPv6
Type/Code        : ECHO Request CheckSum: 4F51 0000
Id               : 0028 Seq: 0
Time             : 2002/05/23 18:43:00.332756
Echo Data        : 256

Data               : 720 Data Length: 256
```

RESOLVER command

Use the RESOLVER command to format and summarize resolver control blocks and cache information.
Parameters

If no parameters are specified, information about the Resolver is summarized.

*  
   An asterisk is used as a placeholder if no variable parameters are specified.

**variable_item**  
   Any one of the following variable parameters.

**variable_list**  
   You can repeat from 1 - 32 of the following variable parameters, each separated by a blank space, within parentheses:

Variable parameters are:

**jobname**  
   Displays only the Resolver control blocks for this job name. The job name can be a TCP/IP application name or a stack name. Must be from 1-8 characters.

**ASCB_address**  
   Displays the Resolver control blocks with this address space control block (ASCB) address. An IPCS symbol name can be specified for the address. The address is specified as 1-8 hexadecimal digits. If an address begins with digit A–F, prefix the address with a zero to avoid the address being interpreted as a symbol name or as a character string.

**ASID_number**  
   Displays the Resolver control blocks with this Address Space Identifier (ASID). The ASID is a hexadecimal number containing one to four digits.

**Restriction:** To display the resolver cache information, the resolver address space must be included in the dump and be specified as one of the address spaces to be displayed.

In addition to the variable parameters described above, you can describe the following keyword parameters:

**HELP**  
   Display RESOLVER usage and syntax information instead of the control blocks.

**ALL**  
   Displays help about the function, operands, and syntax information for the RESOLVER command. ALL is the default.
**FUNCTION**
Display only function help information.

**OPERANDS**
Display only operands help information.

**SYNTAX**
Display only syntax help information.

**SUMMARY**
Displays the addresses of the control blocks and other data in tables. SUMMARY is the default.

**DETAIL**
In addition to the SUMMARY display, DETAIL also shows the contents of the control blocks.

**TITLE**
The title contains information about the dump and about the RESOLVER command. The title information is displayed as the default. The title contains the following information:
- RESOLVER command input parameters.
- Dump data set name.
- Dump title.

**NOTITLE**
Suppress the title lines. Use this when you are processing lots of commands on the same dump and do not need to see the title information repeated.

**Rules:**
- If you specify multiple keywords from the set {TITLE, NOTITLE}, only the last one is used.
- If you specify multiple keywords from the set {SUMMARY, DETAIL}, only the last one is used.
- If you specify multiple keywords from the set {ALL, FUNCTION, OPERANDS, SYNTAX}, all of the keywords that you specify are used.

**Sample output of the RESOLVER command**

The following is sample output of the RESOLVER command with only DETAIL specified:

```plaintext
RESOLVER + DETAIL
Dataset: D74L.AA112546.DUMP3
Title: IPCS RESOLVER + DETAIL EXAMPLE

+------------------------------------------------------------------------------------------------------------------+-
| Resolver Analysis                                                                                                 |
| RCRT: 019F9060                                                                                                      |
| +0000  RCRETENT0. 00000001  RCRTRCVT. 9571E000                                                                       |
| +0008  RCRETENTS. 019F9130  RCRETENTS. 019F92BC  RCRETENTS. 019F9448  RCRETENTS. 019F95D4  RCRETENTS. 019F9760  RCRETENTS. 019F98EC |
| +0020  RCRETENTS. 019F947B  RCRETENTS. 019F96F4  RCRETENTS. 019F99D0  RCRETENTS. 019F9FC0  RCRETENTS. 019FA0A8  RCRETENTS. 019FA234 |
| +0038  RCRETENTS. 019FA3C0  RCRETENTS. 019FA4BC  RCRETENTS. 019FA5B8  RCRETENTS. 019FA744  RCRETENTS. 019FA8D0  RCRETENTS. 019FAAC5 |
| +0050  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 019FB0F8 |
| +0068  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  RCRETENTS. 01083010  |
| +------------------------------------------------------------------------------------------------------------------|
| +0000  RCVTID. ....... RCVT                                                                          |
| +0004  RCVTASIB. ...... 00F8C400                                                                         |
| +0008  RCVTETKN. ...... 7FF9F900                                                                         |
| +000C  RCVTXLK. ...... 00002700                                                                         |
| +0010  RCVTFREFR. ...... 00006000                                                                         |
| +0014  RCVTCA. ...... 7FF5A868                                                                            |
| +0018  RCVTOPT. ...... P60000000                                                                         |
| +001C  RCVTSRMT. ...... 15684000                                                                         |
| +0020  RCVTDEFA. ...... 00000001                                                                         |
| +0024  RCVTDEFI. ...... 00000002                                                                         |
| +0028  RCVTBGLA. ...... 00000000                                                                         |
| +002C  RCVTGLB. ...... 00000004                                                                          |
| +------------------------------------------------------------------------------------------------------------------|
| +0000  Array elements --                                                                                  |
| +0030  RCVTCFG. ................................................................................................................................. |
| +0048  ................................................................. USER1.OUR.DEFAULT.TCPDATA ........................................... |
| +0060  RCVTCFG. ................................................................................................................................. |
| +0078  ......................................................................................................................................................... |
| +0128  ................................................................. /etc/TRDP3461_resolv.conf ........................................... |
+------------------------------------------------------------------------------------------------------------------+
```

266  z/OS Communications Server: IP Diagnosis Guide
IPCS subcommands for TCP/IP
Resolver Services Module Table

Module Table entries by Entry Point Address

<table>
<thead>
<tr>
<th>Module</th>
<th>Epa</th>
<th>Date</th>
<th>Time</th>
<th>PTF</th>
<th>Lmod</th>
<th>Asid</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZBRESMT</td>
<td>15684000</td>
<td>2010/05/25</td>
<td>19:56:00</td>
<td>HIP61D0</td>
<td>EZBRESRV</td>
<td>0001</td>
</tr>
<tr>
<td>EZBRESRV</td>
<td>15684498</td>
<td>2010/05/27</td>
<td>16:28:00</td>
<td>HIP61D0</td>
<td>EZBRESRV</td>
<td>0001</td>
</tr>
<tr>
<td>EZBREARR</td>
<td>15691678</td>
<td>2010/05/27</td>
<td>16:24:00</td>
<td>HIP61D0</td>
<td>EZBRESRV</td>
<td>0001</td>
</tr>
<tr>
<td>EZBRECSR</td>
<td>156929C0</td>
<td>2010/05/27</td>
<td>16:24:00</td>
<td>HIP61D0</td>
<td>EZBRESRV</td>
<td>0001</td>
</tr>
<tr>
<td>EZBRETRM</td>
<td>15718238</td>
<td>2010/05/27</td>
<td>16:28:00</td>
<td>HIP61D0</td>
<td>EZBRESRV</td>
<td>0001</td>
</tr>
<tr>
<td>EZBRETRR</td>
<td>15718438</td>
<td>2010/05/27</td>
<td>16:28:00</td>
<td>HIP61D0</td>
<td>EZBRESRV</td>
<td>0001</td>
</tr>
</tbody>
</table>

Resolver Address Space is RESOLVER (ASID 000F)

Resolver setup file: SYS1.TCPPARMS(SETUPRES)
Resolver setup file warning messages: No
Global TCPIP.DATA file: /etc/TRDP3461_resolv.conf
Default TCPIP.DATA file: None
Global IPNODES file: None
Default IPNODES file: SYS1.TCPPARMS(IPNODES)
Common Search: Yes
Unresponsive Threshold: 25
Autoquiesce: Yes
Caching: Yes
Cache Limit: 209715200
Cache Size: 80352
Cache Status: Unconstrained
Cache Refs: 28
Cache Hits: 0
Cache Max Use: 80352
Max TTL: 2147483647
Max Neg TTL: 2147483647
Cache Reorder: YES

Resolver Initialization Module Table

Module Table entries by Entry Point Address

<table>
<thead>
<tr>
<th>Module</th>
<th>Epa</th>
<th>Date</th>
<th>Time</th>
<th>PTF</th>
<th>Lmod</th>
<th>Asid</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZBREIMT</td>
<td>18000000</td>
<td>2010/05/25</td>
<td>19:54:00</td>
<td>HIP61D0</td>
<td>EZBREINI</td>
<td>000F</td>
</tr>
<tr>
<td>EZBREINI</td>
<td>180002F8</td>
<td>2010/05/27</td>
<td>16:07:00</td>
<td>HIP61D0</td>
<td>EZBREINI</td>
<td>000F</td>
</tr>
<tr>
<td>EZBRETRM</td>
<td>1802B258</td>
<td>2010/05/27</td>
<td>16:28:00</td>
<td>HIP61D0</td>
<td>EZBREINI</td>
<td>000F</td>
</tr>
<tr>
<td>EZBRETRR</td>
<td>1802BCA8</td>
<td>2010/05/27</td>
<td>16:28:00</td>
<td>HIP61D0</td>
<td>EZBREINI</td>
<td>000F</td>
</tr>
</tbody>
</table>

CTCA: 7FF5A868
+0000  CTCA_CBID....... CTCA
+0004  CTCA_CBSIZE..... 0398
+0008  CTCA_CBERV....... 0001
+000C  CTCA_CNAME...... C3E39C3C C3E39C3C 00F8C400 00000000
+0010  CTCA_CTOKEN..... C3E39C3C 7FF5A868 15E58300 00F8C400
+0018  CTCA_CURCTBS.... 7E5B8B58

... edited out part of output ...

IPCS subcommands for TCP/IP 269
+098C 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+098F 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0A18 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0A34 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0A50 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0A6C 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0A88 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0AC0 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0AF8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0B14 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

--- End of array ---

Resolver Cache
Nameserver Cache
Hash Table Header : 00000848_00000100
Instance : 1
Active entries : 3
Hash buckets : 251

Index Element®
IP Address
IPv4 Fwd Lookup Cache for Nameserver 10.0.6.1
Hash Table Header : 00000048_00000500
Instance : 3
Active entries : 11
Hash buckets : 251

IPCS subcommands for TCP/IP 271
IPv6 Forward Lookup Cache for Nameserver 10.0.6.1

<table>
<thead>
<tr>
<th>Index Element</th>
<th>Hostname</th>
<th>Rcode</th>
<th>IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td><a href="http://WWW.IETF.ORG">WWW.IETF.ORG</a></td>
<td>NOERROR</td>
<td>2001:1890:1112:1::20</td>
</tr>
<tr>
<td>86</td>
<td>BOGUSNAME2</td>
<td>NXDOMAIN</td>
<td></td>
</tr>
<tr>
<td>128</td>
<td><a href="http://WWW.YAHOO.COM">WWW.YAHOO.COM</a></td>
<td>NXDOMAIN</td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>BOGUSNAME2.raleigh.ibm.com</td>
<td>NXDOMAIN</td>
<td></td>
</tr>
<tr>
<td>172</td>
<td>BOGUSNAME2.raleigh.ibm.com</td>
<td>NXDOMAIN</td>
<td></td>
</tr>
</tbody>
</table>

IPv6 Forward Lookup Cache for Nameserver 10.0.6.1

| Hash Table Header | 000000048_00003000 |
| Instance | 2 |
| Active entries | 7 |
| Hash buckets | 256 |

Reverse Lookup Cache for Nameserver 10.0.6.1

<table>
<thead>
<tr>
<th>Index Element</th>
<th>IP Address</th>
<th>Rcode</th>
<th>Hostname</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>ędzi@.............</td>
<td>7E50EF08</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Shadow.Indicator.</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>User.Job.........</td>
<td>RESOLVER</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>IOCINETFLAGS......</td>
<td>0000</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>ProcessID.........</td>
<td>00000002</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>RPID_STATE_EXT....</td>
<td>00000002</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Request..........</td>
<td>00800000</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Responce........</td>
<td>10020035</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td><a href="http://www.w3.org">www.w3.org</a>........</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td><a href="http://www.w3.org">www.w3.org</a>........</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td><a href="http://www.w3.org">www.w3.org</a>........</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>178</td>
<td><a href="http://www.w3.org">www.w3.org</a>........</td>
<td>00000000</td>
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</tr>
<tr>
<td>212</td>
<td><a href="http://www.w3.org">www.w3.org</a>........</td>
<td>00000000</td>
<td></td>
</tr>
</tbody>
</table>

IPv6 Forward Lookup Cache for Nameserver 10.0.6.1

| Hash Table Header | 000000048_00003000 |
| Instance | 4 |
| Active entries | 2 |
| Hash buckets | 256 |

IPv6 Forward Lookup Cache for Nameserver 10.0.6.1

<table>
<thead>
<tr>
<th>Index Element</th>
<th>IP Address</th>
<th>Rcode</th>
<th>Hostname</th>
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</thead>
<tbody>
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<td>6</td>
<td>ędzi@.............</td>
<td>7E50EF08</td>
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</tr>
<tr>
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<td>10</td>
<td>User.Job.........</td>
<td>RESOLVER</td>
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</tr>
<tr>
<td>20</td>
<td>IOCINETFLAGS......</td>
<td>0000</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>ProcessID.........</td>
<td>00000002</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>RPID_STATE_EXT....</td>
<td>00000002</td>
<td></td>
</tr>
<tr>
<td>40</td>
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<td><a href="http://www.w3.org">www.w3.org</a>........</td>
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<td><a href="http://www.w3.org">www.w3.org</a>........</td>
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<td></td>
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<tr>
<td>212</td>
<td><a href="http://www.w3.org">www.w3.org</a>........</td>
<td>00000000</td>
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</tbody>
</table>
### Array elements

<table>
<thead>
<tr>
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<th>Value</th>
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</thead>
<tbody>
<tr>
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<td>RPID_SEARCH_ENTRY</td>
</tr>
<tr>
<td>+0888</td>
<td>raleigh.ibm.com</td>
</tr>
<tr>
<td>+0974</td>
<td>RPID_SEARCH_ENTRY</td>
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<tr>
<td>+097C</td>
<td>IBM.COM</td>
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<tr>
<td>+0988</td>
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<tr>
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<td>RPID_SEARCH_ENTRY</td>
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### Array elements

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### Array elements

<table>
<thead>
<tr>
<th>Offset</th>
<th>Value</th>
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<tbody>
<tr>
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<tr>
<td>+0A2C</td>
<td>RPID_ABOVE_AIMAP@</td>
</tr>
<tr>
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<td>RPID_ABOVE_AIMAP@</td>
</tr>
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</tr>
<tr>
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</tr>
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</tr>
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</tr>
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</tr>
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</tr>
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</tr>
<tr>
<td>+0A7C</td>
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### Array elements

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<tr>
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<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0F84</td>
<td>00000000</td>
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<tr>
<td>+0F88</td>
<td>RPID_BELOW_AIMAP@</td>
</tr>
<tr>
<td>+0F90</td>
<td>RPID_BELOW_AIMAP@</td>
</tr>
<tr>
<td>+0F94</td>
<td>RPID_BELOW_AIMAP@</td>
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<tr>
<td>+0F98</td>
<td>RPID_BELOW_AIMAP@</td>
</tr>
<tr>
<td>+0F9C</td>
<td>RPID_BELOW_AIMAP@</td>
</tr>
<tr>
<td>+0FA0</td>
<td>RPID_BELOW_AIMAP@</td>
</tr>
<tr>
<td>+0FA4</td>
<td>RPID_BELOW_AIMAP@</td>
</tr>
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</tr>
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<td>+0FAC</td>
<td>RPID_BELOW_AIMAP@</td>
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</tr>
<tr>
<td>+0FC2</td>
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### Array elements

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<th>Value</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

---

RPID_STATE NSADDR_LIST contains only IPv4 name server addresses
RPID_STATE_IPV6EXPERT STAT_NSADDR_LIST contains the full set of name server addresses

---

<table>
<thead>
<tr>
<th>Offset</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0010</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+0030</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+0050</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+0070</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+0090</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+00B0</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+00D0</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+00F0</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+0110</td>
<td>NSADDR_LIST</td>
</tr>
<tr>
<td>+0130</td>
<td>DEFNAME</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Offset</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0142</td>
<td>...</td>
</tr>
</tbody>
</table>

---

**IPCS subcommands for TCP/IP**

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### z/OS Communications Server: IP Diagnosis Guide

**RES_TASK: 7F5CFC70**

<table>
<thead>
<tr>
<th>RES_0018</th>
<th>7F5FCF70</th>
</tr>
</thead>
<tbody>
<tr>
<td>RES_0080</td>
<td>RES IDENTIFIER ... RTSK</td>
</tr>
<tr>
<td>RES_0054</td>
<td>RES LENGTH ... 0000</td>
</tr>
<tr>
<td>RES_0066</td>
<td>RES SUBPOOL ... F9</td>
</tr>
<tr>
<td>RES_0077</td>
<td>RES USEKEY ... 06</td>
</tr>
<tr>
<td>RES_0088</td>
<td>RES SEQUENCE ... 00000007</td>
</tr>
<tr>
<td>RES_0090</td>
<td>RESMR TOKR ... 00000000</td>
</tr>
<tr>
<td>RES_0041</td>
<td>RESMR DATA ... 00000000</td>
</tr>
<tr>
<td>RES_0018</td>
<td>RESRTX00 ... 7F5FCF70</td>
</tr>
<tr>
<td>RES_001C</td>
<td>RESRTX00 ... 7F5CFF00</td>
</tr>
</tbody>
</table>

**RES_STATE: 7F5FCF40**

| RES_0030 | 08000000 00000002 00000010 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_0048 | 08000000 00000001 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_0058 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_0068 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_0078 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_0088 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_0098 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_00A8 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_00B8 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_00C8 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_00D8 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_00E8 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |
| RES_00F8 | 08000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |

**RES_STATE_EXT: 7F5FCF40**

| RES_0020 | 7F5CFF00 |
| RES_0028 | 7F5CFF00 |
| RES_0038 | 7F5CFF00 |
| RES_0048 | 7F5CFF00 |
| RES_0058 | 7F5CFF00 |
| RES_0068 | 7F5CFF00 |
| RES_0078 | 7F5CFF00 |
| RES_0088 | 7F5CFF00 |
| RES_0098 | 7F5CFF00 |
| RES_00A8 | 7F5CFF00 |
| RES_00B8 | 7F5CFF00 |
| RES_00C8 | 7F5CFF00 |
| RES_00D8 | 7F5CFF00 |
| RES_00E8 | 7F5CFF00 |
| RES_00F8 | 7F5CFF00 |
RPID_STATE_IPV6EXT...

RPID_STATE_IPV6EXT contains only IPv4 name server addresses

RPID_STATE NSADDR_LIST contains only IPv4 name server addresses

--- Array elements ---

--- End of array ---

RPID_EBCDIC2ASCII...

--- Array elements ---

--- End of array ---

RPID.ASCII2EBCDIC....

--- Array elements ---

--- End of array ---

RPID_FLAGS............

--- Array elements ---

--- End of array ---

RPID_XLATENAME

--- Array elements ---

--- End of array ---

RPID_STATE_NSADDR_LIST contains only IPv4 name server addresses
RES_STATE NSADDR_LIST contains only IPv4 name server addresses
RES_STATE_IPV6EXT STAT_NSADDR_LIST contains the full set of name server addresses

RES_SEARCH_ENTRY........
RES_URI2PROTOCOL....
RES_CHARACTERISTICS.
RES_IPV4ADDR Extension.
RES_WINCMutex.
RES_CLEANUP.
RES_NETWORK_ERROR.
RES_TRANSPARENT.
RES_ASSOCIATION.
RES_CONNECTION.
RES_FFPROCINFO.
RES_MIB.
RES_STACK.
RES_IPV6ACCELERATION.
IPCS subcommands for TCP/IP  281
SETPRINT command

Use the SETPRINT command to change the destination of subsequent IPCS command output. If the IPCSPRNT data set is allocated and being sent to a node, the output of future IPCS commands accumulates (but not displayed at the terminal) until you exit IPCS. When you exit IPCS, the IPCSPRNT data set is sent to the specified node.

Syntax

```
SETPRINT  ON
          OFF
          node_name . user_id
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>Allocates the IPCSPRNT data set and issues the IPCS SETDEF PRINT command.</td>
</tr>
<tr>
<td>OFF</td>
<td>Frees the IPCSPRNT data set and issues the IPCS SETDEF NOPRINT command.</td>
</tr>
<tr>
<td>node_name</td>
<td>The name of a TSO or VM system to which the output is sent.</td>
</tr>
<tr>
<td>user_id</td>
<td>The user ID on the TSO or VM system to which the output is sent.</td>
</tr>
</tbody>
</table>

**Note:** If `user_id` is specified, there must be a period but no space between `node_name` and `user_id`.

Sample output of the SETPRINT command

If the command completes successfully, there is no output for the SETPRINT command. The following examples are invalid invocations of the SETPRINT command.

Allocating IPCSPRNT when it is already allocated:

```
setprint on ralvms.testid
IKJ56861I  FILE IPCSPRNT NOT UNALLOCATED, DATA SET IS OPEN
```

Freeing IPCSPRNT when it is already freed:

```
setprint off
BLS21060I PRINT file not open
IKJ56247I FILE IPCSPRNT NOT FREED, IS NOT ALLOCATED
```

SKMSG command

This topic describes the SKMSG command.

Use the SKMSG command to display the SKMSG fields.
Syntax

Parameters

* To omit this positional parameter when using the HELP keyword.

**skmb_address**
The address of an SKMB control block or the symbol for the address.

**skdb_address**
The address of an SKDB control block or the symbol for the address.

**skbd_address**
The address of an SKBD control block or the symbol for the address.

**skqu_address**
The address of an SKQU control block or the symbol for the address.

**raw_control_block_address**
The address of a RAW control block or the symbol for the address.

**tcb_control_block_address**
The address of a TCB control block or the symbol for the address.

**udp_control_block_address**
The address of a UDP control block or the symbol for the address.

**HELP**
Display SKMSG usage and syntax information.

**ALL**
Displays help about the function, operands, and syntax information for the SKMSG command. ALL is the default.

**FUNCTION**
Display only function help information.

**OPERANDS**
Display only operands help information.

**SYNTAX**
Display only syntax help information.

**Rule:** If you specify multiple keywords from the set {ALL, FUNCTION, OPERANDS, SYNTAX}, all of the keywords that you specify are used.

Sample output of the SKMSG command

The following is a sample output of the SKMSG command:

```
SKMSG 15D4D5B8
SKDB at 15D4D5B8
```
TCPHDR command

Use the TCPHDR command to display the TCP header fields.

Syntax

```
TCPHDR tcp_header_address
```

```
tcp_control_block_address
```

```
skb_address
```

```
skmb_address
```

```
size *
```

Parameters

* To omit this positional parameter when using the HELP keyword.

**tcp_header_address**

The address of the TCP header or an IPCS symbol.
TCPHDR command

The following is sample output of the TCPHDR command:

```
TCPHDR 7F522108
TCB at 7F522108
TCP Header at 7F5222D8
7F5222D8  04010402  7228DD16  7228DB82  50107FD8  | ...........b&."Q |
+0010  00000000                                | ....             |
Source Port         : 1025
Destination Port    : 1026
Sequence Number     : 1,915,280,662
Ack Number          : 1,915,280,258
Header Length       : 20
Flags               : Ack
Window Size         : 32728
Checksum            : 0000
Urgent Data Pointer : 0000
```

TOD command

Use the TOD command to format a hexadecimal time-of-day value into a readable date and time.

Syntax

```
TOD — time_value , — time_zone
```
Parameters

*time_value*
The time to be converted. The *time_value* can be specified as either 16 hexadecimal digits or as an address in a dump of an eight-byte STCK value. If less than 16 digits are specified, the value is padded on the right with zeros. If an address is specified, it must be followed by a period. If an address is less than eight hexadecimal digits, it is padded on the left with zeros.

*time_zone*
An offset for the time (the difference between local time and GMT). The *time_zone* can be specified either as a word or as a positive or negative decimal value. The recognized words are:

- **LOCAL**
  Time zone value of zero is used. This is the default.

- **GMT**
  Greenwich Mean Time

- **EDT**
  U.S. Eastern Daylight Time zone

- **EST**
  U.S. Eastern Standard Time zone

- **CDT**
  U.S. Central Daylight Time zone

- **CST**
  U.S. Central Standard Time zone

- **MDT**
  U.S. Mountain Daylight Time zone

- **MST**
  U.S. Mountain Standard Time zone

- **PDT**
  U.S. Pacific Daylight Time zone

- **PST**
  U.S. Pacific Standard Time zone

Sample output of the TOD command

The following are sample outputs of the TOD command.

Sample output for STCK time-of-day with a time zone word:

```
Command ===> ip tod b214030791f3a92c,est
B2140307 91F3A92C : 1999/04/10 20:51:58.684986  TIMEZONE: 0000430E23400000
```

Sample output for an address in the dump where an STCK time-of-day value is located with a negative time zone offset:

```
Command ===> ip tod 11275d4.,-4
B24000E0 51900000 : 1999/05/16 05:36:37.632256  TIMEZONE: FFFFCA5B17000000
```

UDPHDR command

Use the UDPHDR command to display the UDP header fields.
Syntax

```
UDPHDR  UDP_header_address
       skdb_address  size
HELP   (ALL)
       FUNCTION
       OPERANDS
       SYNTAX
```

Parameters

* To omit this positional parameter when using the HELP keyword.

**UDP_header_address**
The address of a UDP header or the symbol for the address.

*Note:* The UDP header has no version or identifier, so it is not possible to definitively recognize a UDP header given an address in storage. Therefore, this command formats the storage assuming it is a UDP header.

**skdb_address**
The address of an SKDB control block or the symbol for the address.

**skmb_address**
The address of an SKMB control block or the symbol for the address.

**HELP**
Display UDPhdr usage and syntax information.

**ALL**
Displays help about the function, operands, and syntax information for the UDPhdr command. ALL is the default.

**FUNCTION**
Display only function help information.

**OPERANDS**
Display only operands help information.

**SYNTAX**
Display only syntax help information.

**Rule:** If you specify multiple keywords from the set {ALL, FUNCTION, OPERANDS, SYNTAX}, all of the keywords that you specify are used.

Sample output of the UDPhdr command

The following is a sample output of the UDPhdr command:

```
UDPHDR 08D0A0DB
UDP Header at 08D0A0EC
08D0A0EC 04B700A1 0033CD23 | ...~....         |
Source port : 1031
Destination port : 161
```
Installing TCP/IP IPCS subcommands by using the panel interface

To use the panel interface to the TCP/IP IPCS subcommands, you can either display the panels using an IPCS command or connect the TCP/IP ISPF panels to an existing ISPF panel. No additional installation steps are required to display the panels using an IPCS command. To connect the TCP/IP ISPF panels to an existing panel, find an existing panel where you wish to add TCP/IP as an option and modify the panel. Modify the panel by adding the TCP/IP option, which processes the following command:

```
PGM(BLSGSCMD) PARM(%EZBTCPEX) NEWAPPL(EZBD)
```

where BLSGSCMD is the IPCS command, EZBTCPEX is the TCP/IP REXX exec, and EZBD is the TCP/IP key list prefix.

You can also start the TCPIP panel interface by performing the following steps:

1. Log on to TSO.
2. Access IPCS to display the IPCS Primary Option menu. Figure 27 on page 290 shows an example of an IPCS Primary Option Menu.
3. Select option 2, "ANALYSIS - Analyze dump contents".
4. Select option 6, "COMPONENT - MVS component data".
5. Scroll down to "TCPIP TCP/IP Dump Analysis" and select it.

Entering TCP/IP IPCS subcommands

You can enter the TCP/IP IPCS subcommands as an IPCS command, either by using panels provided by TCP/IP or by using the IPCS batch facility.

You can invoke the TCP/IP IPCS panels in one of the following ways:

- Invoke the panel REXX exec as an IPCS subcommand. Follow the steps above for entering a TCP/IP IPCS subcommand using the IPCS Subcommand Entry panel and enter the command:

  EZBTCPEX

- Invoke the TCP/IP IPCS panels by selecting the option provided in the installation section above.

For either method, you should see the main menu for the TCP/IP IPCS commands shown in Figure 26 on page 290.

Select an option, and the panels prompt you for additional menu choices or input for the specific TCP/IP IPCS subcommand you select. After all input has been selected, the TCP/IP IPCS subcommand is invoked using the current default dump data set. If the dump data set is for Telnet, only the commands indicated "Available for Telnet" in the IPCS command list provide data. The commands not supported by Telnet return no data.

Restriction: For those TCP/IP IPCS subcommands that support storage addresses as input, a panel is displayed with a List field where you can enter multiple addresses for the subcommand. The List field only supports 31-bit storage addresses. 64-bit storage addresses are not supported. If you are interested in a specific 64-bit storage address related to a subcommand, invoke the subcommand without specifying any addresses in the List field. The resulting display includes the 64-bit storage addresses. You can then use the IPCS FIND command to locate the 64-bit storage addresses that you are interested in.
Figure 26. Main menu for TCP/IP IPCS subcommands.

See z/OS Communications Server: New Function Summary for information regarding VTAM IPCS commands.

Steps for entering a TCP/IP IPCS subcommand

Enter a TCP/IP IPCS subcommand by using the IPCS Subcommand Entry panel.

Procedure

Follow these steps to enter a TCP/IP IPCS subcommand:

1. Log on to TSO.
2. Access IPCS to display the IPCS Primary Option Menu. Figure 27 on page 290 shows an example of an IPCS Primary Option Menu.

3. Select option 4, COMMAND.

4. Type the TCP/IP IPCS subcommand. Figure 28 on page 291 shows the IPCS Subcommand Entry panel with a subcommand entered.
Step for using the batch option
Access IPCS commands by using the batch processing interface.

Procedure
Perform the following step:
• Prepare the JCL data set.

See z/OS MVS IPCS User’s Guide and z/OS MVS IPCS Commands.

The following is a sample command (single command):

%TCPIPCS TELNET (* DETAIL)
Part 3. Diagnosing z/OS Communications Server components
Chapter 7. Diagnosing problems with the z/OS Load Balancing Advisor

The z/OS Load Balancing Advisor is a system that comprises outboard load balancers (LBs), an Advisor, and one or more Agents.

This topic discusses problem diagnosis of the Advisor and Agents and includes the following sections:

- “Diagnostic data” on page 295
- “Diagnosing Advisor and Agent problems” on page 296
- “Debug settings and corresponding syslogd priority levels” on page 299

Tip: For diagnosing problems with the load balancer, see the appropriate load balancer documentation.

Diagnostic data

You might need to collect multiple pieces of data to accurately diagnose problems. For example, the following might be useful:

- Console messages for Advisor and Agents
- Output from the MODIFY command for the Advisor and Agents
- syslogd log messages for Advisor and Agents (possibly including debug level trace)
- Advisor and Agent address space dumps and snap output
- Packet traces of Load Balancer data
- TCP/IP CTRACE of Agents and possibly the Advisor
- Netstat displays on TCP/IP stacks managed by Agents
- SNMP information

Guideline: syslogd does not have to be running to run the Advisor or Agents; however, syslogd is the only logging facility that either the Advisor or its Agents is capable of using. Useful diagnostic information might be lost if syslogd is not running before the Advisor or Agents are run.

The Advisor and Agent trigger address space dumps when certain unexpected error conditions are encountered. Both a CEEDUMP and address space snap output are produced and written to the data sets or files that are specified by the start procedure CEEDUMP and CEESNAP DD statements, respectively.

If the Advisor or Agent abnormally terminate (for example a 0Cx abend occurs), an unformatted SYSMDUMP is produced and written to the data set that is specified by the start procedure SYSMDUMP DD statement. If you override the Language Environment run-time option TERMTHDACT during the installation or start procedure, the SYSMDUMP might not be produced, or a CEEDUMP might be produced instead. Therefore, you should not override the TERMTHDACT run-time option. See z/OS Language Environment Programming Guide for more information about run-time options.

In other situations, the z/OS operator might need to dump the address space manually.

Packet trace data of Server/Application State Protocol (SASP) protocol messages that are sent between the Advisor and LBs might be needed. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details about how to use the IP packet trace facility.

Restriction: When encrypting data, the packet trace data will be encrypted. Use MESSAGE level log messages instead.

The TCP/IP CTRACE trace of the Agents provides some information about data that has been collected from the TCP/IP stack for determining availability and desirability metrics. If the Agent is managing a CINET environment, a TCP/IP CTRACE might be needed in each TCP/IP stack. A TCP/IP CTRACE on the
Advisor or Agent TCP/IP stack might also show data that is flowing between the Agents and Advisor. On the Agent TCP/IP stack, the SOCKET, INTERNET, and IOCTL CTRACE options are useful. On the Advisor TCP/IP stack, the INTERNET and SOCKET options are useful. See “Component trace” on page 43 for more information.

The following Netstat displays on stacks that are managed by Agents might be useful:

**HOME**
- Indicates which interfaces exist and which stack owns them

**ALLCONN**
- Indicates the listening TCP sockets and UDP end-points

SNMP information gives information similar to Netstat displays.

## Diagnosing Advisor and Agent problems

This topic includes diagnostic information about Advisor and Agent problems.

### Abends

Messages and error-related information are usually sent to the MVS system console when an abend on the Advisor or Agent occurs. Perform a dump of the error unless the symptoms already match a known problem.

### Workload not distributed to a particular application

Use the following checklist to determine why workload is not being distributed to an application:

- **Verify** that the Advisor is running and that an Agent is running on the MVS system that contains the application. If they are not running, start the Advisor or Agent.

- **Verify** if you are using sysplex subplexing, verify that the Advisor and Agents are in the same subplex. If there are multiple TCP/IP stacks in a subplex, ensure the IP addresses used by the Advisor and Agents are DVIPAs defined within a VIPARANGE statement on each of the stacks in the subplex. Review the syslog for the Advisor and Agents for messages indicating what subplex had been used. Each subplex must have an active Advisor associated with it, and each subplex in a z/OS system must have an Agent associated with it.

- **Issue** display commands on the Advisor to determine whether any LBs have registered the application. Verify that the LB is connected to the Advisor. If you are using sysplex subplexing, ensure that the load balancers have connectivity to the Advisor's subplex.

- **Verify** that the Advisor's lb_id_list statement includes the IP address of the LB in question if not using AT-TLS.

- **Verify** that the IP address and protocol of the member on the LB match the IP address and protocol of the application. If the IP addresses or protocols do not match, correct the definition at the LB.

- **Verify** that the Advisor's agent_id_list statement contains the IP address and port that the Agent is bound to on the system where the application exists, if not using AT-TLS. If it does not match and you are not using AT-TLS, correct the agent_id_list statement on the Advisor or the advisor_id statement on the Agent.

- **Verify** that network connectivity exists between the Advisor and the Agent in question. Unexpected loss of network connectivity between the two should result in an immediate action console message and related messages in the Agent and Advisor log. Issue NETSTAT CONN or NETSTAT ALLCONN commands on the Advisor system to see which Agents have connections to the Advisor, and by omission, which do not. Issue the MODIFY DISPLAY command on the Agents in question to verify that the connection to the Advisor is still active. The DISC flag is shown on the MODIFY DISPLAY command when the Agent is not connected to an Advisor. Correct the underlying network connectivity problem. For more information, see Chapter 4, “Diagnosing network connectivity problems,” on page 25.

- **Verify** if using AT-TLS with SERVAUTH access control checks to validate connections between the Advisor, Agents, and external load balancers, see Chapter 27, “Diagnosing Application Transparent Transport
Layer Security (AT-TLS),” on page 637. In addition, ensure that the SERVAUTH class is active. Ensure that the EZB.LBA.LBACCESS.sysname.tcpysplexgroupname resource profile is defined and that the user ID associated with the external load balancer has READ access to it. Ensure that the EZB.LBA.AGENTACCESS.sysname.tcpysplexgroupname resource profile is defined and that the Agents have READ access to it. On the system console where the Advisor is running, look for message EZD1280I which indicates that a connection attempt using AT-TLS failed. This message has specific reason codes which indicate the reason for the failure.

- Issue display commands on the Advisor and Agent in question to verify that the application is available and enabled (not quiesced). Start the application or enable the application using the Agent MODIFY ENABLE command.
- Check the log file for ERROR or WARNING messages and take the appropriate corrective action. If ERROR and WARNING level log messages are not enabled, enable them and recheck the log file later.
- Verify that the LB has connectivity to the IP address of the member in question.

Workload not distributed as expected

Use the following checklist to diagnose workload distribution problems:

- Verify that the Advisor's update interval value is not inordinately large. The Advisor must wait at least two update intervals before beginning to receive enough data to properly calculate weights when an application becomes available or when an Agent is started.

  Allow at least three update intervals to expire after an application is started before re-examining the distribution of workload. If workload is occasionally being sent to overloaded applications or systems, adjust the update_interval downward so workload distribution can react more quickly to the pace of new workload requests.

- Periodically issue display commands on the Advisor to check the weights of members within the group in question. Determine whether the weights are consistent with the expected behavior. If the weights are not consistent with expected behavior, see z/OS Communications Server: IP System Administrator's Commands for more information about how to analyze the member weights; if all releases in the sysplex are not V1R9 or above, note the restrictions and limitations described in this section. If these are consistent with the expected behavior, investigate the problem at the LB. For more information, see z/OS Communications Server: New Function Summary.

- Verify that the Advisor's agent_id_list value contains the IP addresses and ports that each Agent is bound to on the MVS systems where the application exists, if not using AT-TLS. If it does not match and you are not using AT-TLS, correct the agent_id_list statement on the Advisor or the advisor_id statement on the Agent.

- If using AT-TLS with SERVAUTH access control checks to validate connections between the Advisor, Agents, and external load balancers, see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637. In addition, ensure that the SERVAUTH class is active. Ensure that the EZB.LBA.LBACCESS.sysname.tcpysplexgroupname resource profile is defined and that the user ID associated with the external load balancer has READ access to it. Ensure that the EZB.LBA.AGENTACCESS.sysname.tcpysplexgroupname resource profile is defined and that the Agents have READ access to it. On the system console where the Advisor is running, look for message EZD1280I which indicates that a connection attempt using AT-TLS failed. This message has specific reason codes which indicate the reason for the failure.

- Issue display commands at the Advisor to make sure that members of the group in question are not unexpectedly quiesced or unexpectedly unavailable (AVAIL status is NO).

  If AVAIL is NO because sysplex problem detection and recovery issued message EZD1973E then the TCP/IP stack must either be restarted or at least 10 minutes must pass from the last occurrence of the problem (for example, an abend). See the Sysplex problem detection and recovery section in z/OS Communications Server: IP Configuration Guide for more information.

- Issue display commands at the Advisor for all system-level members in the sysplex to verify that the MVS systems have the expected residual capacity.
• Check the log file for ERROR or WARNING messages and take the appropriate corrective action. If ERROR and WARNING level log messages are not enabled, enable them and recheck the log file later.

**Advisor or Agent appears to be hung**

Verify that the Agent or Advisor is actually hung by issuing a MODIFY procname,DISPLAY,DEBUG command. If no response is received, then attempts to stop (not cancel) the application. If the application does not terminate, the application is hung. If the hang occurred while DEBUG-level Advisor or Agent trace was in effect, collect the following problem documentation and call IBM Service.

• Take an SVC dump of the Agent or Advisor address space (depending on which application is hung) and of the OMVS address space including its data spaces.
• Capture the MVS console messages.
• Capture the application (Agent or Advisor) log messages written to syslogd.

If DEBUG-level trace was not in effect at the time, turn on DEBUG-level Advisor or Agent trace, reproduce the problem, collect the problem documentation previously mentioned, and call IBM Service.

**Group names in displays are indecipherable**

When LBs define group names, the names are coded in UTF-8 format. This character set is a superset of the EBCDIC character set; therefore, not all characters are translatable to EBCDIC. Rename the group names in the LBs to use characters limited to the ASCII character set.

**Load balancer connection terminates unexpectedly**

Check the following:

• Verify the load balancer administrator has not shut down the load balancer.
• Verify that TCP/IP connectivity still exists between the load balancer and the Advisor (for example, from the Advisor host, ping the address of the load balancer).
• Check the Advisor's log file for ERROR or WARNING messages and take the appropriate corrective action. If you see an ERROR message indicating a send() operation failed with "errno = EDC8102I Operation would block" you might have too many groups or members registering from the load balancer. Increase the TCPSENDDBFRSIZE parameter of the TCP_CONFIG PROFILE.TCPIP statement, or register fewer groups and members from the load balancer, and then try the operation again. If ERROR and WARNING level log messages are not enabled, enable them, repeat the operation, and recheck the log file again.

**Tip:** Keep in mind that the Advisor has an internal maximum message size of 128K bytes. If this limit is exceeded, the connection is closed and an error message is logged stating that the message is too large and was not received.
• Check the load balancer for errors.

**Agent-Advisor connection terminates unexpectedly**

Check the following:

• Verify that the Agent's MVS operator has not shut down the Agent.
• Verify that TCP/IP connectivity still exists between the Agent and the Advisor.
• Check the Advisor's log file for ERROR or WARNING messages and take the appropriate corrective action. If you see an ERROR message indicating a send() operation failed with errno = EDC8102I Operation would block, you might have too many groups or members registered that belong to the same Agent. Increase the TCPSENDDBFRSIZE parameter of the TCP_CONFIG PROFILE.TCPIP statement, or register fewer groups and members belonging to the Agent. Then try the operation again.

**Tip:** Keep in mind that the Advisor and Agent have an internal maximum message size of 128KB. If this limit is exceeded, the connection is closed and an error message is logged, which states that the message is too big and was not received.
If ERROR and WARNING level log messages are not enabled, enable them, repeat the operation, and recheck the log file again.

- Check the Agent’s log for errors.
- Connectivity can be dropped between the Advisor and Agents if processing slows down too much (due to lots of registered members and/or high debug levels) and the update_interval is configured too low. Using AT-TLS could increase the possibility of this happening. Try increasing the update_interval.

**Automatic restart manager (ARM) registration failure**

Failure of the Advisor or Agent to properly register with ARM is indicated by a warning-level message written to the log file. This log message is a result of the IXCARM call failing with the return code and reason codes indicated in the log message. See z/OS MVS Programming: Sysplex Services Reference for information about interpreting the IXCARM return code and reason code.

One of the common causes of failure is the lack of a security profile. See the EZARACF sample for instructions on how to add an ARM security profile for the application.

When you are using sysplex subplexes, do the following:

- Define an ARM policy with the TARGET_SYSTEM keyword to indicate which systems the element can be restarted on to ensure that the application is restarted only on a system that is in the same subplex.
- Restart the Advisor and Agent on a VTAM system that has been started with an XCFGRPID start option that corresponds with the vv portion of the sysplex_group_name in the Advisor and Agent configuration files, and has an available TCP/IP stack with a GLOBALCONFIG XCFGRPID parameter that corresponds with the tt portion of the sysplex_group_name in the Advisor and Agent configuration files.
- If there are multiple TCP/IP stacks in a subplex, ensure the IP addresses used by the Advisor and Agents are DVIPAs defined within a VIPARANGE statement on each of the stacks in the subplex.

**Debug settings and corresponding syslogd priority levels**

Table 16 on page 299 summarizes the available debug levels and their associated syslogd priority levels.

<table>
<thead>
<tr>
<th>Logging category/Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None — 0</td>
<td>No messages of any kind are sent to the logging file after initialization is complete.</td>
</tr>
<tr>
<td>ERROR — 1</td>
<td>Error messages indicate something that requires attention. Messages at this level could be fatal (terminating) or could indicate that an important part of the workload advising system is not working properly. This information is logged at the syslogd ERROR priority level.</td>
</tr>
<tr>
<td>WARNING — 2</td>
<td>Warning messages indicate that an error has occurred, but it is not severe enough to warrant an ERROR. Corrective action might be necessary because the Advisor or Agent might not be behaving as intended. This information is logged at the syslogd WARNING priority level.</td>
</tr>
<tr>
<td>Logging category/Level</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>EVENT — 4</td>
<td>Event messages are logged for things that happen periodically, like operator commands, UNIX signals, timer pops, receipt of a network message, and so on. This information is logged at the syslogd NOTICE priority level.</td>
</tr>
<tr>
<td>INFO — 8</td>
<td>Informational messages are sent to the logging file. These messages do not require corrective action. This information is logged at the syslogd INFO priority level.</td>
</tr>
<tr>
<td>MESSAGE — 16</td>
<td>Message messages concern the detailed contents of message packets that are sent between the Advisor and LB, or between the Advisor and Agent. These can be used to assist debugging Advisor/LB and Advisor/Agent communications. This information is logged at the syslogd DEBUG priority level. This level is intended for IBM service use only.</td>
</tr>
<tr>
<td>COLLECTION — 32</td>
<td>Collection messages concern the details of collecting and manipulating the data that forms the basis of weight calculations. This information is logged at the syslogd DEBUG priority level. <strong>Restriction:</strong> COLLECTION is only used by the Agent. This level is intended for IBM service use only.</td>
</tr>
<tr>
<td>DEBUG — 64</td>
<td>Debug messages are intended for Development or Service and give detail that customers would not normally want. The intention of this level of message is to provide information that is useful in debugging code, logic, or timing errors. This information is logged at the syslogd DEBUG priority level. This level is intended for IBM service use only.</td>
</tr>
<tr>
<td>TRACE — 128</td>
<td>Trace messages are intended for Development or Service to track code processing (footprints). This information is logged at the syslogd DEBUG priority level. This level is intended for IBM service use only.</td>
</tr>
</tbody>
</table>
Chapter 8. Diagnosing problems with the automated domain name registration application (ADNR)

The automated domain name registration (ADNR) application is a function that dynamically updates name servers with information about sysplex resources in near real time. The DNS names managed by ADNR can be names that represent all instances of an application within the sysplex, names that represent a specific instance of an application within the sysplex, names that represent the entire sysplex, or names that represent individual systems within the sysplex. ADNR communicates with the z/OS Load Balancing Advisor, specifically the Advisor application, which architecturally is a Global Workload Manager (GWM) according to the Server/Application State Protocol (SASP). The Advisor application from the z/OS Load Balancing Advisor is the only GWM with which ADNR is designed to interact. All references to a GWM in this topic see the Advisor application of the z/OS Load Balancing Advisor.

Diagnostic data

You might need to collect multiple pieces of data to accurately diagnose problems, such as the following:

- Console messages for ADNR
- syslogd log messages for ADNR (possibly including DEBUG - 64 level trace)
- Name server log data for the name servers that are managed by ADNR
- ADNR address space dump and snap output
- SYSTCPIP CTRACE for the TCP/IP stack where ADNR and the GWM are running
- Packet traces of GWM data
- Netstat displays for the connection between ADNR and the GWM
- A listing of the zone data from the managed name server or name servers

Note: syslogd is the only logging facility that ADNR uses. Useful diagnostic information might be lost if syslogd is not running before you run ADNR.

ADNR triggers address space dumps when certain unexpected error conditions are encountered while communicating with a GWM. Just after connecting to the GWM, ADNR enters a negotiation phase. During negotiation, a series of architected SASP requests are sent to the GWM; for each request, an architected SASP reply is received from the GWM. If the negotiation does not successfully complete, ADNR closes the connection, increases the logging level, establishes a new connection to the GWM, and retries the negotiation.

If the negotiation fails a second time, ADNR dumps its address space; the dump title header is ADNR Dump - Neg Failed and the logging level is restored to its original configured value and the connection is closed. Retries continue at 1 minute intervals using the configured logging level.

After completing the negotiation phase, the GWM might send an unsolicited SendWeights message to ADNR; the message contains information about the changed state of resources that the ADNR application registered to the GWM during negotiation. If the SendWeights message contains an architectural error, ADNR closes the connection, increases the logging level, establishes a new connection to the GWM, and completes negotiation with the GWM. If the next SendWeights message received from the GWM contains an error, ADNR dumps its address space; the dump title header is as follows:

ADNR Dump - Rcv Failed

The logging level is restored to its original configured value and the connection is closed. Retries continue at 1 minute intervals using the configured logging level.
These types of errors generally occur because incompatible levels of maintenance are applied to the GWM and ADNR. After being started, ADNR dumps its address space only once when these types of errors are detected. For further diagnosis, collect the ADNR log and address space dump. Review the log to determine the type of error that occurred. Review the PTF requirements of any recently installed PTFs. If you cannot correct the problem with additional maintenance or a configuration change, then contact IBM Service.

For other types of errors, both a CEEDUMP and address space snap output might be produced and written to the data sets or files that are specified by the start procedure CEEDUMP and CEESNAP DD statements, respectively.

If ADNR abnormally terminates (for example an 0Cx abend occurs), then an unformatted SYSMDUMP is written to the data set that is specified by the start procedure SYSMDUMP DD statement. If you override the Language Environment run-time option TERMTHDACT during the installation or start procedure, then the SYSMDUMP may not be produced, or a CEEDUMP may be produced instead. Therefore, you should not override the TERMTHDACT run-time option. See z/OS Language Environment Programming Guide for more information about Language Environment runtime options.

In other situations, the z/OS operator might need to dump the ADNR address space manually. See z/OS MVS Diagnosis: Tools and Service Aids for more information about obtaining a dump.

SYSTCPD CTRACE (packet trace) data of the SASP protocol messages sent between ADNR and GWM may be needed. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details about how to use the IP packet trace facility.

Restriction: When encrypting data, the packet trace data will be encrypted. Use MESSAGE level log messages instead.

A SYSTCPIP component trace on the TCP/IP stacks used by ADNR and its associated GWM shows data that is flowing between them. Start the trace by specifying OPTIONS=(PFS,TCP,UDP,INTERNET),JOBNAME=(server) on both stacks, where the server value is the ADNR or GWM address space (or both names separated by a comma if they are using the same stack). See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for more information.

You can dump the contents of the DNS zones managed by ADNR by issuing the domain information grouper (dig) command from z/OS UNIX:

```
dig @server zone axfr -p port -k key_file 2>zone_xfer.err 1>zone_xfer.out
```

where

<table>
<thead>
<tr>
<th>server</th>
<th>The server IP address or host name which contains the zone managed by ADNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>zone</td>
<td>The zone being managed by ADNR whose contents are being dumped</td>
</tr>
<tr>
<td>port</td>
<td>Optionally specify the port number which the DNS server is listening on for queries</td>
</tr>
<tr>
<td>key_file</td>
<td>Optionally specify the key file that is used to sign transactions for this zone</td>
</tr>
<tr>
<td>zone_xfer</td>
<td>Redirect the stdout and stderr file streams of the command to two distinct z/OS UNIX files.</td>
</tr>
</tbody>
</table>

See z/OS Communications Server: IP System Administrator's Commands for more information about the dig command.

The following Netstat command displays stacks that have affinity with ADNR:

```
ALLConn/-a, C0nn/-c
```

This command is used to determine whether there is an active connection between ADNR and the GWM. ALLConn/-a displays information for all TCP connections and UDP sockets, including some recently closed ones. C0nn/-c displays information about each active TCP connection and UDP socket. See z/OS
Diagnosing ADNR problems

This topic includes diagnostic information about ADNR problems.

Abends

Messages and error-related information are usually sent to the MVS system console when an abend on ADNR occurs. Perform a dump of the error unless the symptoms already match a known problem.

ADNR fails to initialize

Problems with the configuration file are the most common cause for ADNR failure during initialization. This class of problems is identified by a console message. However, failure to give the ADNR load module proper APF authorization will not result in an ADNR termination message on the console or in the syslog. In this particular case, the failure message is sent to the SYSOUT data set. If the sample ADNR started procedure is used, then this output appears in the ADNR job log.

ADNR not communicating with the Global Workload Manager

ADNR communicates with only one GWM. Use the following information to diagnose why ADNR fails to communicate with the GWM.

**Restriction:** ADNR supports only the z/OS Load Balancing Advisor application as the GWM.

- Verify that ADNR is running. If it is not running, then start ADNR.
- Verify that the GWM is running. If it is not running, then start the GWM. See Chapter 7, “Diagnosing problems with the z/OS Load Balancing Advisor,” on page 295 for more on z/OS Load Balancing Advisor problems.
- Verify network connectivity exists between the GWM and ADNR.
  - Issue display commands on the GWM (by using the MODIFY command) to determine whether ADNR is connected to the GWM and has registered its group and member data. For more information about the MODIFY command see z/OS Communications Server: IP System Administrator's Commands. If not using AT-TLS, verify that the z/OS Load Balancing Advisor's lb_id_list statement includes the IP address on the host_connection_addr parameter in the gwm statement in the ADNR configuration file. The eventual action message, EZD1272E will persist on the console if communication with a GWM does not exist.
  - If using AT-TLS with SERVAUTH access control checks to validate connections between the Advisor and ADNR, see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637. In addition, ensure that the SERVAUTH class is active. Ensure that the EZB.LBA.LBACCESS.sysname.tcpip.sysplexgroupname resource profile is defined and that the load balancer and ADNR have READ access to it. On the system console where the Advisor is running, look for message EZD1280I which indicates that a connection attempt using AT-TLS failed. This message has specific reason codes which indicate the reason for the failure.
  - If you are using sysplex subplexing, ensure that the ADNR application does the following:
    - Has connectivity to the Advisor's subplex.
    - Is using one of the TCP/IP stacks in this subplex; when in a common INET (CINET) environment with multiple TCP/IP stacks on one MVS system, either by establishing affinity to one of the stacks in the subplex or by binding to a VIPA that is only defined on stacks that are in that subplex. See the adnrproc.sample for an example of the JCL to establish affinity.
- Verify that network connectivity exists between ADNR and the GWM in question. Issue Netstat CONn/-c or Netstat ALLConn/-a commands on the ADNR system to see whether a connection exists between ADNR and the GWM. Correct the underlying network connectivity problem. For guidance on using Netstat commands see z/OS Communications Server: IP System Administrator's Commands.

- Issue a display command on ADNR to determine whether there are indications that any groups and members are known to exist within the sysplex. For more information about the MODIFY command see z/OS Communications Server: IP System Administrator’s Commands.

- Check the syslogd output file where ADNR writes its log data for ERROR or WARNING messages and take the appropriate corrective action. If ERROR and WARNING level log message are not enabled, then enable them and recheck the log file later. The current ADNR debug level can be displayed by issuing the MODIFY proclname,DISPLAY,DEBUG command at the MVS console. The debug level can be dynamically changed by issuing the MODIFY proclname,DEBUG,LEVEL=n command at the MVS console. The proclname is the JCL procedure name for ADNR and n is the new debug level. For more information about the MODIFY command, see z/OS Communications Server: IP System Administrator’s Commands.

Automatic restart manager (ARM) registration failure

Failure of ADNR to properly register with ARM is indicated by a warning-level message written to the log file. This log message is a result of the IXCARM call failing with the return code and reason codes indicated in the log message. See z/OS MVS Programming: Sysplex Services Reference for information about interpreting the IXCARM return code and reason code.

One of the common causes of failure is the lack of a security profile. See the EZARACF sample for instructions on how to add an ARM security profile for the application. Ensure that each instance of ADNR is configured to use an ARM element name that is unique within the sysplex. Use the arm_element_suffix configuration statement to specify a unique suffix for the element name.

ADNR not updating zones in a DNS server

Use the following information to determine why changes to host names are not being updated in the DNS server zone being managed by ADNR:

- Verify that ADNR is running. If it is not running then start ADNR.

- If message EZD1278E or EZD1257I has been issued, see “Diagnosing unresponsive zones” on page 305.

- Issue display commands with the ADNR MODIFY command to determine whether it is connected to the GWM and has registered its group and member data. If not using AT-TLS, verify that the z/OS Load Balancing Advisor’s lb_id_list value includes the IP address of ADNR specified with the host_connection_addr keyword of the gwm statement.

If using AT-TLS with SERVAUTH access control checks to validate connections between the Advisor and ADNR, see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637. In addition, ensure that the SERVAUTH class is active. Ensure that the EZB.LBA.LBACCESS.sysname.tcpysplesxgroupname resource profile is defined and that the load balancer and ADNR have READ access to it. On the system console where the Advisor is running, look for message EZD1280I which indicates that a connection attempt using AT-TLS failed. This message has specific reason codes which indicate the reason for the failure.

- Check the log file for any ADNR ERROR or WARNING messages and take the appropriate corrective action. If ERROR and WARNING level log messages are not enabled, then enable them and recheck the log file later. For more information about the ADNR display commands see z/OS Communications Server: IP System Administrator's Commands.

- Ensure that the ADNR configuration is not changed when ADNR is not active. Removing a dns statement or zone parameter while ADNR is not active causes ADNR to lose control of the information in that name server’s zones. The information in this case is considered to be orphaned.
DNS name servers managed by ADNR contain incorrect or outdated data

Use the following information to determine why zones being managed by ADNR contain incorrect or outdated information:

- Verify that ADNR is communicating with the GWM and its managed name servers.
- Verify that ADNR is able to communicate with the managed DNS name server’s zones.
- Ensure that the ADNR configuration file is not changed when ADNR is not active. Removing a dns statement or zone parameter while ADNR is not active causes ADNR to lose control of the information in that name server’s zones. The information in this case is considered orphaned and goes stale. These types of configuration file changes should be made while ADNR is active and applied by using the MODIFY procname,REFRESH command to avoid orphaned data in the name server; ADNR deletes the information in the name server that is associated with the removed dns statement or zone parameter.
- Verify that the zones in the name servers managed by ADNR have not been updated by any entity other than ADNR. This includes manual updates to the zone data files, updates from DHCP servers, or other nsupdate clients. Failure to abide by this restriction can result in lost DNS records and ADNR zone update failures.
- Verify that the update interval of the GWM is not longer than you expect. The GWM update interval dictates how frequently ADNR receives data from the GWM and consequently, how frequently the managed name servers are updated with that data. Lower the update interval on the GWM if you need the managed name servers to have data that more closely follows the actual availability status of the sysplex resources they represent. ADNR waits a certain time after ADNR initialization and after a dynamic update to ensure that all of the sysplex data has been reported before attempting to update its managed name servers. When the GWM is the z/OS Load Balancing Advisor (Advisor) application, the Advisor’s update_interval statement determines the time that ADNR waits; specifically two times the update_interval received from the GWM. If the ttl keyword under a zone parameter of the ADNR DNS statement is defaulted to use the value from the GWM’s update_interval statement, then that value is used as the time-to-live value for the DNS resource records for that zone
- If the ttl value for a zone is defaulted as described in the previous bullet, ensure the resource records in the name server for that zone reflect this value.

Diagnosing unresponsive zones

Messages EZD1278E and EZD1257I indicate when a zone is unresponsive and identify an unresponsive zone. An unresponsive zone does not accept updates or queries for information from ADNR. Unresponsive zones cause other symptoms, such as zones in a name server not being updated at all, or failure of the zone to contain up-to-date information regarding the status of resources in the sysplex. Use the following information to determine why a zone is not responsive.

- Issue display commands through the ADNR MODIFY command to determine whether the name server is responding. A name server managed by ADNR can be comprised of one or more zones. A MODIFY procname,DISPLAY,DNS,DETAIL command shows a count of the number of zones defined under a dns statement and a count of the number of zones under that dns statement that are active. When all of the zones managed by a DNS server controlled by ADNR are not responding then the DNS server is considered dead. ADNR makes periodic probes to determine whether the zones for a dead server respond positively.
- Verify that the DNS server being used supports RFC 2136, Dynamic Updates in the Domain Name System (DNS UPDATE). Review your DNS server’s documentation.
- Verify the DNS name server is running and responsive by issuing the dig or nsupdate command for the zone. If it is not running then start the DNS server. See z/OS Communications Server: IP System Administrator’s Commands, Querying and administrating a Domain Name System (DNS), for guidance on using the nslookup, dig and nsupdate commands.
- Verify that network connectivity exists for the DNS server as it must be listening on the IP address and port number specified by the server parameter value (IP address) of the dns statement in the ADNR configuration. Unexpected loss of network connectivity for the DNS server will result in a console message and related messages in the DNS log. Correct the underlying network connectivity problem.
For guidance on using Netstat commands see z/OS Communications Server: IP System Administrator’s Commands.

- Review your firewall’s log files to verify a firewall is not blocking communications between the system where ADNR resides and the name server on the port where the name server is listening for queries.

- Verify the name server being used is listening at the IP address and port that is specified by the dns_id parameter of the dns statement in the ADNR configuration file. For DNS BIND9, the IP addresses and ports the DNS server will listen on may be specified by the listen-on and listen-on-v6 DNS option statements.

- Verify that the name server IP address, optional port, zone domain suffix names, and optional Transaction Signature (TSIG) keys are correctly specified in the ADNR configuration file.

- Verify that the DNS name server specified in the ADNR dns statement actually manages the zone specified by the domain_suffix parameter of the ADNR dns statement and is the authoritative, primary master name server for the zone. For DNS BIND9 on the name server’s zone configuration statement, the type master option is used to specify that the server is an authoritative master. The name server managing this zone must be configured for the specified zone before ADNR can add DNS records to it. ADNR cannot dynamically create a zone in a name server. It can only add records to a zone that already exists.

- Verify that ADNR has the authority to manage the DNS resource records contained in this zone including the authority to request and receive zone transfers and perform dynamic updates. See Automated Domain Name Registration in z/OS Communications Server: IP Configuration Guide, for guidance on authorizing ADNR.

- Verify that the transaction security (TSIG) keys represented in the update and transfer keys (if specified in the ADNR configuration file) match those specified in the DNS name server for the zones ADNR is managing.

- Verify that the name server is configured with the same key names that ADNR is configured to use for the zone. Even if the name server configuration does not require a key to update or transfer an ADNR managed zone, the keys must at least be configured to the name server if ADNR is configured to use a key for that zone. If your security policies do not require you to use an update or a transfer key, they should be removed from the ADNR configuration, otherwise, the keys should be configured to the name server and used to restrict which entities are allowed to update the zone and request zone transfers.

- Verify that the name server’s working directory did not run out of disk space. ADNR makes dynamic updates to name servers. Many name server implementations require that dynamic updates be written to disk. If a name server is unable to do this, the dynamic updates from ADNR will fail causing the zone to go unresponsive. In this case, the zone emerges from the unresponsive state spontaneously, but again returns to the unresponsive state. This cycle will repeat until the storage problem on the name server host is corrected.

- Verify that the zone specified on the zone_label keyword of the ADNR dns configuration statement is not a DNSSEC signed zone. ADNR does not support the use of zones signed by DNSSEC.

- Verify that OMVS has not run out of file descriptors. See the DISPLAY OMVS command in z/OS MVS System Commands for information about how to make this determination.

**ADNR appears to be hung**

Verify that ADNR is actually hung by first issuing a MODIFY procname,DISPLAY,GWM command. If no response is received then attempt to stop (not cancel) the application. See z/OS MVS System Commands, STOP command subsection for more information about stopping an address space. If the application does not terminate, then the application is hung. If the hang occurred while the debug-level ADNR trace was in effect, then collect the following problem documentation and call IBM Service:

- Take an SVC dump of the ADNR address space
- Take an SVC dump of TCP/IP address space
- Take an SVC dump of the OMVS address space including its data spaces
- Capture the MVS console messages
- Capture the ADNR log messages written to syslogd
If the ADNR debug-level trace was not in effect at the time, then turn on the debug-level ADNR trace, reproduce the problem, collect the problem documentation, and call IBM Service.

**ADNR connection to the GWM terminates unexpectedly**

Determine whether the GWN is available, that TCP/IP connectivity still exists between ADNR and the GWM, and check for error and warning messages.

**Procedure**

Check the following:

- Verify that the load balancing administrator has not shut down the GWM advising ADNR.
- Verify that TCP/IP connectivity still exists between ADNR and the GWM (for example, from the ADNR host, ping the address of the GWM). See Monitoring the TCP/IP network, Ping subsection, in *z/OS Communications Server: IP System Administrator’s Commands*, for further information about ping.
- Check ADNR's log file for ERROR or WARNING messages and take the appropriate corrective action. If ERROR and WARNING debug level log messages are not enabled, then enable them, repeat the operation, and recheck to log file again. See Modify command -- Automated Domain Name Registration in *z/OS Communications Server: IP System Administrator’s Commands*, for further information about enabling ADNR's debug levels.
- Check the GWM for errors.

**Debug settings**

The value specified by the ADNR debug_level configuration option determines the ADNR logging levels. See *z/OS Communications Server: IP Configuration Reference*, Automated Domain Name Registration, Automated Domain Name Registration configuration file section for more on ADNR logging levels. The values may be added together to trace multiple logging categories. See *z/OS Communications Server: IP System Administrator’s Commands*, Operator commands and system administration, Modify command, Modify command -- Automated Domain Name Registration subsection for further information about displaying and changing ADNR's debug levels.

- When a problem occurs communicating with a DNS zone, then specifying a debug level of COLLECTION -32 causes ADNR to log the Nsupdate and Dig commands, and responses against the DNS zone. This data is the exact Nsupdate and Dig client commands and any associated responses
- When ADNR is not able to communicate with a GWM, then specifying a debug level of MESSAGE record (16) causes ADNR to log the SASP flows.
Chapter 9. Diagnosing IKE daemon problems

This topic describes how to diagnose IKE daemon problems, and contains the following subtopics:

• “Overview of diagnosing IKE daemon problems” on page 309
• “Diagnosing IKE daemon problems” on page 310
• “IKE daemon debug information” on page 328
• “TCP/IP services component trace for the IKE daemon” on page 329
• “Steps for enabling the CTRACE at IKE daemon startup” on page 331

Overview of diagnosing IKE daemon problems

This section provides overview information about the z/OS Internet Key Exchange (IKE) daemon and its functions.

The IKE daemon manages dynamic IPSec tunnels. The IKE daemon is not involved in the filtering, encapsulation, or decapsulation of packets. The IKE daemon is not required for the configuration or use of IP filters.

The critical elements of IP security are security associations (SAs); specifically the information that they provide about the partners of a secure communications channel, and the cryptographic algorithms and keys to be used. The z/OS IKE daemon supports two versions of the Internet Key Exchange: IKE version 1 (IKEv1) and IKE version 2 (IKEv2). The Internet Security Association Key Management protocol (ISAKMP) provides a framework for exchanging messages to automate the negotiation of security associations. The IKEv1 protocol is a hybrid protocol that conforms to the ISAKMP framework and implements a subset of the Oakley and SKEME protocols to negotiate SAs and provide authenticated keying material for SAs in a protected manner. The IKEv2 protocol is very similar to the IKEv1 protocol, in that it also negotiates SAs and provides authenticated keying material for SAs in a protected manner.

The z/OS IKE daemon implements the IKE protocol to dynamically establish SAs with peer daemons that also support these protocols. In the sections that follow, a peer daemon might be referred to as an ISAKMP server or ISAKMP peer. Also, the z/OS IKE daemon might be referred to as the IKE daemon or IKED.

The IKE daemon establishes SAs within the guidelines of internet protocol security (IP security) policy. IP security policies are defined in one or more local files that are read by the Policy Agent. The IKE daemon obtains IP security policies from the Policy Agent using the Policy API (PAPI). See z/OS Communications Server: IP Configuration Guide for more information about configuring and starting Policy Agent, as well as defining policies.

The IKE daemon establishes and installs the following types of SAs:

• A phase 1 SA. For IKEv1, this is known as an ISAKMP SA. For IKEv2, this is known as an IKE SA. Its purpose is to protect communications between IKE peers.
• A phase 2 SA. For IKEv1, this is known as an IPSec SA. For IKEv2, this is known as a child SA. Its purpose is to protect internet protocol (IP) traffic originating from, destined to, or routed by the z/OS TCP/IP stack.

The IKE daemon installs three primary types of information in the TCP/IP stack:

**Phase 2 SAs**

The IKE daemon installs established phase 2 SAs in the TCP/IP stack. On z/OS, the phase 2 SA information that is installed in the TCP/IP stack is referred to as a dynamic tunnel.
Dynamic IP filters
When the IKE daemon installs a dynamic tunnel in the TCP/IP stack, it also installs dynamic IP filters that define what IP traffic can be sent or received through the tunnel. The IKE daemon installs one inbound and one outbound dynamic IP filter with each dynamic tunnel.

Phase 1 SAs
For Sysplex-Wide Security Association (SWSA) support, the IKE daemon also installs phase 1 SA information in the TCP/IP stack. This is only done for SAs established using IKEv1. The IKE daemon only installs phase 1 SAs in a stack that is configured for SWSA support using the DVIPSEC keyword. See z/OS Communications Server: IP Configuration Guide for more information about SWSA support. For information about diagnosing SWSA problems, see “Steps for diagnosing sysplex-wide security association (SWSA) problems” on page 377.

Diagnosing IKE daemon problems
This topic contains information helpful in diagnosing IKE daemon problems.

Initialization problems
When IKE successfully initializes, message EZD1046I is issued. If the IKE daemon fails to initialize, message EZD1045I or EZD1049I is issued. Common initialization problems include:

- The IKE daemon load module is not APF-authorized. The IKE daemon load module must be APF-authorized. The symptom for this problem is the following message: EZD0986I IKE is not APF authorized.
  To correct this problem, ensure that the IKE daemon load module is in an APF-authorized library, and then restart the IKE daemon.
- IKE cannot create the /var/ike or /var/sock directories. The IKE daemon attempts to create the /var/ike and /var/sock directories at initialization. If IKE cannot create either of these directories, then initialization fails. If this problem occurs, one of the following messages is issued:
  
  EZD1045I IKE initialization error : mkdir /var/ike failed  
  EZD1045I IKE initialization error : mkdir /var/sock failed
  To correct this problem, ensure that the /var directory is mounted as read/write. Additionally ensure that either the IKE daemon has permission to create these directories or that these directories are already created and that the IKE daemon has access to them. If the problem still occurs, contact IBM for additional assistance.
- If the IKE daemon is configured in FIPS 140 mode, ICSF must be active when the IKE daemon is started. If ICSF is not active, message EZD2017I is issued. To correct this problem, start ICSF and then start the IKE daemon. ICSF must be configured in one of several FIPS operational modes when started.

Problems establishing security associations
This topic describes problems in establishing security associations and offers guidance on what steps to take to overcome these problems.

Common problems
Table 17 on page 311 lists common problems in establishing security associations.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot send or receive packets on UDP ports 500 or 4500</td>
<td>Message EZD1065I was issued. When filter logging is active, message EZD0815I is issued, showing packets to UDP port 500 or UDP port 4500 that were denied.</td>
<td>The IKE daemon communicates using UDP ports 500 and 4500 for IPv4. The IKE daemon communicates using UDP port 500 for IPv6. See “Steps for verifying IP routing to a destination when not using policy-based routing” on page 28 to verify that the IKE daemon is running and bound to ports 500 and 4500. A filter rule must be configured to permit inbound UDP traffic from any source port to destination ports 500 and 4500. A filter rule must be configured to permit outbound UDP traffic from source ports 500 and 4500 to any destination port. Use the <code>ipsec -f display</code> command to confirm there is a filter rule installed in the stack that permits receiving traffic from any source UDP port to destination UDP ports 500 and 4500. Also confirm that there is a filter rule that permits receiving traffic from source UDP ports 500 and 4500 to any destination port. Activate filter logging for these rules so that you can observe packets sent on source ports 500 and 4500 and received on destination ports 500 and 4500 in the syslog. For information about the <code>ipsec</code> command, see z/OS Communications Server: IP System Administrator's Commands. See z/OS Communications Server: IP Configuration Guide for general information about configuring IP filters.</td>
</tr>
<tr>
<td>Problem</td>
<td>Symptom</td>
<td>Cause/response</td>
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<tr>
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<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pre-shared key mismatch</td>
<td>Message EZD0965I was issued.</td>
<td>If IKE is using pre-shared key mode authentication and it cannot interpret a decrypted message that it has received, then message EZD0965I is issued, indicating a likely pre-shared key mismatch. In main mode, the responder gets the message upon receipt of message 5. In aggressive mode, the initiator gets the message upon receipt of message 2. EZD0965I can also be issued if IKE receives a corrupted message even though the pre-shared keys match. If the remote peer cannot decrypt the message that was sent by IKE because of a pre-shared key mismatch, the local symptom is that IKE retransmits the first encrypted message of the exchange. Review the pre-shared key configuration on the local and remote system and ensure that the keys match. <strong>Tip:</strong> The keys might be represented differently (for example, ASCII or EBCDIC) on the local and remote system.</td>
</tr>
<tr>
<td>Failure accessing local certificate repository</td>
<td>One of the following messages was issued:</td>
<td>For the IKE daemon to support RSA signature mode authentication using a local certificate repository, the daemon must be able to access certificates on the SAF key ring. IKE issues message EZD0990I to indicate that RSA signature mode is supported or EZD1030I if RSA signature mode is not supported for a given stack using the key ring. See the messages to determine the appropriate response. The key ring is specified on the KeyRing parameter in the IkeConfig statement. When configuring with the IBM Configuration Assistant for z/OS Communications Server GUI, the key ring is specified on the key ring database field on the IPSec: IKE Daemon Settings panel.</td>
</tr>
</tbody>
</table>

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Table 17. Establishing security associations problems (continued)
Table 17. Establishing security associations problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
</table>
| Failure accessing the network security services (NSS) server | One of the following messages was issued:  
  • EZD1136I  
  • EZD1137I  
  • EZD1138I  
  • EZD1905 | For the IKE daemon to support digital signature mode authentication using IPsec certificate services, it must be able to connect to a network security server. IKE issues the following messages:  
  • EZD1136I to indicate that it has connected to a network security server  
  • EZD1137I to indicate that it is not connected to a network security server.  
  • EZD1138I to indicate that it is connecting to a network security server.  
  For the IKE daemon to support digital signature mode authentication for IKEv2 security association activation, IPSec certificate services must be provided by a z/OS V1R12 or later NSS server. If the IKE daemon is not connected to an NSS server, or it is not configured for certificate services, or the NSS is not V1R12 or later, EZD1905 is issued for each IKEv2 SA activation attempt that requires digital signature mode authentication.  
  The network security services server is specified on the NetworkSecurityServer and NetworkSecurityServerBackup parameters on the IkeConfig statement. When configuring with the IBM Configuration Assistant for z/OS Communications Server GUI, the network security server is specified on the server setting in the NSS perspective. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
</table>
| RSA signature authentication failure - missing certificate in the local certificate repository | Message EZD1037I was issued. | Check the syslog to determine whether message EZD1037I was issued. If the IKE daemon cannot locate a certificate that is needed for RSA signature mode authentication, message EZD1037I is issued.  
  - Display the certificates on the SAF key ring.  
  - Ensure that all the certificates on the key ring that are to be used by the IKE daemon include a digital signature.  
  - If you are using RACF, make sure that the trust status of the certificates is TRUST or HIGHTRUST.  
  Use the IKE daemon IkeSyslogLevel 64 to display the contents of the IKE daemon's certificate caches and ensure that the certificates that you want are included in the caches. |
| RSA signature authentication failure because of identity mismatch | One of the following messages was issued:  
  - EZD0981I  
  - EZD1075I | Check the syslog to determine whether message EZD0981I or EZD1075I was issued. If the identity that is contained within a received certificate does not match the identity that is configured on the RemoteSecurityEndPoint statement, message EZD0981I is issued. If the peer detects such a mismatch, it might send an "Invalid ID information" notification. If IKE receives such a notification, message EZD1075I is issued. See the messages to determine the appropriate response. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSA signature authentication failure because of a local certificate</td>
<td>One of the following messages was issued:</td>
<td>Check the syslog to determine whether message EZD0902I or EZD0903I was issued. If the certificate that is received from a peer cannot be verified, message EZD0902I is issued. If the certificate that is received from the peer cannot be authenticated, message EZD0903I is issued.</td>
</tr>
<tr>
<td>verification or authentication failure</td>
<td>• EZD0902I</td>
<td>See the messages to determine the appropriate response. Activate IkeSyslogLevel 64 to get additional diagnostic information that relates to RSA signature mode authentication. The IKE daemon syslog level is set in the IkeSyslogLevel parameter in the IkeConfig statement. When configuring with the IBM Configuration Assistant for z/OS Communications Server GUI, the IKE Daemon Syslog settings are accessed from the IPSec: IKE Daemon Settings panel. IKE maintains a separate cache for Certificate Authority (CA) certificates and security endpoint certificates. When IkeSyslogLevel 64 is active, the contents of the certificate caches are displayed when they are built or rebuilt.</td>
</tr>
<tr>
<td></td>
<td>• EZD0903I</td>
<td>See z/OS Communications Server: IP Configuration Reference for information about setting the IkeSyslogLevel, or see the online help in the IBM Configuration Assistant for z/OS Communications Server.</td>
</tr>
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<td></td>
<td><strong>Tip</strong>: The name of the key ring is case-sensitive.</td>
</tr>
<tr>
<td>RSA signature authentication failure - IPsec certificate services failure</td>
<td>Message EZD1139I was issued.</td>
<td>Check the syslog to determine whether message EZD1139I was issued. The EZD1139I message will be issued if the network security server failed to locate a certificate, could not verify a digital signature, or could not create a digital signature for RSA signature mode authentication. See the messages to determine the appropriate response.</td>
</tr>
<tr>
<td>Problem</td>
<td>Symptom</td>
<td>Cause/response</td>
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<tr>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Failure to locate phase 1 policy| Message EZD0917I was issued. | In order for IKE to establish a phase 1 SA, it must first locate an applicable phase 1 policy.  
KeyExchangeRules encapsulate phase 1 policy for IKE. KeyExchangeRules are classified according to a 4-tuple that is comprised of LocalSecurityEndpoint Location, LocalSecurityEndpoint Identity, RemoteSecurityEndpoint Location, and RemoteSecurityEndpoint Identity. When IKE needs to locate a KeyExchangeRule statement, it performs a search of the configured KeyExchangeRules statements, supplying specific values or Any for each parameter of the classification 4-tuple.  
When configuring with the IBM Configuration Assistant for z/OS Communications Server the following are configured in each Connectivity Rule:  
• Local Security End Point Location  
• Local Security End Point Identity  
• Remote Security End Point Location  
• Remote Security End Point Identity  
• Key Exchange Settings  
It is also possible in the GUI to configure a single Local Security End Point Location and Identity for an entire TCP/IP stack.  
If IKE fails to locate an applicable KeyExchangeRule statement, message EZD0917I is issued that lists the classification 4-tuple. Use the `pasearch -v k -r` command to review the configured KeyExchangeRules statement. If there is no KeyExchangeRule statement that corresponds to the classification 4-tuple that is given on the EZD0917I message, configure a new KeyExchangeRule statement as needed.  
See the messages for EZD0917I for more information.
Table 17. Establishing security associations problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>IKE version mismatch</td>
<td>Message EZD1753I was issued.</td>
<td>The IKE daemon sent an IKEv2 initiation request to an IKEv1 peer, and it responded with an IKEv1 message, probably a rejection of the request. The local policy must have HowToInitiate IKEv2, but the peer does not support IKEv2. Change the value on HowToInitiate to Main or Aggressive, to cause the IKE daemon to use IKEv1 flows for tunnel initiation. Alternatively, have the peer IKE node initiate the tunnel. z/OS IKED accepts either IKEv1 or IKEv2 initiation requests, as long as the other attributes being negotiated are properly configured.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 policy mismatch</td>
<td>Message EZD1093I or EZD1075I was issued.</td>
<td>The ISAKMP initiator and responder must agree on phase 1 policy to successfully complete negotiation of a phase 1 security association. If the IKE daemon rejects the phase 1 policy that is proposed by an ISAKMP peer, it issues message EZD1021I, which indicates the KeyExchangeRule and KeyExchangeAction statements that were in effect when the mismatch occurred. Message EZD1093I is issued, which indicates why the mismatch occurred. When configuring with the IBM Configuration Assistant for z/OS Communications Server, the Key Exchange Settings are set in each Connectivity Rule. If the IKE daemon proposes phase 1 policy that the ISAKMP peer rejects, the ISAKMP peer should send a notification message to the IKE daemon. If the IKE daemon receives such a notification, it issues message EZD1075I. For more information, see the EZD1075I message documentation in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). If the peer is a z/OS IKE daemon, it issues the EZD1021I and EZD1093I messages as described above. If the peer is not a z/OS IKE daemon, consult the documentation for the ISAKMP peer product to determine why it rejected the proposal. In the case of a mismatch, a No proposal chosen notification is expected from the peer.</td>
</tr>
<tr>
<td>Problem</td>
<td>Symptom</td>
<td>Cause/response</td>
</tr>
<tr>
<td>----------------------------------------</td>
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</tr>
<tr>
<td>Failure to locate phase 2 policy</td>
<td>Message EZD1795I was issued</td>
<td>In order for IKE to establish a phase 2 SA, it must first locate an applicable phase 2 policy. Phase 2 policy for the IKE daemon is comprised of IpFilterRule and IpDynVpnAction statements. The first step in locating a phase 2 policy for the IKE daemon is to locate an IpFilterRule statement that matches the traffic to be protected and includes a reference to an IpDynVpnAction statement. If IKE cannot find an applicable IpFilterRule statement, message EZD1795I is issued, which indicates the traffic that was to be protected. When configuring with the IBM Configuration Assistant for z/OS Communications Server, the Connectivity Rules are used to locate the phase 2 policies. The Connectivity Rules contain the local and remote data end points, and which type of traffic is protected by Security Levels implementing dynamic tunnels. See the messages to determine the appropriate response. See “Steps for verifying IP security and defensive filter operation” on page 670, supplying the IP traffic characteristics identified on the EZD1795I message.</td>
</tr>
</tbody>
</table>
Table 17. Establishing security associations problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 policy mismatch</td>
<td>Message EZD1022I, EZD1093I, or EZD1075I was</td>
<td>The ISAKMP initiator and responder must agree on phase 2 policy to successfully complete negotiation of a phase 2 security association. If the IKE</td>
</tr>
<tr>
<td></td>
<td>issued.</td>
<td>daemon rejects the phase 2 policy that is proposed by an ISAKMP peer, it issues message EZD1022I, which indicates the IpFilterRule and IpDynVpnAction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>statements that were applied. When configuring with the IBM Configuration Assistant for z/OS Communications Server, the Connectivity Rules are used to locate the phase 2 policies. The Connectivity Rules contain the local and remote data end points, and which type of traffic is protected by Security Levels implementing dynamic tunnels. Message EZD1093I is issued indicating why the mismatch occurred. Check the syslog to determine whether message EZD1075I was issued. If the IKE daemon proposes a phase 2 policy that the ISAKMP peer rejects, the ISAKMP peer should send a notification message to the IKE daemon. If the IKE daemon receives such a notification, it issues message EZD1075I. Review the diagnostic data at the ISAKMP peer to determine why the peer rejected the proposal. See the EZD1075I message documentation for more information. In the case of a mismatch, a No proposal chosen notification is expected from the peer.</td>
</tr>
</tbody>
</table>

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Table 17. Establishing security associations problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES encryption/decryption failure</td>
<td>Message EZD0918 or EZD1109 was issued.</td>
<td>If IKE is using AES for phase1 or phase2 encryption and decryption, it calls Integrated Cryptographic Service Facility (ICSF) to do the actual cryptography. If ICSF has not been started the cryptography cannot be performed, and IKE cannot encrypt or decrypt messages using AES. This can happen any time during an informational exchange, any time during a phase 2 exchange, in message 5 of main mode if acting as the initiator, or in message 6 of main mode if acting as the responder. The return and reason codes for an ICSF failure are output in message EZD0918 (encryption) or message EZD1109 (decryption). If the return code is C(12) and the reason code is 0, this normally means that ICSF has not been started and therefore cannot perform the necessary cryptography. Ensure that ICSF is started so that the IKE daemon can perform AES cryptography. If the return code is C(12) and the reason code is 8, this normally means that the installed version of ICSF does not support AES. The Security Level Feature of ICSF is required (FMID HCR7706 or higher) for AES support.</td>
</tr>
</tbody>
</table>

Network security services client problems

IKED can be configured to request network security services (NSS) from an NSS server. The following table lists common problems when IKED, running as an NSS client, is unable to obtain services from the NSS server.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSL is not properly configured for IKED, running as an NSS client, to connect to the NSS server.</td>
<td>When AT-TLS is not enabled or is misconfigured on the TCP/IP stack used by IKED or the NSS server, IKED issues message EZD1149I indicating that the connection is not secure.</td>
<td>AT-TLS must be enabled on both the client and server stacks with the TCPCONFIG TTLS statement in the TCP/IP profile. AT-TLS policies must be defined for both the client and the server to secure the connection. See “Define AT-TLS policy to protect communication with an NSS server” in z/OS Communications Server: IP Configuration Guide. If AT-TLS is enabled and the definitions are configured on the client and server stacks but EZD1149I is still displayed then see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637.</td>
</tr>
<tr>
<td>The userid used for the IKED connection to the NSS server has insufficient authority to connect.</td>
<td>IKED issues message EZD1139I with reason code NSSRsnUserAuthentication. For example: EZD1139I Request type NSS_ConnectClientReqToSrv with correlator ID 00000000000000040000000000000000 for stack TCPCS2 failed - return code EACCES reason code NSSRsnUserAuthentication</td>
<td>The IKED connection to the NSS server requires configuration of a valid userid and password or passticket on the NssStackConfig statement in the IKED configuration file.</td>
</tr>
<tr>
<td>The userid used for the IKED connection to the NSS server has insufficient authority to access services requested.</td>
<td>IKED issues messages indicating which requested services are not available. For example:  - EZD1145I The network security certificate service is not available for stack TCPCS2  - EZD1147I The network security remote management service is not available for stack TCPCS2</td>
<td>The following SAF resource permissions are required to access network security services:  - EZB.NSS.sysname.clientname.IPSEC.CERT  - EZB.NSS.sysname.clientname.IPSEC.NETMGMT  These resources must be defined on the NSS server system and the userid configured on the NssStackConfig statement in the IKED configuration file must be permitted read access to them.</td>
</tr>
<tr>
<td>IKED fails to retrieve certificates from the NSS server.</td>
<td>IKED syslog daemon traces may show that no cache entries were received from the NSS server. For example: IKE: Initializing CA Cache with 0 entries for stack TCPCS2 Dynamic tunnel negotiations using RSA signature mode fail.</td>
<td>The following SAF resource permissions are required to access certificates from the NSS server:  - EZB.NSSCERT.sysname.mappedlabelname.CERTAUTH  - EZB.NSSCERT.sysname.mappedlabelname.HOST  These resources must be defined on the NSS server system and the userid configured on the NssStackConfig statement in the IKED configuration file must be permitted read access to it. See &quot;Steps for authorizing resources for NSS&quot; in z/OS Communications Server: IP Configuration Guide.</td>
</tr>
<tr>
<td>Problem</td>
<td>Symptom</td>
<td>Cause/response</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>IKED does not attempt to connect to the NSS server for a given stack.</td>
<td>IKED does not issue message EZD1138I for the given stack.</td>
<td>A valid NssStackConfig statement is required for each stack to use NSS. See IKE daemon in z/OS Communications Server: IP Configuration Reference for information about configuring the NssStackConfig statement.</td>
</tr>
</tbody>
</table>

**NAT traversal considerations**

- NAT traversal support must be enabled.

  By default, NAT traversal support on z/OS is disabled. To enable NAT traversal support do one of following:
  - Specify a value of Yes for the AllowNat parameter of the KeyExchangeAction statement used when negotiating with a remote security endpoint that you want to perform NAT traversal with.
  - Specify a value of Yes for the AllowNat parameter of the KeyExchangePolicy statement. Verify that the AllowNat parameter is not specified as No on the KeyExchangeAction statement used when negotiating with the remote security endpoint that you want to perform NAT traversal with.

  Use care when using the latter method. The AllowNat parameter specified on the KeyExchangePolicy statement becomes the default AllowNat setting for KeyExchangeAction statements that do not specify the AllowNat parameter. See z/OS Communications Server: IP Configuration Reference for more details concerning the AllowNat parameter. When configuring with the IBM Configuration Assistant for z/OS Communications Server, you configure whether to allow NAT traversal processing on the Stack Level Settings panel. This setting can be overridden in each Connectivity Rule.

  The AllowNat field contained in the output of the `ipsec -k display` command can be used to determine whether NAT Traversal support was enabled for a phase 1 negotiation.

  Changes made to the AllowNat parameter do not impact existing phase 1 security associations. Existing phase 1 security associations must be refreshed before any changes to the AllowNat setting are honored. There are no configuration options to enable or disable NAT traversal for an IPSec security association. The state of NAT traversal for an IPSec security association is determined by the phase 1 security association used when negotiating the IPSec security association.

- The remote security endpoint must support an acceptable version of NAT traversal. z/OS provides limited support for the following levels of NAT Traversal:
  - draft-ietf-ipsec-nat-t-ike-02
  - draft-ietf-ipsec-nat-t-ike-03
  - RFC 3947
  - RFC 3947 with z/OS-only extensions
  - RFC 5996
  - RFC 5996 with z/OS-only extensions

  The remote security endpoint must support one of these levels of NAT traversal.
You can use the NATTSupportLevel field contained in the output of the `ipsec -k display` command to determine what level of NAT traversal support was used during a phase 1 negotiation. If the NATTSupportLevel is None, verify that NAT traversal support is enabled when negotiating with this remote security endpoint. If NAT traversal support was enabled, then the remote security endpoint does not provide an acceptable level of NAT traversal support.

• z/OS does not support NAT traversal for IPv6 traffic.
• z/OS cannot act as a gateway when traversing a NAT.

The z/OS IKE daemon does not support acting in the gateway role when traversing a NAT. The z/OS IKE daemon is acting as a gateway when the local data endpoint of an IPSec security association is not the same as the IP address used as the local IP address of the protecting phase 1 security association. Message EZD1089I is issued when z/OS is acting as a gateway while traversing a NAT.

When a NAT is detected between z/OS IKE and a remote security endpoint, all IPSec security associations negotiated with that remote security endpoint must end in the local z/OS box. Specifically, the local data endpoint of any IPSec security association negotiated when traversing a NAT must be the IP address used as the local IP address of the protecting phase 1 security association. If z/OS is behind a NAT this could be its private address or the public IP address provided by the NAT.

You can use the LocalEndpoint field contained in the `ipsec -k display` command used to determine the local private IP address of the protecting phase 1 security association. The local public IP address of the protecting phase 1 security association is assigned by the NAT box in front of z/OS.

You can use the NATInFrmtLclScEndPnt and NATInFrmtRmtScEndPnt fields contained in the output of the `ipsec -k display` command to determine whether a NAT was detected between the IKE daemon and the remote security gateway.

• z/OS cannot act as an initiator to a security gateway.

The z/OS IKE daemon cannot act as the initiator of a phase 2 negotiation for a new IPSec security association when traversing a NAT and the remote security endpoint is acting as security gateway. Messages EZD1090I or EZD1057I are issued in this case. The z/OS IKE daemon can act as the initiator of subsequent refreshes of an existing IPSec security association with a remote security endpoint that is acting as a security gateway.

A new IPSec security association is the first IPSec security association negotiated for a particular traffic pattern. A remote security endpoint is acting as a security gateway when the remote endpoint of the IPSec security association is not the same as the IP address used as the remote IP address of the protecting phase 1 security association.

• z/OS cannot act as an initiator to a remote security endpoint located behind a NAT device performing network address port translation (NAPT).

The z/OS IKE daemon does not support initiating the first security association to a remote security endpoint when a NAT has translated the remote security endpoint's port (that is, when IKE detects the existence of a NAPT in front of the remote security endpoint). If this condition is detected during a phase 1 or phase 2 negotiation, the negotiation is terminated.

• z/OS uses only IPv4 identities during IKEv1 phase 2

During an IKEv1 phase 2 negotiation for a new IPSec security association, the z/OS IKE daemon uses IPv4 ID types to identify the traffic pattern to be protected by the new IPSec security association. When traversing a NAT, other IKE implementations might require the traffic pattern to be specified using a non-IPv4 ID type. The z/OS IKE daemon is not able to act as the initiator of an IKEv1 phase 2 negotiation with such an implementation when creating a new IPSec security association. The z/OS IKE daemon can act as the initiator of subsequent refreshes of an existing IPSec security association with a remote security endpoint utilizing such an IKE implementation.

When the z/OS IKE daemon acts as the initiator of an IKEv1 phase 2 negotiation to create a new IPSec security association and the remote security endpoint is using an implementation that requires a non-IPv4 ID type, the remote security endpoint rejects the proposal. Some implementations might send an informational notification in this case. The informational notification indicates that the proposal was
rejected and why. If an informational notification is received, the z/OS IKE daemon issues message EZD1075I.

- Interoperability considerations when z/OS initiates a phase 2 negotiation to a non-z/OS peer for a host-to-host tunnel that traverses a NAT
  - Host-to-host dynamic tunnel protecting all ports and all protocols, tunnel mode
    When z/OS initiates phase 2 negotiation for a new host-to-host dynamic tunnel that protects all ports and all protocols, z/OS uses a traffic pattern consisting of the IP addresses of the local and remote security endpoints. IKE and its peer view the traffic pattern differently. z/OS views the traffic pattern as its private IP address and the peer’s public IP address. The peer views the traffic pattern as the public address of z/OS and the peer’s private address.

    A host-to-host dynamic tunnel uses either the transport or tunnel mode of encapsulation. When z/OS initiates a phase 2 negotiation to a non-z/OS peer for a new host-to-host dynamic tunnel that protects all ports and all protocols it is possible that the negotiation succeeds, but it produces an SA that cannot be used to send traffic. This is partially because data protected using tunnel mode SAs have two IP headers. Because both peers have a different view of the traffic pattern, they might not agree on the contents of the inner-most IP header. When both the local and remote peers are z/OS, the SA negotiation should be successful and produce an SA that can be used to send traffic.

  - RFC 3947 does not discuss how traffic patterns should be defined when one or more NATs are being traversed. When z/OS initiates a phase 2 negotiation for a UDP encapsulated tunnel mode SA with a non-z/OS peer, message EZD1104I or EZD1105I is issued for IKEv1 and message EZD1924I or EZD1925I is issued for IKEv2. When z/OS initiates a phase 2 negotiation for a UDP-encapsulated tunnel or transport-mode SA for a specific port, protocol, or both, message EZD1107I is issued for IKEv1. In all cases, the negotiation continues.

- SWSA implications
  During VIPA takeover or giveback processing, the IKE daemon attempts to create security associations that existed on the stack that owned the security association prior to the takeover or giveback. These security associations appear as new security associations on the new owning stack.

  The z/OS IKE daemon cannot initiate the creation of new IPSec security associations when the peer is acting as a gateway, or when the peer is behind a NAT, or when the peer expects a non-IPv4 identity during a quick mode exchange; however, it can act as a responder in these cases. VIPA takeover and giveback of such phase 2 security associations are not supported.

  There are also cases when the results might be unpredictable when the z/OS IKE daemon initiates a new host-to-host SA negotiation to a non-z/OS peer. These cases include:
  - z/OS IKE initiates a new host-to-host UDP encapsulated tunnel mode SA to a non-z/OS peer
  - z/OS IKE initiates a new host-to-host UDP encapsulated SA for a specific port, protocol, or both to a non-z/OS peer

  It is expected that IKE can always act as a responder in these cases. If such SAs exist when a VIPA takeover or giveback occurs, the IKE daemon attempts to re-establish these security associations. The results of these attempts are unpredictable. This can result in a disruption of traffic until new SAs are created by the remote security endpoint. The IKE daemon still sends delete notifications informing the remote security endpoint that the security associations are no longer valid.

- Remapping of a remote security endpoint’s address
When a remote security endpoint is behind a NAT, the NAT maps the private IP address of the remote security endpoint to a public IP address. This mapping could expire as a result of inactivity or a new mapping could be created due to a reboot of the NAT device. In such cases, the public IP address of the remote security endpoint might change.

In the cases where NAT performs port translation (NAPT), the IP address or port or both might change.

If the IKE daemon or stack detects such a change while there are one or more security associations (SAs) with that remote security endpoint, the IKE daemon attempts to verify the new IP address and port pair. It does this by initiating the creation of a new phase 1 SA using the remote security endpoint's new IP address and port pair. Message EZD1086I is issued when this negotiation starts. If this negotiation is successful, the IKE daemon issues message EZD1087I and all phase 1 and IPSec security associations with that remote security endpoint using the old address are deleted. IKEv2, as specified in RFC 5996, requires an attempt to create a phase 2 SA when creating a phase 1 SA. When the IKE daemon attempts to verify a new IP address and port pair with IKEv2, one or more phase 2 SAs can be initiated when the phase 1 SA is initiated. The number of phase 2 SA initiations attempted is determined by the number of phase 2 SAs belonging to the phase 1 SA that corresponds to the remote security endpoint for which an IP address or port change was detected.

**NAT keepalive timer**

When a z/OS is behind a NAT, the NAT maps its private IP addresses to public IP addresses. A static NAT mapping does not expire. A dynamic NAT mapping can expire as a result of inactivity. To prevent the expiration of this mapping, the stack occasionally sends messages known as NAT keepalive messages. If these messages are not sent frequently enough, the NAT device could expire the mapping of any z/OS private IP addresses to public IP addresses. Such a remapping could be disruptive to existing IPSec traffic.

The frequency of message transmission is defined by the NatKeepAliveInterval value on the KeyExchangePolicy statement. See z/OS Communications Server: IP Configuration Reference for more details. When configuring with the IBM Configuration Assistant for z/OS Communications Server, the NAT keep alive interval is specified on the Stack Level Settings panel.

A NAT keep alive is a 1-byte UDP message sent to a remote security endpoint using the UDP encapsulation ports. The sent byte is set to x'FF'. Figure 29 on page 326 shows a NAT keep alive message:

![NAT keep alive message](image)

**Figure 29. NAT keep alive message**

**Multiple remote security endpoints sharing the same phase 1 identity**

During a phase 1 negotiation the remote security endpoint sends its identity in an ID payload. The IKE daemon can manage multiple remote security endpoints using the same ID when those endpoints are not behind a NAT. However, when a remote security endpoint is behind a NAT it must use a unique phase 1 identity. If a second remote security endpoint behind a NAT attempts to use a phase 1 identity already in use by another remote security endpoint behind a NAT, the IKE daemon detects this as a remapping of the first remote security endpoint's IP address.

When multiple remote security endpoints behind a NAT share the same phase 1 identity, messages EZD1086I and EZD1087I might be repeatedly issued.

**Responding to phase 1 main mode SA negotiations with multiple remote security endpoints behind a NAPT**

When acting as a responder in main mode SA negotiations, the z/OS IKE daemon must agree to key exchange parameters before the remote security endpoint identity is known. The key exchange policy is searched to match on a KeyExchangeRule based upon the IP addresses of the local and remote security endpoints. Different remote security endpoints located behind an NAPT might use the same public IP address.
address. This can cause a policy mismatch if the KeyExchangeRule settings for those remote security endpoints do not match. A policy mismatch will cause EZD1093I to be issued to syslog.

To prevent this situation, do the following:

Configure a single KeyExchangeRule to represent all the remote security endpoints behind the NAPT device. The remote security endpoints, represented by the same public address, must use the same security parameters. The remote security endpoints' policy must be configured with the same security parameters as well.

**Resource constraint problems**

This topic describes problems that can occur when the IKE daemon experiences shortages of certain system resources. The following table lists system resources that can become constrained when large numbers of remote IKE peers simultaneously attempt to negotiate IPSec tunnels with z/OS. For each resource, instructions are also provided for alleviating the constraints.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of messages on system message queue exceeded</td>
<td>Message EZD0970I was issued, which indicates that the C/C++ runtime library function msgsnd() failed with the following error information: 021D - 112</td>
<td>The IKE daemon uses system message queues to internally route work between different threads. In this case, one of these queues reached its maximum capacity as defined by the IPCMSGQMNUM parameter of the SETOMVS command. Resource temporarily unavailable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This situation occurs when thousands of IKE peers simultaneously attempt to negotiate new or refresh existing security associations with z/OS. To resolve the problem, use the SETOMVS command with the IPCMSGQMNUM parameter to specify a higher message queue capacity.</td>
</tr>
<tr>
<td>IKED memory limits exceeded</td>
<td>Message EZD0963I was issued multiple times, which indicates that the IKE daemon cannot allocate memory.</td>
<td>This situation occurs when thousands of IKE peers simultaneously attempt to negotiate new or refresh existing security associations with z/OS. To resolve the problem, increase the amount of virtual storage available to the IKE daemon. For instructions on how to ensure that the IKE daemon's user ID has enough system resources, see Step 2: Ensure the IKE daemon's user ID has enough system resources in z/OS Communications Server: IP Configuration Guide.</td>
</tr>
</tbody>
</table>
Table 19. Resource constraint problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
</table>
| UDP queue limits for IKE port exceeded | • An unusually high percentage of receive errors is displayed in the UDP statistics section of the NETSTAT STATS/-S report.  
• In some cases when no UDPQUEUELIMIT is specified in the TCPIP profile, you might also see message IST2273E. | The IKE daemon communicates by using UDP ports 500 and 4500. If UDP traffic to one of these ports overruns the capacity of the UDP queue in the TCP/IP stack, you might encounter one or both of the listed symptoms. The capacity of the UDP queue is defined by the UDPQUEUELIMIT parameter of the UDPCONFIG statement in the TCPIP profile data set. When this symptom happens, the TCP/IP stack discards inbound UDP packets in a randomized way until the constrained queue condition is relieved.  
This situation occurs when thousands of IKE peers simultaneously attempt to negotiate new or refresh existing security associations with z/OS.  
To resolve the problem, enable Intrusion Detection Services (IDS) for the stack and define a UDP Traffic Regulation rule for the IKE daemon's UDP ports with the VERY_LONG queue size. For more information about IDS and UDP Traffic Regulation, see Traffic regulation policies in z/OS Communications Server: IP Configuration Guide. |

Abends

Messages and error-related information should be sent to the system console when an abend occurs during IKE daemon processing. A dump of the error is needed unless the symptoms match a known problem. System dumps of IKE include Language Environment data. The Language Environment IPCS verbexit LEDATA can be used to format this information. See z/OS Language Environment Debugging Guide for more information. The following command is a sample IPCS verbexit ledata command:

```
verbx ledata 'asid(68) tcb(007E5E88) ceedump nthreads(*)'
```

Tip: In this example, the IKE asid is 0x68 and the address of the abended IKE TCB is 0x007E5E88.

IKE daemon debug information

Additional IKE daemon debug information can be sent to the syslog by using the IkeSyslogLevel and PagentSyslogLevel parameters in the IKE configuration file.

Obtaining syslog debug information for the IKE daemon

The IkeSyslogLevel parameter in the IKE configuration file controls the level of IKE internal debug information that is sent to syslog. When configuring with the IBM Configuration Assistant for z/OS Communications Server, use the IKE Daemon Settings panel to configure the level of IKE internal debug information that is sent to syslog.

The IKE syslog level value should be set above 1 only when diagnosing a problem; levels above 1 impact IKE performance. Level 8 and Level 16 have the greatest performance impact because they affect processing on each UDP datagram IKE sends and receives.

IKE Syslog level values can be combined. See z/OS Communications Server: IP Configuration Reference or the IBM Configuration Assistant for z/OS Communications Server online help for more information.
**Note:** When IKED logs messages through syslogd, the messages are immediately preceded by the parenthesized thread identifier of the IKED thread from which they were issued. For example, the following message was logged by thread 1:

```
Jul 28 15:10:47 mvs046 IKE: (00000001) EZD1061I IKE connecting to PAGENT
```

**Obtaining debug information using PagentSyslogLevel**

IKE uses the Policy API (PAPI) to communicate with the Policy Agent and manipulate policy information it has obtained from the Policy Agent. The PagentSyslogLevel parameter in the IKE configuration file controls the level of debug information that is sent to syslog when IKE uses PAPI. When configuring with the IBM Configuration Assistant for z/OS Communications Server, the Policy Agent Syslog events are configured from the IKE Daemon Settings panel. The Policy Agent Syslog level value should be set above 0 only at the direction of IBM service as it impacts IKE performance. For more information about setting the Policy Agent Syslog levels, see z/OS Communications Server: IP Configuration Reference or the IBM Configuration Assistant for z/OS Communications Server online help.

**TCP/IP services component trace for the IKE daemon**

z/OS CS provides component trace support for the IKE daemon. This section describes how to specify IKE daemon trace and formatting options. For short descriptions of other tracing procedures, such as displaying trace status, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43. For detailed information, see the following information:

- z/OS MVS Diagnosis: Tools and Service Aids for information about component trace procedures.
- z/OS MVS Initialization and Tuning Reference for information about the component trace SYS1.PARMLIB member.
- z/OS MVS System Commands for information about commands.
- z/OS MVS Programming: Authorized Assembler Services Guide for procedures and return codes for component trace macros.

**Using CTRACE**

You can specify component trace options at TCP/IP initialization or after TCP/IP has initialized. Table 20 on page 329 lists the IKE daemon trace options.

**Table 20. IKE daemon trace options**

<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>Trace all types of records. This option slows performance.</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>Trace the IKE daemon's minimum level of tracing.</td>
</tr>
<tr>
<td>INIT</td>
<td>Trace IKE daemon initialization information.</td>
</tr>
<tr>
<td>TERM</td>
<td>Trace IKE daemon termination information.</td>
</tr>
<tr>
<td>EXCEPT</td>
<td>Trace IKE daemon exception information.</td>
</tr>
<tr>
<td>CONFIG</td>
<td>Trace IKE daemon configuration information.</td>
</tr>
<tr>
<td>WORKUNIT</td>
<td>Trace IKE workunit information.</td>
</tr>
<tr>
<td>SERIAL</td>
<td>Trace IKE serialization information.</td>
</tr>
<tr>
<td>IKE</td>
<td>Trace IKE protocol information.</td>
</tr>
</tbody>
</table>
### Table 20. IKE daemon trace options (continued)

<table>
<thead>
<tr>
<th>Trace Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRYPTO</td>
<td>Trace IKE cryptographic information.</td>
</tr>
<tr>
<td>OPMSGS</td>
<td>Trace IKE operator messages.</td>
</tr>
<tr>
<td>LOGMSGS</td>
<td>Trace IKE syslog messages.</td>
</tr>
<tr>
<td>MSGQ</td>
<td>Trace IKE message queue information.</td>
</tr>
<tr>
<td>TIMER</td>
<td>Trace IKE timer information.</td>
</tr>
<tr>
<td>SOCKETS</td>
<td>Trace IKE socket information.</td>
</tr>
<tr>
<td>IOCTL</td>
<td>Trace IKE IOCTL call information.</td>
</tr>
<tr>
<td>REQUESTS</td>
<td>Trace IKE request information.</td>
</tr>
<tr>
<td>FLOW</td>
<td>Trace IKE code flow information.</td>
</tr>
<tr>
<td>STORAGE</td>
<td>Trace IKE storage information.</td>
</tr>
<tr>
<td>EVENT</td>
<td>Trace IKE event information.</td>
</tr>
<tr>
<td>POLICY</td>
<td>Trace IKE policy information.</td>
</tr>
<tr>
<td>CONTROL</td>
<td>Trace IKE daemon control information.</td>
</tr>
<tr>
<td>MISC</td>
<td>Trace IKE miscellaneous information.</td>
</tr>
<tr>
<td>DEBUG</td>
<td>Trace IKE debugging information.</td>
</tr>
</tbody>
</table>

### Enabling CTRACE at IKE daemon startup

A default minimum component trace is always started during IKE daemon initialization. Use a parmlib member to customize the parameters that are used to initialize the trace. The default IKE daemon component trace parmlib member is the SYS1.PARMLIB member CTIIKE00. The parmlib member name can be changed using the IKED_CTRACE_MEMBER environment variable.

**Tip:** The IKE daemon reads the IKED_CTRACE_MEMBER environment variable only during initialization. Changes to IKED_CTRACE_MEMBER after daemon initialization have no affect.

For a description of trace options, see Table 20 on page 329.

**Restriction:** In addition to specifying the trace options, you can also change the IKE daemon trace buffer size. The buffer size can be changed only at IKE initialization and has a maximum of 256 MB.

If the CTIIKE00 member or the member that is specified in IKE_CTRACE_MEMBER is not found when starting the IKE daemon, the following message is issued:

**IEE5381** memberName MEMBER NOT FOUND IN PARMLIB

When this occurs, the IKE daemon component trace is started with a buffer size of 1 MB and the MINIMUM tracing option.

```c
/* *************** z/OS Communications Server ***************
/* SMP/E Distribution Name: CTIIKE00 */
/* PART Name: CTIIKE00 */
/* Copyright: */
/* Licensed Materials - Property of IBM */
/* 5694-A01 */
/* (C) Copyright IBM Corp. 2005 */
/* Status: CSV1R7 */
/* */
```
Steps for enabling the CTRACE at IKE daemon startup
Enable the CTRACE at IKE daemon startup.

Procedure
Perform the following steps:

1. Edit the CTIIKE00 parmlib member and specify TRACEOPTS ON, the buffer size you want with the BUFSIZE() parameter and the CTRACE options you want. To direct the CTRACE to an external writer, also specify the name of the writer JCL procedure in the WTR() parameter. See the example CTIIKE00 parmlib member.
2. Start the IKE daemon.

Figure 30. SYS1.PARMLIB member CTIIKE00
Steps for disabling the CTRACE at IKE daemon startup
Disable the CTRACE at IKE daemon startup.

Procedure
Perform the following steps:
1. To disable the CTRACE at IKE daemon startup, edit the CTIIKE00 parmlib member and specify TRACERPT=OFF.
2. Start the IKE daemon.

Step for enabling the CTRACE after the IKE daemon is started
After the IKE daemon is started, enable the CTRACE to an internal buffer or to an external writer.

Procedure
Perform the appropriate step:
- Issue the following console commands to enable the CTRACE to an internal buffer:

  TRACE CT,ON,COMP=SYSTCPIK,SUB=(iked_jobname)
  R xx,OPTIONS=(option[,option2...]),END

- Issue the following console commands to enable the CTRACE to an external writer:

  TRACE CT,WTRSTART=writer_proc
  TRACE CT,ON,COMP=SYSTCPIK,SUB=(iked_jobname)
  R xx,OPTIONS=(option[,option2...],WTR=writer_proc,END

Step for disabling the CTRACE after the IKE daemon is started
After the IKE daemon is started, disable the CTRACE to an internal buffer or to an external writer.

Procedure
Perform the appropriate step:
- Issue the following console commands to disable the CTRACE to an internal buffer:

  TRACE CT,OFF,COMP=SYSTCPIK,SUB=(iked_jobname)

- Issue the following console commands to disable a CTRACE to an external writer:

  TRACE CT,OFF,COMP=SYSTCPIK,SUB=(iked_jobname)
  TRACE CT,WTRSTOP=writer_proc

Step for displaying the CTRACE status
Display the CTRACE status at the console.

Procedure
Perform the following step:
- To display the CTRACE status, issue the following console command:

  D TRACE,COMP=SYSTCPIK,SUB=(iked_jobname)

Enabling CTRACE after IKE daemon initialization
After IKE daemon initialization, you must use the TRACE CT command to change the component trace options. Each time a new Component Trace is initiated, all prior trace options are turned OFF and the new options are put into effect. You can specify the trace options with or without the parmlib member. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.
Formatting IKE daemon trace records

You can format component trace records using IPCS panels or a combination of the IPCS panels and the CTRACE command, either from a dump or from external-writer files. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details.

Enter any combination of the following values as options to filter the CTRACE entries. The options must be entered using the following format:

```
TYPE(option[,option]...)
```

You can use any of the options listed in Table 20 on page 329, except ALL and MINIMUM.
Chapter 10. Diagnosing network security services (NSS) server problems

This topic describes how to diagnose network security services (NSS) server problems, and contains the following information:

- “Overview of diagnosing NSS server problems” on page 335
- “Network security services server debug information” on page 346
- “TCP/IP services component trace for the network security services (NSS) server” on page 356
- “Steps for enabling the CTRACE at network security service (NSS) server startup” on page 358

Overview of diagnosing NSS server problems

The NSS server provides network security services for one or more network security enforcement points. A component that requests network security services from the network security services server is called a network security client or NSS client. Problems with the network security services server may be categorized as follows:

- Network security services server configuration problems
- Network security services server internal problems
- Network security services server problems interacting with an external component such as a network security client or the Secure Access Facility (SAF).

The NSS server provides log output using syslogd and internal trace information using component trace (CTRACE). The log output is sufficient for diagnosing most network security services server problems and is the first place to look if you suspect a problem.

Common NSS server initialization problems

Table 21. Common NSS server initialization problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The NSS load module is not APF-authorized.</td>
<td>The NSS load module abends. The following message will be logged to the console: IEF450I NSSD STEPC - ABEND=S000 U4087 REASON=00000000</td>
<td>The NSS load module must be APF-authorized.</td>
</tr>
<tr>
<td>The NSS socket directory does not exist or else it cannot be created by the NSS server.</td>
<td>When NSS server syslog level 2 is set (NSS_SYSLOG_LEVEL_VERBOSE), debug message DBG0040I is generated. For example: DBG0040I NSS_VERBOSE Cannot create socket directory /var/sock - rc -1 errno 135 EDC5135I Not a directory. The NSS server will immediately shutdown.</td>
<td>1. The /var directory must already exist. 2. The /var/sock subdirectory must already exist, or else the userid that the NSS server is running under must have authority to create the /var/sock subdirectory.</td>
</tr>
</tbody>
</table>
Table 21. Common NSS server initialization problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The NSS server is configured in FIPS 140 mode and ICSF is not active.</td>
<td>Message EZD1390I is issued, and the NSS server stops.</td>
<td>If the NSS server is configured in FIPS 140 mode, ICSF must be active when the NSS server is started. To correct this problem, start ICSF and then start the NSS server. ICSF must be configured in one of several FIPS operational modes when started.</td>
</tr>
</tbody>
</table>

NSS client connection problems

The following table lists common problems when a network security services (NSS) client is unable to obtain services from the NSS server.

Table 22. Common NSS client connection problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
</table>
| SSL is not properly configured for the NSS client connection to the NSS server. NSS client fails to connect. | When NSS server syslog level 8 is set (NSS_SYSLOG_LEVEL_CLIENTLIFECYCLE), debug message DBG0104I is generated: DBG0104I NSS_LIFECYCLE NSS connID 1 - the connection is not secure - the connection will be closed | For NSS IPSec client connections:  
  - AT-TLS must be enabled on both the client and server stacks with the TCPCONFIG TTLS statement in the TCP/IP profile.  
  - AT-TLS policies must be defined to secure the connection.  
  - See "AT-TLS policy" in z/OS Communications Server: IP Configuration Guide.  
  - If AT-TLS is enabled and the definitions are configured on the client and server stacks but DBG0104I is still displayed then see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637.  
For NSS XMLAppliance client connections:  
  - The NSS XMLAppliance client must support an SSL/TLS negotiation protocol that is compatible with that which is configured for the NSS server.  
  - The NSS server stack must have AT-TLS enabled with the TCPCONFIG TTLS statement in the TCP/IP profile.  
  - AT-TLS policies must be defined for the NSS server stack to secure the connection. See AT-TLS policy in z/OS Communications Server: IP Configuration Guide.  
  - If AT-TLS is enabled on the server stack, and the definition is configured on the server stack but DBG0104I is still displayed then see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637. Configuration of the client's TLS settings are left up to the client application's implementation. |
Table 22. Common NSS client connection problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The userid used for the NSS client connection to the NSS server has</td>
<td>When NSS server syslog level 2 is set (NSS_SYSLOG_LEVEL_VERBOSE), debug message DBG0032I is generated. For example:</td>
<td>SAF resource permissions are required to access NSS IPSec services:</td>
</tr>
<tr>
<td>insufficient authority to access services requested.</td>
<td>DBG0032I NSS_VERBOSE ServauthCheck (USER2, EZB.NSS.MVS093.CLIENT2.IPSEC.CERT) rc 4 (DENY) racfRC 4 racfRsn 0</td>
<td>• EZB.NSS.sysname.clientname.IPSEC.CERT</td>
</tr>
<tr>
<td></td>
<td>SAF resource permissions are required to access the NSS XMLAppliance services:</td>
<td>• EZB.NSS.sysname.clientname.IPSEC.NETMGT</td>
</tr>
<tr>
<td></td>
<td>These resources must be defined on the NSS server system and the client userid must be permitted read access to them.</td>
<td>• EZB.NSS.sysname.clientname.XMLAPPLIANCE.SAFACCESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EZB.NSS.sysname.clientname.XMLAPPLIANCE.CERT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EZB.NSS.sysname.clientname.XMLAPPLIANCE.PRIVKEY</td>
</tr>
<tr>
<td>An NSS client appears to be connected to two instances of the NSS</td>
<td>For an NSS IPSec client, the ipsec -x display for both NSS servers shows the same client connected.</td>
<td>Under normal termination, an NSS client will issue a disconnect to close its connection with the NSS server. In some rare recovery situations, the NSS server may not be aware that a connection with an NSS client has ended. When the client restarts or attempts to reconnect, it is possible it may connect to a different NSS server instance, such as the backup server or an NSS server on another system when the client is connecting on a distributed dynamic VIPA. Use the ipsec -w display on the system running the affected NSS IPSec client to determine which NSS server the IPSec client is actually connected. Optionally, use the Netstat DRop/-D command to close out the old connection on the other NSS server.</td>
</tr>
<tr>
<td>server.</td>
<td>For an NSS client, the nssctl -d for both NSS servers shows the same client connected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The NSS server issues the EZD1371I console message to indicate the disabled discipline and closes the connection.</td>
<td>The NSS server has been configured to disable the specified discipline. Modify the NSS server configuration to enable the specified discipline. See z/OS Communications Server: IP Configuration Reference for more information about the NSS server configuration.</td>
</tr>
<tr>
<td>NSS clients are failing to connect to the NSS server.</td>
<td>The NSS server issues the EZD1371I console message to indicate the disabled discipline and closes the connection.</td>
<td></td>
</tr>
</tbody>
</table>

The following table lists common problems when requests from a network security services (NSS) client fails.
Table 23. Common NSS client request failures

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>The userid used for the NSS client connection has insufficient authority to access client certificates.</td>
<td>When NSS server syslog level 4 is set (NSS_SYSLOG_LEVEL_CERTINFO), debug message DBG0004I is generated:</td>
</tr>
<tr>
<td></td>
<td>DBG0004I NSS_CERTINFO Client MVS093_TCPCS3 connected as userid USER1 is not authorized to profile EZB.NSSCERT.VIC012.NSCLIENT3.HOST associated with matching certificate ( NSCLIENT3 ) for request 00000000000000150000000000000000</td>
</tr>
<tr>
<td></td>
<td>• EZB.NSSCERT.sysname.mappedlabelname.HOST</td>
</tr>
<tr>
<td></td>
<td>• EZB.NSSCERT.sysname.mappedlabelname.CERTAUTH</td>
</tr>
<tr>
<td></td>
<td>These resources must be defined on the NSS server system and the client userid must be permitted read access to them.</td>
</tr>
</tbody>
</table>

The userid used for the NSS client connection has insufficient authority to access the private keys associated with client certificates.

When NSS server syslog level 4 is set (NSS_SYSLOG_LEVEL_CERTINFO), debug message DBG0004I is generated:

Jun 25 14:54:43 MVS093 NSSD: DBG0004I NSS_CERTINFO Client XML_ClientB8 connected as userid USER198 is not authorized to profile EZB.NSSCERT.MVS093.KEY1024ICSF.PRIVKEY associated with matching certificate ( Key1024ICSF ) for request 9987A24B879696844B824BF0F0F10000

SAF resource permissions are required to access private keys associated with certificates from the NSS server:

EZB.NSSCERT.sysname.mappedlabelname.PRIVKEY

These resources must be defined on the NSS server system and the client userid must be permitted read access to them.

NSS XMLAppliance client API return codes and reason codes

The following table lists and describes the possible return codes and reason codes returned by the NSS server to NSS XMLAppliance clients.

Table 24. NSS XMLAppliance client API return codes and reason codes

<table>
<thead>
<tr>
<th>Return code (NMsMRC)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>No error</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsrnBadIdent (1)</td>
<td>Invalid message or record identifier supplied in message.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Re-issue the request and send a correctly formatted message</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsrnBadVersion (2)</td>
<td>Invalid version supplied in message header.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Send a correctly formatted message</td>
</tr>
<tr>
<td>Return code (NMsMRC)</td>
<td>Reason code (NMsMRsn)</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsRsnBadType (3)</td>
<td>Unsupported or unknown message type supplied in message header.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Send a supported message type.</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsRsnExcessiveSize (4)</td>
<td>Excessive message size.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Connection is closed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Re-issue the connection and send a correctly formatted message.</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsRsnHdrSize (5)</td>
<td>Message header size is not valid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Send a message with the header size field set to the correct value.</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsRsnMsgSize (6)</td>
<td>Message size is not valid. For example, the message may be too short, or the message size may be greater than the sum of its parts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Send a correctly formatted message.</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsRsnReservedNonzero (7)</td>
<td>Reserved data in message header, record header, or record data is non-zero value. Reserved fields must be set to 0 for compatibility with any future versions of the interface.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Send a message with reserved fields set to 0.</td>
</tr>
<tr>
<td>EINVAL(121)</td>
<td>NMsRsnRecordLength (8)</td>
<td>Unrecognized record length supplied in message. Length does not correspond to known record data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action:</strong> Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response:</strong> Send a message with input filters of the correct length.</td>
</tr>
<tr>
<td>Return code (NMsMRc)</td>
<td>Reason code (NMsMRsn)</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| EINVAL(121)          | NMsrnRecordCount (9)  | Unsupported record count supplied in message. NMI requests currently support a maximum of twenty input records.  
**System Action:** Request is failed but connection remains open.  
**Response:** Send a message with the correct number of input filters. |
| EINVAL(121)          | NMsrnSectionLength (10) | Unrecognized section length supplied in record. Length does not correspond to known section data.  
**System Action:** Request is failed but connection remains open.  
**Response:** Send a message with correct input filters. |
| EINVAL(121)          | NMsrnSectionCount (11) | Unrecognized section count supplied in record. NMI requests currently allow one section in an input record.  
**System Action:** Request is failed but connection remains open.  
**Response:** Send a message with correct input filters. |
| EINVAL(121)          | NMsrnClientAlreadyConnected (10002) | The remote client name is already registered with the NSS server. NSS client names must be unique.  
**System Action:** Connection is closed.  
**Response:** Re-issue the connection request using a unique client name. |
| EINVAL(121)          | NMsrnNoMatchingCert (10004) | The NSS server could not find a matching certificate. The certificate does not exist on the NSS servers configured keyring, it is marked untrusted, or the NSS client does not have the authority to use the certificate.  
**System Action:** Request is failed but connection remains open.  
**Response:** Re-issue the request with an existing, trusted, and authorized certificate label. |
<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EINVAL(121)          | NMsrNoCertRep (10014) | The NSS server does not have a certificate repository available to process the request.  
**System Action:** Request is failed but connection remains open.  
**Response:** Start the appropriate application logic. |
| EINVAL(121)          | NMsrInvalidService (10021) | A service has been requested that is not affiliated with the requested discipline.  
**System Action:** Connection is closed.  
**Response:** Re-attempt the connection and request only the services affiliated with the requested discipline. |
| EINVAL(121)          | NMsrInvalidIdentity (10022) | The SAF user access check request did not contain a valid user identity. The SAF ID is not recognized or, if a certificate was provided as input to the NSS_CheckUserAccessReqToSrv, no valid certificate name filter mapping is defined in RACF.  
**System Action:** NSS server processing continues.  
**Response:** Ensure that the user identity is entered correctly and reissue the request. |
| EINVAL(121)          | NMsrInvalidSAFClass (10023) | The SAF class specified in the NSS_SAFCheckUserAccessReqToSrv message was unsupported.  
**System Action:** None.  
**Response:** Contact the NSS client vendor. The SERVAUTH class is the only currently-supported SAF class. |
| EINVAL(121)          | NMsrInvalidProfileLength (10024) | The SAF user access check request contained an invalid profile length.  
**System Action:** NSS server processing continues.  
**Response:** Contact the NSS client vendor. The maximum profile length for the SERVAUTH class is 64 bytes. |
| EINVAL(121)          | NMsrInvalidDiscipline (10025) | The discipline specified in the connection request contains an invalid value.  
**System Action:** Connection is closed.  
**Response:** Re-attempt the connection and pass in a valid discipline. |
<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EINVAL(121)         | NMsRsnBadUpdate (10026)                       | The client has attempted to update its client information using values that cannot be changed after the initial connection has succeeded.  
**System Action:** Request is failed but connection remains open.  
**Response:** Re-attempt the update by changing only those fields which are acceptable under and update.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| EINVAL(121)         | NMsRsnInvalidAPIVersion (10027)               | An NSS client has attempted to connect to the NSS server and has specified adherence to an API version that is insufficient for the requested discipline.  
**System Action:** Connection is closed.  
**Response:** Contact the NSS client vendor. NSS XMLAppliance clients must adhere to NMsec_NSS_API_VERSION2 (2) or higher.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| EINVAL(121)         | NMsRsnInvalidAccessLevel (10028)              | The SAF user access check request contained an invalid value for the requested access level.  
**System Action:** NSS server processing continues.  
**Response:** Contact the NSS client vendor. Supported access levels are:  
| Requested access   | Hexadecimal value  
READ | 0x02  
UPDATE | 0x04  
CONTROL | 0x08  
ALTER | 0x80 |
| EINVAL(121)         | NMsRsnInvalidClientName (10029)               | NSS_ConnectClientReqToSrv or NSS_UpdateClientInfoReqToSrv request is invalid.  
**System Action:** If the client name is invalid on the connect, the request is failed and the connection is closed. If the client name is invalid on the update, the request is failed, the connection remains open, but the client remains in the update pending state until a valid update is provided.  
**Response:** Re-attempt the connect or update by providing a valid NSS client name. Valid characters are [a-zA-Z0-9_-]. The client name must be left-justified and blank-padded. Embedded spaces are invalid.
<table>
<thead>
<tr>
<th>Return code (NMsMRC)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EINVAL(121)          | NMsRsnInvalidCertLabelName (10030) | The NSS XMLAppliance client request contained an invalid value for the requested certificate label name.  
**System Action:** NSS server processing continues.  
**Response:** The NSS client should re-issue the request with a valid certificate label name. The values accepted in this field are documented in the request input for the NSS_GetCertificateReqToSrv call. |
| EINVAL(121)          | NMsRsnNoPrivateKey (10031) | The certificate does not contain the private key.  
**System Action:** Request is failed but connection remains open.  
**Response:** If the certificate is intended to have a private key, then contact the NSSD administrator to determine what action to take. |
| EACCES(111)          | NMsRsnDisconnectPending (1) | A client disconnect operation is pending, so no new request messages are being accepted.  
**System Action:** Request is rejected and connection is eventually closed.  
**Response:** Stop sending requests for this connection. Reconnect to the server and re-issue the request. |
| EACCES(111)          | NMsRsnUpdatePending (2) | A client update operation is pending, so no new request messages are being accepted.  
**System Action:** None.  
**Response:** Re-issue the request. |
| EACCES(111)          | NMsRsnNoAuthForService (4) | Userid is not authorized to use the NSS server for the requested service.  
**System Action:** Connection is closed.  
**Response:** Ensure that the clients access to the requested service is defined in the servers SERVAUTH profiles (EZB.NSS.sysname.clientname.dicipline.service). |
| EACCES(111)          | NMsRsnUserAuthentication (10001) | User authentication failed.  
**System Action:** NSS server processing continues.  
**Response:** Ensure that the userid is defined in the server’s security manager and that the password or passticket is formed correctly. |
<table>
<thead>
<tr>
<th>Return code (NMsmRc)</th>
<th>Reason code (NMsmRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EACCES(111)          | NMsmRsnSAFUserNotAuthenticated (10002) | The SAF user identity specified in the request failed authentication.  
**System Action:** The NSS server successfully completed the authentication check. Processing continues.  
**Response:** NSS client independent. The NSS client should react accordingly. |
| EACCES(111)          | NMsmRsnSAFUserAccessDenied (10003) | The SAF user access check indicates access denied from the security server.  
**System Action:** The NSS server successfully completed the access check. Processing continues.  
**Response:** NSS client independent. The NSS client should react accordingly. |
| EACCES(111)          | NMsmRsnSAFResourceError (10004) | The SAF user access check indicates that a SAF server is not installed, has not been started, or the specified class is not active, is not defined, or that no profile exists for the specified resource.  
**System Action:** The NSS server failed to complete the access check. Processing continues.  
**Response:** NSS client independent. The NSS client should react accordingly. Most commonly this reason code indicates that the profile that was queried does not exist. It would then be up to the NSS client to decide whether this implies access denied or access granted. |
| EACCES(111)          | NMsmRsnUnsupportedDiscipline (10005) | The discipline specified in the connection request is currently disabled in the NSS server.  
**System Action:** Connection is closed.  
**Response:** Modify the NSS server configuration to enable the specified discipline. |
| EACCES(111)          | NMsmRsnNoAuthForPrivKey (10006) | Userid is not permitted to use the requested certificate’s private key.  
**System Action:** Request is failed but connection remains open.  
**Response:** Permit user to security resource SERVAUTH profile EZB.NSSCERT.sysname.mappedlabelname.PRIVKEY |
<table>
<thead>
<tr>
<th>Return code (NMsmRc)</th>
<th>Reason code (NMsmRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EACCES(111)          | NMsrnPrivKeyProtected (10007) | The certificate's private key is protected from being retrieved.  
**System Action:** Request is failed but connection remains open.  
**Response:** If the private key is intended to be retrieved, then contact the NSSD administrator to determine what action to take. |
| EACCES(111)          | NMsrnPrivKeyNotProtected (10008) | The certificate's private key is not stored in the ICSF PKA key data set (PKDS). Signature generation and decryption require use of certificates for which the private keys are stored in the ICSF PKDS.  
**System Action:** Request is failed but connection remains open.  
**Response:** If the private key is intended to be used for signature generation or decryption, then contact the NSSD administrator to determine what action to take. |
| EACCES(111)          | NMsrnNoAuthForCert (10009) | Userid is not permitted to retrieve the requested certificate.  
**System Action:** Request is failed but connection remains open.  
**Response:** Send a message with correct input filters. Permit user to proper security resource SERVAUTH profiles: Read access to either of the following profiles will authorize the NSS server to retrieve the requested certificate:  
- EZB.NSSCERT. sysname.mappedlabelname.CERTAUTH  
- EZB.NSSCERT. sysname.mappedlabelname.SERVHOST |
| ENOMEM(132)          | 0                     | Insufficient storage available in the server to process the request.  
**System Action:** Request is failed but connection remains open.  
**Response:** Increase the REGION size for the NSS server, or send a message with a narrower set of input filters to limit the response. |
<table>
<thead>
<tr>
<th>Return code (NMsM Rc)</th>
<th>Reason code (NM sMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| ENOLCK(131)           | 0                      | Failed to obtain an internal lock.  
**System Action:** Request fails but connection remains open. A message will appear in the MVS system log with additional diagnostic information.  
**Response:** Contact IBM service. |
| EGSKCMS(10004)        | See gskcms.h. The Reason code represents the GSK (system SSL) return code provided on the failed call. | A System SSL error was encountered when issuing a System SSL library call. The NSS reason code will contain the System SSL CMS Status Code.  
**System Action:** Request is failed but connection remains open.  
**Response:** Review the system SSL CMS status codes from z/OS Cryptographic Services System SSL Programming. |
| ECSFBEXT(10005)       | The high-order 16 bits of the reason code represent the ICSF return Code. The low-order 16 bits of the reason code represent the ICFS reason code. | An Integrated Cryptographic Service Facility (ICSF) error was encountered while performing an RSA operation. The reason code will contain the ICSF return code(high order 16 bits) and reason code(low order 16 bits).  
**System Action:** Request is failed but connection remains open.  
**Response:** Review the ICSF return and reason codes from z/OS Cryptographic Services ICSF Application Programmer’s Guide. |

Network security services server debug information

Obtaining syslog debug information for the network security service server

The SyslogLevel parameter in the network security services server configuration file controls the level of NSS server internal debug information that is sent to syslog. When configuring with the IBM Configuration Assistant for z/OS Communications Server, use the NSS Daemon Syslog Trace panel to configure the level of network security services server internal debug information that is sent to syslog. See z/OS Communications Server: IP Configuration Reference or the IBM Configuration Assistant for z/OS Communications Server online help for more information.

Abends

Messages and error-related information should be sent to the system console when an abend occurs during NSS server processing. NSSD will initiate a system dump for the abend condition. System dumps of the NSS server include Language Environment data. The Language Environment IPCS verbexit LEDATA can be used to format this information. See z/OS Language Environment Debugging Guide for more information. The following is a sample IPCS verbexit ledata command:

```
verbx ledata 'asid(68) tcb(007E5E88) cee dump nthreads(*)'
```
In this example, the network security services server asid is 0x68 and the address of the abended NSS TCB is 0x007E5E88.

**Error codes**

Several messages display a return code and reason generated by the NSS server. Most of these return codes and reasons are generated in support of the application interface for managing IP filtering and IPSec on remote network security clients. These return codes and reasons are documented in z/OS Communications Server: IP Programmer’s Guide and Reference.

Additional return codes and reasons may be generated by the NSS server. These return codes and reasons are generated in support of remote management services offered to remote network security clients and are explained in the following error codes table.

<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGSKSIGN (10001)</td>
<td>gsk_status code generated during the failure. Common codes are:</td>
<td>A System SSL CMS error was encountered while attempting to create a signature. The reason code will contain the System SSL return code.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ALG_NOT_SUPPORTED]</td>
<td>System Action</td>
</tr>
<tr>
<td></td>
<td>The signature algorithm is not supported.</td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_BAD_DIGEST_SIZE ]</td>
<td>Response</td>
</tr>
<tr>
<td></td>
<td>The certificate private key is not long enough to be used with the digest size required by the requested hash algorithm.</td>
<td>Examine gsk_status code (returned as the reason code), which are documented in z/OS Cryptographic Services System SSL Programming. Verify the failed message contained correct data. If it did not then take action to correct the message content. If it did then contact the NSSD administrator to determine what action to take.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_KEY_MISMATCH]</td>
<td>If the gsk_status_code is CMS_ERR_ICSF_NOT_AVAILABLE, request that the NSSD administrator verify that ICSF is started.</td>
</tr>
<tr>
<td></td>
<td>The supplied key does not match the signature algorithm.</td>
<td>If the gsk_status_code is CMS_ERR_ICSF_SERVICE_FAILURE, notify the NSSD administrator. The NSSD administrator should determine whether the SAF CSFSERV general resource class is defined and determine whether the CSF1PKS profile is defined for that resource. If the CSF1PKS profile is defined, verify that NSSD has read access to it. See the z/OS Cryptographic Services ICSF Administrator’s Guide for more information about the CSFSERV general resource and the CSF1PKS profile.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_NO_MEMORY]</td>
<td>Insufficient storage is available.</td>
</tr>
<tr>
<td></td>
<td>ICSF is not available.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ICSF_NOT_AVAILABLE]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>An ICSF service failed.</td>
<td></td>
</tr>
<tr>
<td>Return code (NMzMRc)</td>
<td>Reason code (NMzMRSn)</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>EGSKVAL (10002)</td>
<td>gsk_status code generated during the failure. Common codes are:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[CMSERR_BAD_HANDLE]</td>
<td>The database handle is not valid.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_BAD_ISSUER_NAME]</td>
<td>The certificate issuer name is not valid.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_BAD_SIGNATURE]</td>
<td>The signature is not correct.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_CERT_CHAIN_NOT_TRUST]</td>
<td>The certification chain is not trusted.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_CERTIFICATE_REVOKED]</td>
<td>The certificate is revoked.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_EXPIRED]</td>
<td>The certificate is expired.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_INCORRECT_DBTYPE]</td>
<td>The database type does not support certificates.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_INCORRECT_KEY_USAGE]</td>
<td>The issuer certificate does not allow signing certificates</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ISSUER_NOT_CA]</td>
<td>The certificate issuer is not a certification authority.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ISSUER_NOT_FOUND]</td>
<td>The issuer certificate is not found in one of the data sources.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_NAME_CONSTRAINTS_VIOLATED]</td>
<td>The certificate name is not consistent with the name constraints.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_NAME_NOT_SUPPORTED]</td>
<td>The AuthorityKeyIdentifier extension name is not a directory name.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_NOT_YET_VALID]</td>
<td>The certificate is not yet valid.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_PATH_TOO_LONG]</td>
<td>The certification chain exceeds the maximum allowed by the CA.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_SELF_SIGNED_NOT_FOUND]</td>
<td>A self-signed certificate is not found in a trusted data source</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ICSF_NOT_AVAILABLE]</td>
<td>ICSF is not available.</td>
</tr>
</tbody>
</table>

**GSK validate certificate failure.**

**System Action**

Request fails but connection remains open.

**Response**

Examine gsk_status code (returned as the reason code), which are documented in z/OS Cryptographic Services System SSL Programming. Verify the failed message contained correct data. If it did not, then take action to correct the message content. If it did and the reason code is one of the following, contact the certificate owner and inform them of the problem encountered with the certificate:

- CMSERR_BAD_ISSUER_NAME
- CMSERR_BAD_SIGNATURE
- CMSERR_CERTIFICATE_REVOKED
- CMSERR_EXPIRED
- CMSERR_INCORRECT_KEY_USAGE
- CMSERR_ISSUER_NOT_CA
- CMSERR_NAME_CONSTRAINTS_VIOLATED
- CMSERR_NAME_NOT_SUPPORTED
- CMSERR_NOT_YET_VALID
- CMSERR_PATH_TOO_LONG

If the reason code is anything other than the codes above, contact the NSSD administrator to determine what action to take. Other common reason codes include:

- CMSERR_BAD_HANDLE
- CMSERR_CERT_CHAIN_NOT_TRUST
- CMSERR_INCORRECT_DBTYPE
- CMSERR_ISSUER_NOT_FOUND
- CMSERR_SELF_SIGNED_NOT_FOUND

If the gsk_status_code is CMSERR_ICSF_NOT_AVAILABLE, request that the NSSD administrator verify that ICSF is started.
<table>
<thead>
<tr>
<th>Return code (NMsmRc)</th>
<th>Reason code (NMsmRsn)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGSKVER (10003)</td>
<td>gsk_status code generated during the failure. Common codes are:</td>
<td>A System SSL CMS error was encountered while attempting to verify a signature. The reason code will contain the System SSL return code.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ALG_NOT_SUPPORTED]</td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td>The signature algorithm is not supported.</td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_BAD_DIGEST_SIZE]</td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td>The digest size is not correct.</td>
<td>Examine gsk_status code (returned as the reason code), which are documented in z/OS Cryptographic Services System SSL Programming. Verify the failed message contained correct data. If it did not, then take action to correct the message content. If it did, then treat the signature as an invalid signature.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_BAD_SIGNATURE]</td>
<td>If the gsk_status_code is CMS_ERR_ICSF_NOT_AVAILABLE, request that the NSSD administrator verify that ICSF is started.</td>
</tr>
<tr>
<td></td>
<td>The signature is not correct.</td>
<td>If the gsk_status_code is CMS_ERR_ICSF_SERVICE_FAILURE, notify the NSSD administrator. The NSSD administrator should determine whether the SAF CSFSERV general resource class is defined and determine whether the CSF1PKV profile is defined for that resource. If the CSF1PKV profile is defined, verify that NSSD has read access to it. See z/OS Cryptographic Services ICSF Administrator’s Guide for more information about the CSFSERV general resource and the CSF1PKV profile.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_KEY_MISMATCH]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The supplied key does not match the signature algorithm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ICSF_NOT_AVAILABLE]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICSF is not available.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ICSF_SERVICE_FAILURE]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>An ICSF service failed.</td>
<td></td>
</tr>
<tr>
<td>EGSKCMS (10004)</td>
<td>gsk_status code generated during the failure. Common codes are:</td>
<td>A System SSL CMS error was encountered while processing the request. The reason code will contain the System SSL return code.</td>
</tr>
<tr>
<td></td>
<td>[CMSERR_ICSF_NOT_AVAILABLE]</td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td>ICSF is not available.</td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Examine gsk_status code (returned as the reason code), which are documented in z/OS Cryptographic Services System SSL Programming.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the gsk_status_code is CMS_ERR_ICSF_NOT_AVAILABLE, request that the NSSD administrator verify that ICSF is started.</td>
</tr>
<tr>
<td>Return code (NMsMrC)</td>
<td>Reason code (NMsMRsn)</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>ECSFBEXT (10005)</td>
<td>The high-order 16 bits of the reason code represent the ICSF return code. The low-order 16 bits of the reason code represent the ICFS reason code.</td>
<td>An Integrated Cryptographic Service Facility (ICSF) error was encountered. The reason code will contain the ICSF return code (high-order 16 bits) and reason code (low-order 16 bits).</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request is failed but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Review the ICSF return and reason codes from z/OS Cryptographic Services ICSF Application Programmer’s Guide.</td>
</tr>
<tr>
<td>EACCES (111)</td>
<td>NMSRsnUserAuthentication (10001)</td>
<td>User authentication failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails and the connection is closed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify the following: The user ID under which the NSS client connects to the NSS server is correct The password used to authenticated that user ID is valid, or the application key used to generate the passticket is correct (this key is stored in the SAF-enabled security manager).</td>
</tr>
<tr>
<td>EACCES (111)</td>
<td>NMSRsnNoAuthForService (4)</td>
<td>The NSS client does not have access to the requested service through the governing SERVAUTH profile.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If appropriate, define a SERVAUTH profile that will allow the requested access.</td>
</tr>
<tr>
<td>EACCES (111)</td>
<td>NMSRsnNoAuthForClientname (3)</td>
<td>The user ID in the connection request is not authorized to act on behalf of the NSS clientName.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails and the connection is closed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ensure that all of the following are correct: The user ID (and password, if necessary) as configured at the client. The client name as configured at the client. Also ensure that the appropriate SERVAUTH profiles are defined at the server system for the client.</td>
</tr>
</tbody>
</table>
Table 25. NSS IPSec client API return codes and reason codes (continued)

<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EACCES (111)         | NMsRsnDisconnectPending (1) | A disconnect operation is pending.  
**System Action**  
Request fails but connection remains open for a very short time.  
**Response**  
The client must reconnect the server before any more NSS services can be requested. |
| ECCESS (111)          | NMsRsnUnsupportedDiscipline (10005) | The discipline specified in the connection request is currently disabled in the NSS server.  
**System Action**  
Connection is closed.  
**Response**  
Modify the NSS server configuration to enable the specified discipline. |
| EINVAL (121)          | NMsRsnClientAlreadyConnected (10002) | Client is already connected to this server.  
**System Action**  
Request fails and the connection is closed.  
**Response**  
If appropriate, disconnect the active client and reattempt the connection request. |
| EINVAL (121)          | NSSRsnRIDNotInCert (10003) | The certificate used to sign does not contain remote ID specified.  
**System Action**  
Request fails but connection remains open.  
**Response**  
None - this is an informational code only. |
| EINVAL (121)          | NSSRsnBadCert (10005) | Certificate not valid.  
**System Action**  
Request fails but connection remains open.  
**Response**  
If the failing certificate is one that is stored on the local system, it should be refreshed or replaced. If that certificate comes from a remote system, then this is an informational code only. |
| EINVAL (121)          | NSSRsnUnsupportedCert (10006) | Unsupported certificate encoding.  
**System Action**  
Request fails but connection remains open.  
**Response**  
Contact IBM service. |
<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EINVAL (121)          | NSSRsnBadLIDType (10007) | Unrecognized LID type.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)          | NSSRsnBadLIDValue (10008) | LID value not valid.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)          | NSSRsnBadRIDType (10009) | Unrecognized LID type.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)          | NSSRsnBadRIDValue (10010) | LID value not valid.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)          | NSSRsnBadLocalIPaddr (10011) | Local IPaddr not valid.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)          | NSSRsnBadRemoteIPaddr (10012) | Remote IPaddr not valid.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)          | NSSRsnAddrVersionMismatch (10013) | Local and remote IP address versions don't match.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EINVAL (121)</td>
<td>NSSRsnNoCertRep (10014)</td>
<td>Certificate repository not available.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Create or restore the certificate repository and then try the request again.</td>
</tr>
<tr>
<td>EINVAL (121)</td>
<td>NSSRsnBadHashSize (10016)</td>
<td>Hash size not valid for specified hash algorithm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact IBM service.</td>
</tr>
<tr>
<td>EINVAL (121)</td>
<td>NSSRsnBadHashAlg (10017)</td>
<td>Hash algorithm not supported or an NSSD server is at a lower version than the IKED client. Before calling IBM service, check for msg EZD1904E in your IKED log. If it is a version mismatch, either change your IpSec policy to specify only algorithms that this version of NSSD supports or upgrade the NSSD server to the same version as IKED.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact IBM service.</td>
</tr>
<tr>
<td>EINVAL (121)</td>
<td>NSSRsnSaNotInCertLife (10018)</td>
<td>SA lifetime not in certificate lifetime.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>None - this is an informational code only.</td>
</tr>
<tr>
<td>EINVAL (121)</td>
<td>NSSRsnBadCa (10019)</td>
<td>The DER encoding type specified for the Certificate Authority name is unrecognized.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact IBM service.</td>
</tr>
<tr>
<td>EINVAL (121)</td>
<td>NSSRsnUnsupportedCaType (10020)</td>
<td>Unsupported CA encoding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>System Action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request fails but connection remains open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact IBM service.</td>
</tr>
<tr>
<td>Return code (NMsMRc)</td>
<td>Reason code (NMsMRsn)</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| EINVAL (121) | NMsrInvalidService (10021) | A service has been requested that is not affiliated with the requested discipline.  
**System Action**  
Connection is closed.  
**Response**  
Re-attempt the connection and request only the services affiliated with the requested discipline. |
| EINVAL (121) | NMsrInvalidDiscipline (10025) | The discipline specified in the connection request contains an invalid value.  
**System Action**  
Connection is closed.  
**Response**  
Re-attempt the connection and pass in a valid discipline. |
| EINVAL (121) | NMsrBadUpdate (10026) | The client has attempted to update its client information using values that cannot be changed after the initial connection has succeeded.  
**System Action**  
Request is failed but connection remains open.  
**Response**  
Re-attempt the update by changing only those fields which are acceptable under an update. |
| EINVAL (121) | NMsrInvalidAPIVersion (10027) | An NSS client has attempted to connect to the NSS server and has specified adherence to an API version that is insufficient for the requested discipline.  
**System Action**  
Connection is closed.  
**Response**  
Re-attempt the connection using an accepted API version. NSS IPSec clients must adhere to NMsec_NSS_API_VERSION1 (1) or higher. NSS XMLAppliance clients must adhere to NMsec_NSS_API_VERSION2 (2) or higher. |
<table>
<thead>
<tr>
<th>Return code (NMsMrC)</th>
<th>Reason code (NMsMrSn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EINVAL (121)         | NMsrnInvalidClientName (10029) | **NSS_ConnectClientReqToSrv or NSS_UpdateClientInfoReqToSrv request is invalid.**  
  **System Action**  
  If the client name is invalid on the connect, the request is failed and the connection is closed. If the client name is invalid on the update, the request is failed, the connection remains open, but the client remains in the update pending state until a valid update is provided.  
  **Response**  
  Re-attempt the connect or update by providing a valid NSS client name. Valid characters are [a-zA-Z0-9-_]. The client name must be left-justified and blank-padded. Embedded spaces are invalid. |
| EINVAL (121)         | NSSrnbAudMethod (10032) | Authentication method not supported.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)         | NSSrnbPRAIg (10033) | PRF algorithm not supported.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Contact IBM service. |
| EINVAL (121)         | NSSrnbMissingCRLs (10034) | The NSS client requested strict revocation checking but certificate revocation lists (CRLs) are missing from the request.  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Re-attempt the request providing the missing CRLs. |
| EINVAL (121)         | NSSrnbPRFAIgNotFIPS (10035) | The NSS server is configured for FIPS mode but the NSS client requested a PRF algorithm that is not valid for FIPS mode (e.g. HMAC-MD5).  
  **System Action**  
  Request fails but connection remains open.  
  **Response**  
  Re-attempt the request with a PRF algorithm that is valid for FIPS mode. |
<table>
<thead>
<tr>
<th>Return code (NMsMRc)</th>
<th>Reason code (NMsMRsn)</th>
<th>Description</th>
</tr>
</thead>
</table>
| EINVAL (121)         | NSSRsnHashAlgNotFIPS (10036) | The NSS server is configured for FIPS mode but the NSS client requested a hash algorithm that is not valid for FIPS mode (e.g. MD5).  
**System Action**  
Request fails but connection remains open.  
**Response**  
Re-attempt the request with a hash algorithm that is valid for FIPS mode. |
| ENOLCK (131)         | 0                     | Failed to obtain an internal lock.  
**System Action**  
Request fails but connection remains open.  
A message will appear in the MVS system log with additional diagnostic information.  
**Response**  
Contact IBM service. |
| ENOMEM (132)         | NMsrnTooManyConns (1) | The NSS server is already using its maximum number of 500 connections and cannot accept any more.  
**System Action**  
Connection is not opened and the request is failed.  
**Response**  
Try the request again later. |
| ENXIO (138)          | NSSRsnUnknownClientName (10001) | The specified client name not recognized.  
**System Action**  
Request fails and the connection is closed.  
**Response**  
Verify that the client name was specified correctly and that the NSS client is connected to the NSS server. Note, however, that this error code often occurs when directing a request to an NSS client that is not currently connected to the NSS server. |

**TCP/IP services component trace for the network security services (NSS) server**

The network security services (NSS) server uses component trace support to trace internal operations. This section describes how to specify NSS server trace and formatting options. For short descriptions of other tracing procedures, such as displaying trace status, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

For detailed information, see the following information:

- z/OS MVS Diagnosis: Tools and Service Aids for information about component trace procedures.
Using CTRACE

You can specify component trace options at NSS server initialization or after the NSS server has initialized. Table 26 on page 357 lists the network security services server trace options.

Table 26. NSS server trace options

<table>
<thead>
<tr>
<th>Trace events</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>Select all types of records. Note: This option might have an impact on performance.</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>Select the minimum level of tracing for the network security services server. This level includes the INIT, EXCEPT, and TERM categories.</td>
</tr>
<tr>
<td>INIT</td>
<td>Select NSS server initialization information.</td>
</tr>
<tr>
<td>TERM</td>
<td>Select NSS server termination information.</td>
</tr>
<tr>
<td>EXCEPT</td>
<td>Select NSS server exception information.</td>
</tr>
<tr>
<td>CONFIG</td>
<td>Select NSS server configuration information.</td>
</tr>
<tr>
<td>COMMANDS</td>
<td>Select processing of NSS server commands from the console or command line.</td>
</tr>
<tr>
<td>LOGMSGS</td>
<td>Select NSS server syslog messages. These entries can be used to easily correlate system log messages to a specific point in the CTRACE log.</td>
</tr>
<tr>
<td>ROUTING</td>
<td>Select NSS server threading and request dispatching information</td>
</tr>
<tr>
<td>SERIAL</td>
<td>Select NSS server serialization information</td>
</tr>
<tr>
<td>EVENT</td>
<td>Select NSS server event information.</td>
</tr>
<tr>
<td>SOCKETS</td>
<td>Select NSS server socket information.</td>
</tr>
<tr>
<td>PERFORM</td>
<td>Select NSS server performance information.</td>
</tr>
<tr>
<td>REQUESTS</td>
<td>Select NSS server request/response information.</td>
</tr>
<tr>
<td>FLOW</td>
<td>Select NSS server code flow information.</td>
</tr>
<tr>
<td>STORAGE</td>
<td>Select NSS server storage information.</td>
</tr>
<tr>
<td>CERTOPS</td>
<td>Select NSS server certificate operations information (cert cache ops and signature verify/create calls).</td>
</tr>
<tr>
<td>CONTROL</td>
<td>Select NSS server control information.</td>
</tr>
</tbody>
</table>
Steps for enabling the CTRACE at network security service (NSS) server startup

A default minimum component trace is always started during NSS server initialization. Use a parmlib member to customize the parameters that are used to initialize the trace. The default NSS server component trace parmlib member is the SYS1.PARMLIB member CTINSS00. You can change the parmlib member name using the NSSD_CTRACE_MEMBER environment variable.

**Rule:** The NSS server reads the NSSD_CTRACE_MEMBER environment variable only during initialization. Changes to NSSD_CTRACE_MEMBER after server initialization have no effect.

For a description of trace options, see Table 26 on page 357.

**Restriction:** In addition to specifying the trace options, you can also change the NSS trace buffer size. The buffer size can be changed only at NSS initialization and has a maximum of 256 MB.

If the CTINSS00 member or the member that is specified in NSSD_CTRACE_MEMBER is not found when starting the network security services server, the following message is issued:

```
IEE5381 member:Name MEMBER NOT FOUND IN PARMLIB
```

When this message is issued, the NSS component trace is started with a buffer size of 1 MB and the minimum tracing option.

Steps for enabling the CTRACE at network security services server startup

Edit the CTINSS00 parmlib member and enable the CTRACE at network security services server startup.

**Procedure**

Perform the following steps:

1. Edit the CTINSS00 parmlib member and specify the following:
   - `TRACEOPTS ON`
   - The buffer size you want with the `BUFSIZE()` parameter
   - The CTRACE options you want. To direct the CTRACE to an external writer, also specify the name of the writer JCL procedure in the `WTR()` parameter.

   See the example CTINSS00 parmlib member.

2. Start the network security services (NSS) server.

Steps for disabling the CTRACE at network security services server startup

Disable the CTRACE at network security services server startup.

**Procedure**

Follow these steps:

1. To disable the CTRACE at NSS startup, edit the CTINSS00 parmlib member and specify `TRACEOPTS OFF`.

2. Start the network security services (NSS) server.
Step for enabling the CTRACE after the network security services server is started

After the network security services (NSS) server is started, enable the CTRACE to an internal buffer or to an external writer.

**Procedure**

Perform the appropriate step:

- Issue the following console commands to enable the CTRACE to an internal buffer:

  ```
  TRACE CT,ON,COMP=SYSTCPNS, SUB=(nss_jobname)
  R xx, OPTIONS=(option[,option2...]), END
  ```

- Issue the following console commands to enable the CTRACE to an external writer:

  ```
  TRACE CT, WTRSTART=writer_proc
  TRACE CT, ON, COMP=SYSTCPNS, SUB=(nss_jobname)
  R xx, OPTIONS=(option[, option2...]), WTR=writer_proc, END
  ```

Step for disabling the CTRACE after the network security services server is started

After the network security services (NSS) server is started, disable the CTRACE to an internal buffer or to an external writer.

**Procedure**

Perform the appropriate step:

- Issue the following console command to disable the CTRACE to an internal buffer:

  ```
  TRACE CT, OFF, COMP=SYSTCPNS, SUB=(nss_jobname)
  ```

- Issue the following console commands to disable a CTRACE to an external writer:

  ```
  TRACE CT, OFF, COMP=SYSTCPNS, SUB=(nss_jobname)
  TRACE CT, WTRSTOP=writer_proc
  ```

Step for displaying the CTRACE status

To display the CTRACE status, issue the following console command:

```
D TRACE, COMP=SYSTCPNS, SUB=(nss_jobname)
```

Enabling CTRACE after network security services server initialization

After NSS initialization, you must use the TRACE CT command to change the component trace options. Each time a new component trace is initiated, all prior trace options are turned off and the new options are put into effect. You can specify the trace options with or without the parmlib member. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

Formatting network security services server trace records

You can format component trace records using IPCS panels or a combination of the IPCS panels and the CTRACE command, either from a dump or from external-writer files. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

Enter any combination of values as options to filter the CTRACE entries. The options must be entered using the following format:

```
TYPE(option[,option]...)
```

You can use any of the options listed in Table 26 on page 357, except ALL and MINIMUM.
Chapter 11. Diagnosing dynamic VIPA and sysplex problems

This topic presents diagnostic information for dynamic virtual IP address (DVIPA) and sysplex problems, and contains the following subtopics:

- “Overview of diagnosing sysplex distributor problems” on page 361
- “Steps for diagnosing sysplex problems” on page 362
- “Steps for diagnosing problems using DVIPAs in source IP address selection for TCPconnections problems” on page 372
- “Steps for diagnosing problems with the SYSPLEX-wide ephemeral port assignment for distributed DVIPAs” on page 373
- “Diagnosing problems with the SYSPLEX-wide ephemeral port assignment for EXPLICITBINDPORTRANGE processing” on page 375
- “Diagnosing sysplex-wide security association (SWSA) problems” on page 377
- “Steps for diagnosing sysplex routing problems” on page 381
- “Steps for diagnosing Tier 1 z/OS sysplex distribution problems” on page 383
- “Steps for diagnosing Tier 1 non-z/OS sysplex distribution problems” on page 385

Overview of diagnosing sysplex distributor problems

Diagnosing sysplex distributor problems presents some unique challenges. Because a DVIPA can be associated with multiple stacks in a sysplex, determining where a problem is can be more difficult. You can use a combination of the Netstat command from the system console and display sysplex commands to provide a clear picture of the sysplex. See z/OS Communications Server: IP Configuration Guide for an introduction to sysplex distribution with virtual addressing.

You can collect Netstat information in the following ways:

- You can issue the z/OS UNIX netstat command from the z/OS UNIX shell.
- You can issue the NETSTAT command from TSO.
- You can issue the DISPLAY TCPIP,,NETSTAT command from the system console.

In the following list of activities, you can find steps to perform them in “Steps for diagnosing sysplex problems” on page 362:

- First, determine that all the stacks that you expect to be communicating are in the same subplex, if subplexing is being used. See step “1” on page 362.
- For problems where the actual DVIPAs defined on a stack are not what you expected, confirm the current definitions on a stack. See step “2” on page 363.
- For Sysplex Distributor workload monitoring, use steps “7” on page 367 and “10” on page 371. If the output from these commands is not what you expected, see step “6” on page 366 for an overall picture of all DVIPA activity in your sysplex.
- If the output from step “6” on page 366 reveals an expected target stack not listed for a distributed DVIPA, perform step “3” on page 364 on the target stack in question. This helps to identify configuration problems on that stack. Note what is required of target stacks. Also use step “11” on page 371 to verify that a server application has indeed been activated and bound to the correct port.
- To help follow the flow of packets into and throughout the sysplex, a CTRACE with options XCF, TCP, and SYSTCPDA on participating stacks is useful. Use these to:
  - Identify the connection being received by the distributing stack.
- Determine the stack to which the connection is forwarded
- Verify the connection being forwarded
- Determine the expected target stack receiving and processing the connection

After the connection has been established, subsequent packets can be followed in the same manner. When the connection is terminated, CTRACE records record target stacks, cleans up the connection, and notifies the distributing stack.

### Steps for diagnosing sysplex problems

Use these steps to diagnose sysplex problems. The output is shown in the long, or IPv6-enabled, format.

**Procedure**

Perform the following steps:

1. If subplexing is being used, run the `D XCF,GROUP MVS` command to determine what groups are being used in the sysplex. Find all the group names with the format `EZBTvtt`.

```plaintext
D XCF,GROUP 10.11.09 DISPLAY XCF 637
GROUPS(SIZE):  COFVLFN0(2)  EZBTV112(2)  ISTXCFS11(2)
              10.11.18 DISPLAY XCF 640
GROUP EZBTV11CS:  MVS165TCPCS1  MVS165TCPCS1
D XCF,GROUP,EZBTV111
GROUP EZBTV111:  MVS165TCPCS11  VIC011TCPCS21
D XCF,GROUP,EZBTV112
GROUP EZBTV112:  MVS165TCPCS12  VIC011TCPCS22
D XCF,GROUP,EZBTV113
GROUP EZBTV113:  VIC011TCPCS23
```

Run the `D XCF,GROUP,groupname MVS` command for each of the `EZBTvtt` format groups to find all the member stacks participating in each subplex group.

```plaintext
D XCF,GROUP,EZBTV11CS
GROUP EZBTV11CS:  MVS165TCPCS1  MVS165TCPCS3  VIC011TCPCS2
D XCF,GROUP,EZBTV111
GROUP EZBTV111:  MVS165TCPCS11  VIC011TCPCS21
D XCF,GROUP,EZBTV112
GROUP EZBTV112:  MVS165TCPCS12  VIC011TCPCS22
D XCF,GROUP,EZBTV113
GROUP EZBTV113:  VIC011TCPCS23
```

The member names listed are the MVS name concatenated with the TCP/IP stack name. Verify that all the TCP/IP stacks you expect to be communicating are all within the same subplex group.

If the TCP/IP stacks that you expect to be communicating use the same HiperSockets CHPID, verify that they have all specified the same IQDVLANID value. Issue the Netstat CONFIG/-f command for each stack and verify that the IQDVLANID value displayed in the Global Configuration Information section of the output is the same for each stack.

```plaintext
NETSTAT CONFIG
MVS TCP/IP NETSTAT CS V1R8  TCPIP Name: TCPCS  12:55:20
TCP Configuration Table:
  DefltRcvBufSize: 00016384  DefltSndBufSize: 00016384
  DefltMaxRcvBufSize: 00262144
  MaxRcvTransmitTime: 120.000  MinRcvTransmitTime: 0.500
  RoundTripGain: 0.125  VarianceGain: 0.250
  VarianceMultiplier: 2.000  MaxSegLifeTime: 30.000
  DefaultKeepAlive: 00000120  DelayAck: Yes
  RestrictLowPort: Yes  SendGarbage: No
  TcpTimeStamp: Yes  FinWait2Time: 600
  TTLS: Yes
  UDP Configuration Table:
    DefltRcvBufSize: 00065535  DefltSndBufSize: 00065535
```

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2. Run the Netstat VIPADCFG/-F display command on the distributing stack to confirm that it is configured to distribute the DVIPA and how it is to be distributed.

If the DVIPA has been deactivated, the deactivated configuration definitions are displayed under the heading DEACTIVATED DYNAMIC VIPA INFORMATION.

- Figure 31 on page 364 shows that the TCP/IP identified by TCPCS was configured to distribute DVIPAs. Workload for the first DVIPA, 201.2.10.11 ports 20 and 21, is being distributed to all stacks in the sysplex including TCPCS itself; the configured distribution method is SERVERWLM.

- Workload for 201.2.10.12, ports 20 and 21, is being distributed only to the TCP/IP with dynamic XCF address 193.9.200.2.

- Workload for 201.2.10.13 port 5000 is being distributed to all stacks using the TIMEDAFFinity function.

- Workload for IPv6 DVIPA 2001:0DB8:1::1, port 6000 is being distributed to all stacks; the configured distribution method is SERVERWLM.

- The DVIPA, 201.2.10.23, port 4000, was configured to be distributed to all stacks in the sysplex. Because the DVIPA has been deactivated on this stack, it is not currently being distributed by this stack.
3. Run the display Netstat CONFIG/-f command on the distributing stack and all target stacks to confirm that the correct IPCONFIG and IPCONFIG6 options have been specified.

Specify SYSPLEXROUTING on the distributor and all target stacks in order to get WLM-based distribution. Verify that DYNAMICXCF was specified on the distributor and all target stacks.
Figure 32 on page 365 shows the output of this command for the distributing TCP/IP:

```plaintext
D TCPIP,TCPCS,N,CONFIG
EZD0101I NETSTAT CS V1R8 TCPCS 928
TCP CONFIGURATION TABLE:
DEFAULTRcvBUFSIZE: 00016384 DEFAULTSndBUFSIZE: 00016384
MAXRETRANSMITTIME: 120.000 MINRETRANSMITTIME: 0.500
ROUNDDIPGAIN: 0.125 VARIANCEGAIN: 0.250
VARIANCEMULTIPLIER: 2.000 MAXSEGDEFLIFE: 30.000
DEFAULTKEEPALIVE: 00000120 DELAYACK: YES
RESTRICTLOWPORT: YES SENDGARBAGE: NO
TCPTIMESTAMP: YES FINWAIT2TIME: 600
UDP CONFIGURATION TABLE:
DEFAULTRcvBUFSIZE: 00065535 DEFAULTSndBUFSIZE: 00065535
CHECKSUM: YES UDPQUEUEULIMIT: YES
RESTRICTLOWPORT: YES UDPLIMIT: YES
IP CONFIGURATION TABLE:
FORWARDING: YES HOPLIMIT: 00064 RSMTIMEOUT: 00060
ARPTIMEOUT: 01200 MAXRSMSIZE: 65535 FORMAT: LONG
IGREDIRECT: YES SYSPLEXROUT: YES DOUBLENOP: NO
STOPCLAW: NO SOURCEVIPA: YES
MULTIPATH: NO PATHMTUDSC: NO DEVRTRYDUR: 0000000090
DYNAMIXCF: YES
IPADDR/PREFIXLEN: 193.15.1.1/24 METRIC: 02
IQDIOROUTE: NO
TCPSTACKSRCVIPA: 203.15.1.1
IPv6 CONFIGURATION TABLE:
FORWARDING: YES HCOPHLIMIT: 00255 IGREDIRECT: YES
SOURCEVIPA: YES MULTIPATH: NO ICMPERRLIM: 00003
DYNAMIXCF: YES
IPADDR: 2001:0DB8::151:0 INTFID: 0006:0007:0008:0009
TCPSTACKSRCVIPA: DVIPA1
SMF PARAMETERS:
TYPE 118:
TCPINIT: 00 TCPTERM: 00 FTPCLIENT: 00
TN3270CLIENT: 00 TCPIPSTATS: 00
TYPE 119:
TCPINIT: NO TCPTERM: NO FTPCLIENT: NO
TCPSTACKSTATS: NO IPSTATS: NO PORTSTATS: NO
STACK: NO UDPTERM: NO TN3270CLIENT: NO
GLOBAL CONFIGURATION INFORMATION:
TCPSTACKSTATS: NO ECSALIMIT: 0000000K POOLLIMIT: 0000000K
MLSCHKTERM: NO
SYSPLEX MONITOR:
TIMERSECS: 0060 RECOVERY: YES DELAYJOIN: NO AUTOREJOIN: YES
MONINTF: NO DYNROUTE: NO
```

Figure 32. Netstat CONFIG/-f example

Run the D WLM,SYSTEMS command on the distributing stack and all targets stack to confirm that WLM is active. For more information about the DISPLAY command, see z/OS MVS System Commands. Figure 33 on page 365 shows an example:

```plaintext
D WLM,SYSTEMS
IWM025I 16.38.58 WLM DISPLAY 963
ACTIVE WORKLOAD MANAGEMENT SERVICE POLICY NAME: DEFAULT
ACTIVATED: 2003/10/29 AT: 14:51:50 BY: N/A FROM: VIC015
DESCRIPTION: IBM'S WLM DEFAULT POLICY
RELATED SERVICE DEFINITION NAME: N/A
INSTALLED: 2003/10/29 AT: 14:51:50 BY: N/A FROM: N/A
WLM VERSION LEVEL: LEVEL013
WLM FUNCTIONALITY LEVEL: LEVEL001
SYNTAX SYSLINUXM_WORKUNIT STATUS: DISCONNECTED
SYNTAX SYSLINUXM_WORKUNIT POLICY: N/A
VIC015 GOAL DEFAULT ACTIVE, NOT RUNNING WITH ACTIVE POLICY
```

Figure 33. D WLM,SYSTEMS example

4. Run the display Netstat VIPADYN/-v command on the distributing stack to verify that the DVIPA status is ACTIVE and the distribution status is DIST or DIST/DEST. The deactivated DVIPA 203.2.10.23 do not appear in this display. Figure 34 on page 366 shows an example:
5. Run display Netstat VIPADYN/-v command on the target stacks to verify that they have activated the distributed DVIPA and have it designated as a DEST. In this case, TCPCS2 has designated the distributed DVIPAs as DEST and TCPCS2 is a backup stack for several DVIPAs (status and origin show backup). Figure 35 on page 366 shows an example:

```
D TCPIP,TCPCS,NET,VIPADYN
EZD0101I NETSTAT CS V1R8 TCPCS 827
IPADDR/PREFIXLEN: 201.2.10.11/28
  STATUS: ACTIVE  ORIGIN: VIPADEFINE       DISTSTAT: DIST/DEST
  ActTime: 03/02/2005 16:45:20
IPADDR/PREFIXLEN: 201.2.10.12/28
  STATUS: ACTIVE  ORIGIN: VIPADEFINE       DISTSTAT: DIST
  ActTime: 03/02/2005 16:45:20
IPADDR/PREFIXLEN: 201.2.10.13/28
  STATUS: ACTIVE  ORIGIN: VIPADEFINE       DISTSTAT: DEST
  ActTime: 03/02/2005 16:45:20
IPADDR/PREFIXLEN: 201.2.10.21
  STATUS: BACKUP  ORIGIN: VIPABACKUP       DISTSTAT: DEST
  ActTime: n/a
IPADDR/PREFIXLEN: 201.2.10.22
  STATUS: BACKUP  ORIGIN: VIPABACKUP       DISTSTAT: DEST
  ActTime: n/a
INTFNAME: DVIPA1
IPADDR: 2001:0DB8:1::1
  STATUS: ACTIVE  ORIGIN: VIPADEFINE       DISTSTAT: DEST
  ActTime: 03/02/2005 16:45:20
```

Figure 35. Netstat VIPADyn/-v example

6. Run the Sysplex VIPADyn command from any stack in the sysplex to get a global view of how and where DVIPAs are defined within the sysplex and what their status is on each stack. Deactivated DVIPA configurations do not appear in this display. Figure 36 on page 367 shows the following:

- Which TCP/IPs own distributed DVIPAs, DIST field=BOTH or DIST
- Which TCP/IPs have been made targets, DIST field = DEST
- The status of all other DVIPAs in this sysplex
Figure 36. Sysplex VIPADyn example

7. Run the Netstat VDPT/-O command on the distributing stack to confirm that there are target stacks available with server applications ready.

With the keyword DETAIL you can also see the following fields. For a complete DETAIL display example, see z/OS Communications Server: IP System Administrator’s Commands.

- Raw (before normalization) WLM composite weight
- The original CP, zAAP, and zIIP weights, and the proportioned CP, zAAP, and zIIP weights that were used to determine the raw WLM composite weight. The original CP, zAAP, and zIIP weights, and the proportioned CP, zAAP, and zIIP weights are for only SERVERWLM and BASEWLM distribution algorithms.
- The target server connection responsiveness factors that make up the TSR and the current WLM or QOS weight for each service level mapping to a DVIPA or port entry for each target stack (each DESTXCF ADDR). See the z/OS Communications Server: IP User’s Guide and Commands for more information.

This display shows only target stacks that are currently up and have joined the sysplex. If there are fewer entries than what resulted from the display d tcpip,,net,vipadcfg command, the missing entries might be for target stacks that are not yet up, or for stacks that are already up now, but that do not specify the expected dynamic XCF address. Figure 37 on page 369 shows an example:
DEST:201.2.10.11..20
DESTXCF:193.9.200.2
TOTALCONN:00000000959 RDY:001 WLM:11 TSR: 79
FLG:SERVERWLM
  TCSR: 100 CER: 75 SEF: 79
  Weight 44
  Raw CP: 44 zAAP: 00 zIIP: 00
  Proportional CP: 44 zAAP: 00 zIIP: 00
  QosPlCAct:*DEFAULT*
  W/Q:0:1

DEST:201.2.10.11..20
DESTXCF:193.15.1.1
TOTALCONN:0000000315 RDY:001 WLM:15 TSR: 78
FLG:SERVERWLM
  TCSR: 100 CER: 100 SEF: 100
  Weight 36
  Raw CP: 60 zAAP: 00 zIIP: 00
  Proportional CP: 60 zAAP: 00 zIIP: 00
  QosPlCAct:*DEFAULT*
  W/Q:0:1

DEST:201.2.10.11..20
DESTXCF:193.15.3.1
TOTALCONN:0000000007 RDY:001 WLM:10 TSR: 94
FLG:SERVERWLM
  TCSR: 100 CER: 100 SEF: 100
  Weight 40
  Raw CP: 44 zAAP: 00 zIIP: 00
  Proportional CP: 44 zAAP: 00 zIIP: 00
  QosPlCAct:*DEFAULT*
  W/Q:0:1

DEST:201.2.10.12..20
DESTXCF:193.9.200.2
TOTALCONN:0000000000 RDY:001 WLM:03 TSR: 99
FLG:BASEWLM
  TCSR: 100 CER: 99 SEF: 99
  Weight 12
  Raw CP: 20 zAAP: 11 zIIP: 00
  Proportional CP: 02 zAAP: 10 zIIP: 00
  QosPlCAct:*DEFAULT*
  W/Q:0:1

DEST:201.2.10.12..21
DESTXCF:193.9.200.2
TOTALCONN:0000000000 RDY:001 WLM:03 TSR: 99
FLG:BASEWLM
  TCSR: 100 CER: 100 SEF: 100
  Weight 12
  Raw CP: 12 zAAP: 00 zIIP: 00
  Proportional CP: 12 zAAP: 00 zIIP: 00
  QosPlCAct:*DEFAULT*
W/Q:01
DEST:201.2.10.13..5000
DESTXCF:193.9.200.2
TOTALCONN:0000000000 RDY:001 WLM:03 TSR: 0
FLG:BASEWLM
TCSR: 90 CER: 75 SEF: 0
Weight 12
Raw CP: 12 zAAP: 00 zIIP: 00
Proportional CP: 12 zAAP: 00 zIIP: 00
QosPlcAct:*DEFAULT*
W/Q:01

DEST:201.2.10.13..5000
DESTXCF:193.15.1.1
TOTALCONN:0000000000 RDY:001 WLM:01 TSR: 27
FLG:BASEWLM
TCSR: 100 CER: 27 SEF: 27
Weight 04
Raw CP: 04 zAAP: 00 zIIP: 00
Proportional CP: 04 zAAP: 00 zIIP: 00
QosPlcAct:*DEFAULT*
W/Q:01

DEST:201.2.10.13..5000
DESTXCF:193.15.3.1
TOTALCONN:0000000000 RDY:001 WLM:01 TSR: 48
FLG:BASEWLM
TCSR: 75 CER: 64 SEF: 64
Weight 04
Raw CP: 04 zAAP: 00 zIIP: 00
Proportional CP: 04 zAAP: 00 zIIP: 00
QosPlcAct:*DEFAULT*
W/Q:01

DESTINF:DVIPA1
DEST:1::1.6000
DESTXCF:FEC0::151:0
TOTALCONN:0000000511 RDY:001 WLM:11 TSR: 79
FLG:SERVERWLM
TCSR: 99 CER: 98 SEF: 80
Weight 44
Raw CP: 44 zAAP: 00 zIIP: 00
Proportional CP: 44 zAAP: 00 zIIP: 00
QosPlcAct:*DEFAULT*
W/Q:01

DESTINF:DVIPA1
DEST:1::1.6000
DESTXCF:FEC0::152:0
TOTALCONN:0000001410 RDY:001 WLM:10 TSR: 100
FLG:SERVERWLM
TCSR: 100 CER: 95 SEF: 100
Weight 40
Raw CP: 40 zAAP: 00 zIIP: 00
Proportional CP: 40 zAAP: 00 zIIP: 00
QosPlcAct:*DEFAULT*
W/Q:01

8. Examine the READY (RDY) count fields. The READY (RDY) count is the number of servers that are currently listening on the DVIPA and PORT specified in the DEST: field on the target stack that was identified by the DESTXCF address.

For servers that use more than one port, the RDY value reflects the port where a LISTEN is performed. For example, for FTP, the control connection port (port 21) is where the RDY count is greater than 0. If the ready count is not as expected, proceed to step “11” on page 371 to verify whether any non-quiesced server is listening on the DPORT on the target stack. If there is a server listening on the target stack, verify that it has not been quiesced by a VARY TCPIP,,SYSPLEX,QUIESCE command. On the target stack, run the Netstat ALL/-A command and verify that the quiesced value is NO.

9. Check the TotalConn count to see the distribution history. This is a cumulative count of the number of connections that have been forwarded by the distributing stack to each target stack.

If the connections are not being distributed to the target stacks as expected and either the WLM field or the W/Q field contains 00, then consider the following:

Figure 37. Netstat VDPT/-O example
• If using WLM to distribute connections based upon the workload of the target stacks, verify that all participating stacks (the distributor and all targets) have SYSPLEXROUTING specified. See step “3” on page 364 for instructions for verifying this. Also, verify that WLM is configured and active on all participating stacks. See step “3” on page 364.

• If the WLM configuration appears correct and BASEWLM is being used as the distribution method, consider whether the unexpected distribution results might be caused by the current workload on the target stacks.

If SERVERWLM is being used, consider whether the unexpected distribution results might be the result of how well the server is meeting the goals of its service class, and the amount of workload available on the system given the importance of its service class. See the z/OS Communications Server: IP Configuration Guide for an overview of how WLM determines server recommendations and how they are used by TCP/IP. For more detailed information about sysplex routing services, see z/OS MVS Planning: Workload Management.

• If some entries have a low TSR value, consider whether network or server performance problems might be affecting distribution. Examine the TCSR, CER, and SEF values in the DETAIL output for these entries.
  – A low TCSR value indicates a connectivity problem between the sysplex distributor stack and the target stack for those particular DVIPA, Port, and Destination entries. To diagnose, verify connectivity across the dynamic XCF interface (HiperSockets, IUTSAMEH, XCF interfaces) or that VIPAROUTE is working properly by interface-specific ping.
  – If the SEF value is low but the CER is not, then the application on this target is having problems with accepting new connections. Take the following steps to diagnose:
    a. Verify that the application is accepting connections by connecting to another IP address on the target.
    b. If the connection is not accepted, verify that the application is getting dispatched correctly.
    c. If the connection is accepted, verify that the application can properly handle the load (amount of work, connections, tasks).
  – If the SEF and CER values are low, then the target stack is having problems with establishing connections with one or more clients. Take the following steps to diagnose:
    a. Find the client to which the connection is failing. Because netstat conn does not show connections in syn sent, the best way to find the clients that are not completing the three-way handshake is a packet trace (other means of finding the client IP are possible).
    b. If the client is known, verify that the route from the target to the client is correct by reviewing the target stack routing table. If the route from the target to the client is correct, verify that traceroute shows the correct path is being followed to the client.
    c. If the route from the target to the client is correct, verify that traceroute shows the correct path is being followed to the client.
  – If all entries representing distribution to the same target are very low, or 0, this might indicate that the target stack is experiencing problems.
  – If you used a VIPAROUTE definition to specify the route from the distributor to the target, check the specified route to verify that it is active.

• If SERVERWLM is being used as the distribution method and a server has a WLM weight of 0, verify that the server is using the appropriate WLM Policy and that the system is not too overloaded to enable the server to meet its policy goals. See z/OS Communications Server: IP Configuration Guide for an overview of how WLM determines server recommendations and how they are used by TCP/IP. For more detailed information about sysplex routing services, see z/OS MVS Planning: Workload Management.

• If the unexpected distribution results have not yet been explained and Sysplex Distributor Performance Policies have been defined using Policy Agent, consider whether the distribution might be caused by two network performance issues (TCP retransmissions and timeouts).
• If Sysplex Distributor Routing Policies have been defined using Policy Agent, consider whether the definition of that policy is affecting the connection distribution. After determining which connections are not being distributed correctly, run `D TCPIP,TCPCS,NET,VCRT,DETAIL` (see step “10” on page 371) to determine the policy action to which each connection maps. Look at the QoS weights for those policy actions in the VDPT DETAIL display to see whether they are unusually low. The Policy Agent log on the target stack can display for each DVIPA/Port the QoS service level fractions used to modify the QoS weight. It can also display the calculations that caused a QoS fraction to be set abnormally high (such as connection limit exceeded or throughput exceeded). See “Diagnosing Policy Agent problems” on page 591 for more information.

10. Run the Netstat VCRT/-V command on the distributing stack to check whether there are any active connections that are being routed by the distributor. If you run the command with the keyword DETAIL (`d tcpip,tcpcs,net,vcrt,detail`) you can see the policy rule and policy action that each connection maps to.

If the VCRT table shown in Figure 38 on page 371 is empty, then connection requests might not be reaching the distributor. Check for a routing problem from the client to the distributor.

If you see expected entries in the table, note the dynamic XCF address and proceed to step “11” on page 371. Figure 38 on page 371 shows an example:

```plaintext
D TCPIP,TCPCS,NET,VCRT,DETAIL
EZD0101I NETSTAT CS V1R7 TCPCS 758
DYNAMIC VIPA CONNECTION ROUTING TABLE:
  DEST:  201.2.10.11..21
  SOURCE: 203.110.1.1..1031
  DESTXCF: 193.15.1.1
  POLICYRULE: *NONE*
  POLICYACTION: *NONE*
  DEST:  201.2.10.12..21
  SOURCE: 203.110.1.1..1033
  DESTXCF: 193.9.200.2
  DEST:  201.2.10.13..5000
  SOURCE: 203.110.1.1..0
  DESTXCF: 193.15.1.1
  CFGTIMAFF: 0045  TIMAFFCNT: 0000000002  TIMAFFLFT: 0000
  DEST:  201.2.10.13..5000
  SOURCE: 203.110.1.1..1029
  DESTXCF: 193.15.1.1
  POLICYRULE: *NONE*
  POLICYACTION: *NONE*
  DEST:  201.2.10.13..5000
  SOURCE: 203.110.1.1..1030
  DESTXCF: 193.15.1.1
  POLICYRULE: *NONE*
  POLICYACTION: *NONE*
```

Figure 38. `d tcpip,tcpcs,net,vcrt,detail` example

11. Go to the target stacks represented by the DESTXCF ADDR field in the VCRT or VDPT display and run the Netstat ALLCONN(/-a),IPA=201.2.10.12 display command to see the connections on the target stack. Figure 39 on page 371 shows an example:

```plaintext
D TCPIP,TCPCS2,NET,ALLCONN,IPA=201.2.10.12
EZD0101I NETSTAT CS V1R7 TCPCS2 846
USER ID  CONN     STATE
FTPD1    000000F3 ESTBLSH
LOCAL SOCKET:   ::FFFF:201.2.10.12..21
FOREIGN SOCKET: ::FFFF:203.110.1.1..1033
1 OF 1 RECORDS DISPLAYED
```

Figure 39. Netstat ALLConn/-a example with IPAddr/-I filter value of 201.2.1.12

Tip: For a variety of reasons, the VCRT and ALLCONN displays might not match exactly. For example, with short-lived connections such as Web connections, an entry might show up in one display but be gone by the time the second display is run. Also, the distributing stack places an entry into the Dynamic VIPA Connection Routing Table when it first forwards a connection request. A busy server might reject these connection requests, and therefore cause a temporary mismatch in the two displays.
Steps for diagnosing problems using DVIPAs in source IP address selection for TCP connections problems

Investigating problems that are related to which source IP address is chosen for outbound TCP connections depends on which options you configured.

**Procedure**

1. If you are using the TCPSTACKSRCVIPA function, then run the Netstat CONFIG/-f command on the stack in question to verify that the sysplex-wide dynamic source VIPA was configured as expected. In other words, verify that IPCONFIG/IPCONFIG6 SOURCEVIPA is set to YES and that IPCONFIG/IPCONFIG6 TCPSTACKSRCVIPA is specified with the correct address or interface. If you are using TCPSTACKSOURCEVIPA with a distributed DVIPA, run the Netstat CONFIG/-f command on the distributor stack and on the target stacks. Figure 40 on page 372 shows an example:

```
IP CONFIGURATION TABLE:
FORWARDING: YES    TIMETOLIVE: 00064  RSMTIMEOUT: 00060
ARPTIMEOUT: 01200  MAXRSMSIZE: 65535  FORMAT:  LONG
IGREDIRECT: YES  SYSPLXROUT: YES  DOUBLENOP: NO
STOPCLAWER: NO     SOURCEVIPA: YES
MULTIPATH: NO     PATHMTUDSC: NO  DEVRTRYDUR: 0000000090
DYNAMICXCF: YES  IPADDR/PREFIXLEN: 193.15.1.1/24  METRIC: 02
IPv4 CONFIGURATION TABLE:
FORWARDING: YES    HOPLIMIT: 00255  IGREDIRECT: YES
SOURCEVIPA: YES  MULTIPATH: NO     ICMPERRLIM: 00003
IGRTRHOPLIMIT: NO  IPADDR: 2003::151:0
INTFID: 0006:0007:0008:0009
TCPSTACKSRCVIPA: DVIPA1
```

Figure 40. Netstat CONFIG/-f example

2. If you are using the SRCIP function to specify source IP addressing for specified jobnames or destinations, then run the Netstat SRCIP/-J command to display the SRCIP configuration. Verify that either the jobname for the application performing the outbound CONNECT() or the destination address for the CONNECT() matches an entry in the SRCIP configuration. See z/OS Communications Server: IP Configuration Reference for the order of precedence that is followed if an outbound connection matches more than one entry in the SRCIP configuration.

If you have configured distributed DVIPAs on SRCIP rules and outbound connections are failing with EADDRNOTAVAIL and JRSRCIPDistDVIPA, EXPLICITBINDPORTRANGE processing is either not configured or not working properly. See “Steps for diagnosing problems with EXPLICITBINDPORTRANGE processing” on page 376 for more information.

```
D TCPIP,,N,SRCIP
EZD0101I NETSTAT CS V1R8 TCPCS 745
SOURCE IP ADDRESS BASED ON JOB NAME:
JOB NAME  TYPE  SOURCE
--------  ----  -----
USER*     IPV4  203.15.2.1
USER*     IPV6  2003::151:1
SOURCE IP ADDRESS BASED ON DESTINATION:
DESTINATION: 192.1.1.98  SOURCE: 203.15.2.2
4 OF 4 RECORDS DISPLAYED
END OF THE REPORT
```

Figure 41. Netstat SRCIP/-J example
3. Create an outbound connection. Use the Netstat ALLConn/-a command to confirm that the correct source IP address was used.

**Tip:** TCPSTACKSOURCEVIP and SRCIP specifications can be overridden. For example, a match to an SRCIP entry will override a TCPSTACKSOURCEVIP specification. If your TCPSTACKSOURCEVIP or SRCIP configuration is correct but you are not getting the expected source IP address, see the source IP address selection information in z/OS Communications Server: IP Configuration Guide for the hierarchy of the various ways that the source IP address of an outbound packet is determined.

---

**Steps for diagnosing problems with the SYSPLEX-wide ephemeral port assignment for distributed DVIPAs**

Diagnose problems with the SYSPLEXPORTS setting.

**Procedure**

Perform the following steps:

1. Run the Netstat VIPADCFG/-F command on the distributor stack to confirm that SYSPLEXPORTS was specified for all distributed DVIPAs as expected.

   ```
   D TCP/IP,TCPCS,NET,VIPADCFG
   EZD0101I NETSTAT CS V1R7 TCPCS B62
   DYNAMIC VIPA INFORMATION:
   VIPA DEFINE:
   IPADDR/PREFIXLEN: 203.15.1.1/24
   MOVEABLE: IMMEDIATE SRVMGR: NO
   IPADDR/PREFIXLEN: 203.15.1.2/24
   MOVEABLE: IMMEDIATE SRVMGR: NO
   INTFNAME: DVIPA1
   IPADDR: 2001:0DB8:1::1
   MOVEABLE: IMMEDIATE SRVMGR: N/A
   VIPA DISTRIBUTE:
   DEST: 203.15.1.1..4011
   SYSPT: YES TIMAFF: NO FLG: BASEWLM
   DESTXCF: ALL
   DEST: 203.15.1.2..245
   SYSPT: NO TIMAFF: NO FLG: BASEWLM
   DESTXCF: ALL
   DESTINTF: DVIPA1
   DEST: 2001:0DB8:1::1
   SYSPT: YES TIMAFF: NO FLG: BASEWLM
   DESTXCF: ALL
   ``

   *Figure 42. Diagnosing SYSPLEXPORTS problems*

   In the preceding display, the distributed DVIPAs 203.15.1.1 and 2001:0DB8:1::1 were enabled with SYSPLEXPORTS(SYSPT is Yes), while 203.15.1.2 was not (SYSPT is NO).

2. Verify from the system log that the following message was issued:

   ```
   IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBEPORT
   
   If subplexing is being used, the message will be:
   
   IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBEPORTvvtt
   
   where vv is the VTAM subplex group ID and tt is the TCP/IP subplex group ID. If no VTAM subplex group ID was specified at VTAM startup, but a TCP/IP subplex group ID was specified on the GLOBALCONFIG statement in the TCP/IP Profile, then the structure name is EZBEPORT01tt. If a VTAM subplex group ID was specified, but no TCP/IP subplex group ID was specified, then the structure name is EZBEPORTvv.

   If this message was not issued and Netstat VIPADCFG/-F shows that the SYSPLEXPORTS field was specified, see z/OS Communications Server: SNA Network Implementation Guide for more information about defining EZBEPORTvvtt with the coupling facility.
3. Bind to an ephemeral port and then create an outbound connection with the source IP address of the SYSPLEXPORTS distributed DVIPA.

Do the following to verify SYSPLEXPORTS is working correctly:

a. Issue the `Netstat ALLConn/-a` command to verify the connection on the target stack.

b. Issue the `Netstat VCRT/-V` command to confirm that the distributing stack is aware of the connection.

c. Issue the VTAM `DISPLAY NET,STATS` command, specifying the full name of the EZBEPORT structure to confirm that the coupling facility is managing ports for this distributed DVIPA. For ephemeral ports, the coupling facility assigns a block of 64 ports to the TCP/IP stack. For example:

```
D NET,STATS,TYPE=CFS,STRNAME=EZBEPORT1121,LIST=ALL,SCOPE=ALL
```

```
IST997I DISPLAY ACCEPTED
IST350I DISPLAY TYPE = STATS,TYPE=CFS 180
IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBEPORT1121
IST1797I STRUCTURE TYPE = LIST
IST1517I LIST HEADERS = 1024 - LOCK HEADERS = 1024
IST1371I STORAGE ELEMENT SIZE = 256
IST924I -------------------------------------------------------------
IST1374I CURRENT MAXIMUM PERCENT
IST1375I STRUCTURE SIZE 8192K 15104K *NA*
IST1376I STORAGE ELEMENTS 128 22400 0
IST1377I LIST ENTRIES 5 700 0
IST924I -------------------------------------------------------------
ISTREW1I EXPLICITBINDPORTRANGE - START: 50000 END: 50255
IST1823I LIST DVIPA SYSNAME TCPNAME # ASSIGNED PORTS
IST1824I    0 EXPLICITBINDPORTRANGE                               64
IST1825I    1 203.15.1.1                                          64
IST1826I PORTS: 50000 50001 50002 50003 50004 50005 50006 50007 50008 50009 50010 50011 50012 50013 50014 50015 50016 50017 50018 50019 50020 50021 50022 50023 50024 50025 50026 50027 50028 50029 50030 50031 50032 50033 50034 50035 50036 50037 50038 50039 50040 50041 50042 50043 50044 50045 50046 50047 50048 50049 50050 50051 50052 50053 50054 50055 50056 50057 50058 50059
IST1827I    2 2001:0DB8:1::1                                      64
IST1828I PORTS:  1024  1025  1026  1027  1028  1029  1030  1031  1032  1033  1034  1035  1036  1037  1038  1039  1040  1041  1042  1043  1044  1045  1046  1047  1048  1049  1050  1051  1052  1053  1054  1055  1056  1057  1058  1059  1060  1061  1062  1063  1064  1065  1066  1067  1068  1069  1070  1071  1072  1073  1074  1075  1076  1077  1078  1079  1080  1081  1082  1083  1084  1085  1086  1087
IST1829I    3 2001:0DB8:1::2                                      64
IST1830I PORTS:  1024  1025  1026  1027  1028  1029  1030  1031  1032  1033  1034  1035  1036  1037  1038  1039  1040  1041  1042  1043  1044  1045  1046  1047  1048  1049  1050  1051  1052  1053  1054  1055  1056  1057  1058  1059  1060  1061  1062  1063  1064  1065  1066  1067  1068  1069  1070  1071  1072  1073  1074  1075  1076  1077  1078  1079  1080  1081  1082  1083  1084  1085  1086  1087
```

Figure 43. VTAM NET,STATS example
Diagnosing problems with the SYSPLEX-wide ephemeral port assignment for EXPLICITBINDPORTRANGE processing

This topic contains two subtopics:

- “Steps for determining an optimal range for the EXPLICITBINDPORTRANGE parameter” on page 375
- “Steps for diagnosing problems with EXPLICITBINDPORTRANGE processing” on page 376

Steps for determining an optimal range for the EXPLICITBINDPORTRANGE parameter

Determine an optimal range for the EXPLICITBINDPORTRANGE parameter.

Procedure

Perform the following steps:

1. Change your existing configuration to specify the GLOBALCONFIG EXPLICITBINDPORTRANGE parameter on all stacks that you anticipate will be participating in explicit bind port range processing. As a guideline, the port range size should be at least large enough to allow for 2 blocks of ports to be in use by each participating TCP/IP stack (128 * number of TCP/IP stacks using the explicit bind port range). If you are using an SRCIP block, do not initially make the change to use distributed DVIPAs on the DESTINATION rules.

2. Start all of the stacks, servers and clients to reach the typical steady state connection load for your sysplex environment. All connections from sockets that were explicitly bound to the IPv4 address, INADDR_ANY, or the IPv6 unspecified address (in6addr_any) and port 0 will use ports from the new range.

3. Periodically check to determine how many ports from this new range are in use by issuing a D NET,STATS,TYPE=CFS,STRNAME=EZBEPORTvvtt,LIST=0 command (See Figure 44 on page 375).

4. Check for message EZD1296 which will be issued if local ephemeral ports were used for connections because no explicit bind ports were available from the active EXPLICITBINDPORTRANGE parameter.

5. If message EZD1296 is not issued and if the number of allocated ports is consistently less than the total port range, then proceed to the next step, otherwise:

   a) Change the GLOBALCONFIG EXPLICITBINDPORTRANGE parameter to use a larger explicit bind port range; as a guideline increase the size by at least 64 for each participating stack (64 multiplied by the number of TCP/IP stacks)

   b) Issue a VARY TCPIP,OBEYFILE command to change the range on each of the stacks and return to step 3 above.

6. Change your SRCIP block to use distributed DVIPAs on DESTINATION rules.

Figure 44. VTAM NET,STATS,LIST=0 example

4. Check for message EZD1296 which will be issued if local ephemeral ports were used for connections because no explicit bind ports were available from the active EXPLICITBINDPORTRANGE parameter.

5. If message EZD1296 is not issued and if the number of allocated ports is consistently less than the total port range, then proceed to the next step, otherwise:

   a) Change the GLOBALCONFIG EXPLICITBINDPORTRANGE parameter to use a larger explicit bind port range; as a guideline increase the size by at least 64 for each participating stack (64 multiplied by the number of TCP/IP stacks)

   b) Issue a VARY TCPIP,OBEYFILE command to change the range on each of the stacks and return to step 3 above.

6. Change your SRCIP block to use distributed DVIPAs on DESTINATION rules.
Steps for diagnosing problems with EXPLICITBINDPORTRANGE processing

If you configured distributed DVIPAs on SRCIP rules and outbound connections are failing with EADDRNOTAVAIL and JRSRCIPDistDVIPA, EXPLICITBINDPORTRANGE processing is not working.

About this task

There are several possible reasons for this problem:

- EXPLICITBINDPORTRANGE parameter is not configured on the stack.
- EXPLICITBINDPORTRANGE parameter is configured but:
  - The stack did not connect to the EZBEPORT structure in the coupling facility
  - The stack has lost access to the EZBEPORT structure
  - The stack is running in a CINET environment with more than 1 stack and stack affinity was not established
  - There are no available ports in the range (the range is exhausted)
  - The application is bound explicitly to an ephemeral port (equal to or greater than the low port value that is specified on the EPHEMERALPORTS parameter of the TCP_CONFIG profile statement, or 1024 by default) that is not reserved for this job by the PORT or PORTRANGE profile statement

Procedure

Use the following steps to determine and correct the problem:

1. Issue the D TCPIP,,SYSPLEX,PORTS command to determine the configured EXPLICITBINDPORTRANGE value for this stack and the active EXPLICITBINDPORTRANGE value in the sysplex (or subplex). If the command response indicates "No EXPLICITBINDPORTRANGE is configured on this stack", see z/OS Communications Server: IP Configuration Reference, under the section for the GLOBALCONFIG statement, for information about enabling the EXPLICITBINDPORTRANGE.

   **Tip:** If the active port range does not match the configured port range for this stack, it means that another stack that was started after this stack had a different range defined in the GLOBALCONFIG EXPLICITBINDPORTRANGE parameter, or a VARY OBEYFILE command was processed on another stack that specified a GLOBALCONFIG EXPLICITBINDPORTRANGE parameter with a different range. You should try to ensure that all stacks participating in EXPLICITBINDPORTRANGE parameter processing specify the same port range. This can be done by specifying the GLOBALCONFIG EXPLICITBINDPORTRANGE statement in a file that is included in each stack's TCP/IP profile using an INCLUDE statement.

2. Verify from the system log that the following message was issued:

   - IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBEPORT
   - If subplexing is being used, the message will be:

     IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBEPORTvvtt

     The vv value is the VTAM subplex group ID and the tt value is the TCP/IP subplex group ID. If no VTAM subplex group ID was specified at VTAM startup, but a TCP/IP subplex group ID was specified on the GLOBALCONFIG statement in the TCP/IP profile, then the structure name is EZBEPORT01tt. If a VTAM subplex group ID was specified, but no TCP/IP subplex group ID was specified, then the structure name is EZBEPORTvv.

     - If this message was not issued and D TCPIP,,SYSPLEX,PORTS shows that an EXPLICITBINDPORTRANGE parameter was configured, see z/OS Communications Server: SNA Network Implementation Guide for more information about defining EZBEPORTvvtt with the coupling facility.

     - If the IST1370I message was issued (the stack did connect to the EZBEPORT structure), and D TCPIP,,SYSPLEX,PORTS shows that an EXPLICITBINDPORTRANGE parameter was configured but that no active EXPLICITBINDPORTRANGE is available from this stack, the stack may have lost connectivity to the EZBEPORT structure either as a result of a structure rebuild or a structure
disconnect. In the console log, check for any failure or rebuild messages referencing the EZBEPORT structure. If a structure rebuild was in process for the EZBEPORT structure in use by this stack, wait for the rebuild to complete. If VTAM lost connectivity to the structure, issue the VARY NET,CFS,ACTION=CONNECT,STRNAME=structure_name command to reestablish connectivity to the structure.

3. Bind to the IPv4 address, INADDR_ANY, or the IPv6 unspecified address (in6addr_any) and port 0. Issue the D NET,STATS,TYPE=CFS,STRNAME=EZBEPORTvvt,LIST=0 command to confirm that the coupling facility has ports in the EXPLICITBINDPORTRANGE parameter allocated for the stack on which you issued the bind, and issue the Netstat ALLConn/-a command to determine whether the port assigned to your application for this bind was one in the explicit bind port range.

```
netstat -a -p tcp
MVS TCP/IP NETSTAT CS V1R9       TCPIP Name: TCPCS1          13:21:04
User Id  Conn     State
-------  ----     -----...
BPXOINIT 00000017 Listen
  Local Socket:   0.0.0.0..10007
  Foreign Socket: 0.0.0.0..0
USER11   0000002B Closed
  Local Socket:   0.0.0.0..50001
  Foreign Socket: 0.0.0.0..0
USER11   00000021 Closed
  Local Socket:   0.0.0.0..50000
  Foreign Socket: 0.0.0.0..0
SYSLOGD8 00000018 UDP
  Local Socket:   ::..514
  Foreign Socket: *..*
```

If a port from the explicit bind port range was not allocated, check if you are running in a CINET environment in which more than one TCP/IP stack is being managed by CINET and stack affinity has not been established. Explicit bind port range processing is not supported in such a configuration.

4. Check the system log for message "EZD1296I EXPLICITBINDPORTRANGE exhausted" which indicates that the number of ports in the EXPLICITBINDPORTRANGE parameter is not large enough. The coupling facility was unable to allocate a port from this range and a stack ephemeral port was allocated instead. This may be a temporary situation because EBPR ports are eventually returned to the coupling facility after sockets bound to them are closed.

**Tip:** Message EZD1296I is not issued more than once every 5 minutes. If this message is issued multiple times, you should consider enlarging the number of ports for the EXPLICITBINDPORTRANGE parameter. See “Steps for determining an optimal range for the EXPLICITBINDPORTRANGE parameter” on page 375 for more information.

5. Issue the Netstat ALLCONN/-a command to display the local socket IP address and port the application is bound to, and Netstat PORTLIST/-o command to display the ports that are reserved. If you want to add the applications local port to the list of reserved ports, use the PORT or PORTRANGE profile statement.

## Diagnosing sysplex-wide security association (SWSA) problems

This topic describes methods for diagnosing SWSA problems.

### Steps for diagnosing sysplex-wide security association (SWSA) problems

Use the following information to aid with diagnosing Sysplex-wide Security Association (SWSA) specifically.

**Before you begin**

Ensure that you have consistent IPSec policies on all participating systems, which include the following:

- Distributing stacks, target stacks and backup stacks.
- Certificates identifying hosts must be available on all distributing and backup hosts. This is most easily accomplished by sharing the SAF certificate repository between the processors in the sysplex.
See z/OS Communications Server: IP Configuration Guide for information about configuring IP security policy on an IPSECURITY stack.

**Procedure**

Perform the following steps to diagnose SWSA problems.

1. Code the DVIPSEC option on the owning and backup stacks to take advantage of SWSA. If IPSec protection is needed for intra-sysplex traffic, code the DVLOCALFLTR option. The DVLOCALFLTR option enables IP filtering and IPSec protection of TCP traffic between a client and an IPv4 dynamic VIPA that are defined on the same TCP/IP stack, when the traffic is forwarded to another TCP/IP stack. Do the following on the owning and backup stacks:

   • Use the `netstat,config` command to confirm that IPSECURITY was specified on the IPCONFIG statement and, if appropriate, on the IPCONFIG6 statement.

   ```
   Figure XX. netstat,config example
   D TCPIP,,NETSTAT,CONFIG
   NETSTAT CONFIG
   MVS TCP/IP NETSTAT CS V2R1 TCPIP Name: TCPCS
   ...
   IP Configuration Table:
   Forwarding: Yes TimeToLive: 00064 RsmTimeOut: 00060
   IPSecurity: Yes
   ...
   IPv6 Configuration Table:
   Forwarding: Yes HopLimit: 000255 IgRedirect: No
   SourceVipa: Yes MultiPath: Conn IcmperrLim: 00003
   IgRtrHopLimit: No
   IpSecurity: Yes
   ...
   ```

   • Use the `ipsec -f` command to confirm that DVIPSEC was specified on the IPSEC statement and to confirm the DVLOCALFLTR setting on the IPSEC statement.

   ```
   # ipsec -f disp
   CS V2R1 ipsec Stack Name: TCPCS1 Fri May 27 10:48:47 2011
   Primary: Filter Function: Display Format: Detail
   Source: Stack Profile Scope: Current TotAvail: 2
   Logging: Off Prdecap: Off DVIPSec: Yes
   NatKeepAlive: 20 FIPS140: No DVLocalFltr: No
   ```

   **Figure 45. ipsec -f example**

2. If the DVLOCALFLTR option is specified, take the following actions:

   • Ensure that the IPSec policy accounts for all local TCP traffic with an IPv4 dynamic VIPA endpoint.

   • Use the IKEv2 protocol to negotiate the tunnel to protect the traffic. Use HowToInitiate IKEv2 on the KeyExchangePolicy statement or a specific KeyExchangeAction statement to indicate that IKEv2 should be used when key negotiations are initiated by this system.

   **Restriction:** IKEv1 cannot be used to negotiate a tunnel between a client and an IPv4 dynamic VIPA that are defined on the same TCP/IP stack.

3. Verify from the system log for the distributing and target stacks (for sysplex distribution of IPSec workload) and the primary and backup stacks (for dynamic tunnel recovery) that an IST1370I message like the following was issued:

   **IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBDVIPA**

   If subplexing is being used, the message is:

   **IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBDVIPA*vvtt**

   where vv is the VTAM subplex group ID and tt is the TCP/IP subplex group ID. If no VTAM subplex group ID was specified at VTAM startup, but a TCP/IP subplex group ID was specified on the GLOBALCONFIG statement in the TCP/IP Profile, then the structure name is EZBDVIPA01tt. If a VTAM subplex group ID was specified, but no TCP/IP subplex group ID was specified, then the structure name is EZBDVIPA*vv.
For SWSA functions to work correctly, the stacks involved must be connected to the EZBDVIPAvvtt coupling facility structure. If this message was not issued, see z/OS Communications Server: SNA Network Implementation Guide for information about setting up the sysplex environment for VTAM function and defining EZBDVIPAvvtt with the coupling facility.

4. For sysplex distribution of IPSec traffic, the target stacks must have a copy of the dynamic tunnel, called a shadow tunnel, that matches the dynamic tunnel on the distributing stack. Do the following:

a. Use the following command to verify that a dynamic tunnel is active on distributing stacks:

```
# ipsec -y display
```

```plaintext
CS V2R1 ipsec Stack Name: TCPCS1 Fri May 27 13:22:15 2011
Primary: Dynamic tunnel Function: Display Format: Detail
Source: Stack Scope: Current TotAvail: 2

TunnelID: Y6
Generation: 1
IKEVersion: 2.0
ParentIKEID: K5
VpnActionName: VPN-14-Transport
LocalDynVpnRule: n/a
State: Active
HowToEncap: Transport
LocalEndpoint: 10.93.1.8
RemoteEndpoint: 10.83.4.1
LocalAddressBase: 10.93.1.8
LocalAddressPrefix: n/a
LocalAddressRange: 10.93.4.1
RemoteAddressBase: n/a
RemoteAddressPrefix: n/a
RemoteAddressRange: n/a
HowToAuth: ESP
AuthAlgorithm: HMAC-SHA1
AuthInboundSpi: 1337238202 (0x4FB4A2BA)
AuthOutboundSpi: 3188885928 (0xBE1289A8)
HowToEncrypt: 3DES-CBC
KeyLength: n/a
EncryptInboundSpi: 1337238202 (0x4FB4A2BA)
EncryptOutboundSpi: 3188885928 (0xBE1289A8)
Protocol: ALL(0)
LocalPort: n/a
LocalPortRange: n/a
RemotePort: n/a
RemotePortRange: n/a
Type: n/a
TypeRange: n/a
Code: n/a
CodeRange: n/a
OutboundPackets: 0
OutboundBytes: 0
InboundPackets: 0
InboundBytes: 0
Lifesize: 0K
LifesizeRefresh: 0K
CurrentByteCount: 0b
LifetimeRefresh: 2011/05/27 16:40:23
LifetimeExpires: 2011/05/27 16:58:50
CurrentTime: 2011/05/27 12:58:56
VPNLifeExpires: 2011/05/28 12:58:50
NAT Traversal Topology:
UdpEncapMode: No
LcLNATDetected: No
RmtLNATDetected: No
RmtNAPTDetected: No
RmtIsGW: n/a
RmtIsZOS: n/a
zOSCanInitP2SA: n/a
RmtUdpEncapPort: n/a
SrcNATOARcvd: n/a
DstNATOARcvd: n/a
PassthroughDF: n/a
PassthroughDSCP: n/a
```

Figure 46. ipsec -y example
b. Use the following command to verify that a shadow tunnel is active on target stacks:

```bash
# ipsec -y display -s
```

```
CS V2R1 ipsec Stack Name: TCPCS2 Fri May 27 13:22:23 2011
Primary: Dynamic tunnel Function: display (shadows) Format: Detail
Source: Stack Scope: Current TotAvail: 2

TunnelID: Y6
Generation: 1
IKEVersion: 2.0
ParentIKE TunnelID: K5
VpnActionName: VPN-14-Transport
LocalDynVpnRule: n/a
State: Active
HowToEncap: Transport
LocalEndPoint: 10.93.1.8
RemoteEndPoint: 10.83.4.1
LocalAddressBase: 10.93.1.8
RemoteAddressBase: 10.83.4.1
RemoteAddressPrefix: n/a
RemoteAddressRange: n/a
HowToAuth: ESP
AuthAlgorithm: HMAC-SHA1
AuthInboundSpi: 1337238202 (0x4FB4A2BA)
AuthOutboundSpi: 3188885928 (0xBE1289A8)
HowToEncrypt: 3DES-CBC
KeyLength: n/a
EncryptInboundSpi: 1337238202 (0x4FB4A2BA)
EncryptOutboundSpi: 3188885928 (0xBE1289A8)
Protocol: ALL(0)
LocalPort: n/a
LocalPortRange: n/a
RemotePort: n/a
RemotePortRange: n/a
Type: n/a
TypeRange: n/a
Code: n/a
CodeRange: n/a
OutboundPackets: 0
OutboundBytes: 0
InboundPackets: 0
InboundBytes: 0
Lifesize: 0K
LifesizeRefresh: 0K
CurrentByteCount: 0b
LifetimeRefresh: 2011/05/27 16:40:23
LifetimeExpires: 2011/05/27 16:58:50
VPN LifeExpires: 2011/05/28 12:58:50
NAT Traversal Topology:
UdpEncapMode: No
Lc1NATDetected: No
RmtNATDetected: No
RmtNAPTDetected: No
RmtIsGw: n/a
RmtIsZOS: n/a
zOS CanInitP2SA: n/a
RmtUdpEncapPort: n/a
SrcNATOARcvd: n/a
DstNATOARcvd: n/a
Passthrough DF: n/a
Passthrough DSCP: n/a
```

**Figure 47. ipsec -y display -s example**

5. To confirm that the coupling facility has the information about the tunnels in the event a recovery is necessary, use the following VTAM command, specifying the full name of the EZBDVIPA structure:

```bash
d net,stats,type=cfs,strname=ezbdvipa1121,dvipa=10.93.1.8
```

The following output is displayed:

```
IST097I DISPLAY ACCEPTED
IST350I DISPLAY TYPE = STATS,TYPE=CFS
IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBDVIPA1121
IST1797I STRUCTURE TYPE = LIST
IST1517I LIST HEADERS = 2048 - LOCK HEADERS = 0
```
Information about the dynamic tunnels that are used in SWSA is kept in the coupling facility structure in the event that a recovery of the tunnel is necessary. For example, the recovery information is used when a DVIPA is taken over by another stack in the sysplex.

For more information, see DISPLAY STATS in z/OS Communications Server: SNA Operation.

For IPSec connections to continue functioning with that DVIPA, the tunnel has to be recovered by the same stack that took over the dynamic VIPA.

The list entry for the DVIPA (list 2 above) shows the system and stack for which the coupling facility is maintaining information about the tunnel.

6. Use the following VTAM command, specifying the full name of the EZBDVIP structure, to confirm that the coupling facility is managing the replay count:

```
d net,stats,type=cfs,strname=ezbdvipa1121,list=all
```

For sysplex distribution of IPSec traffic, the dynamic tunnel replay count (sequence number) is maintained in the EZBDVIPAvvtt coupling facility structure. The distributing stack dynamic tunnel and all the target stack shadow tunnels share the replay count.

The following output is displayed:

```
D NET,STATS,TYPE=CFS,STRNAME=EZBDVIPA1121,LIST=ALL
IST097I DISPLAY ACCEPTED
IST350I DISPLAY TYPE = STATS,TYPE=CFS
IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE EZBDVIPA1121
IST1797I STRUCTURE TYPE = LIST
IST1517I LIST HEADERS = 2048 - LOCK HEADERS = 0
IST1373I STORAGE ELEMENT SIZE = 256
IST924I -------------------------------------------------------------
IST1374I                            CURRENT     MAXIMUM  PERCENT
IST1375I STRUCTURE SIZE              15104K      50176K    *NA*
IST1376I STORAGE ELEMENTS                48       28592       0
IST1377I LIST ENTRIES                     6        2902       0
IST924I -------------------------------------------------------------
IST1834I LIST DVIPA SYSNAME  TCPNAME    #ENTRIES    TGCOUNT SEQNUMBER
IST1835I    1 10.93.1.8
IST1837I MVS187   TCPCS1            1                    1
IST1835I    2 10.93.1.8
IST1836I MVS187   TCPCS1            1          0
IST314I END
```

The list entry for the dynamic VIPA with a value in the SEQNUMBER column confirms that this tunnel's replay count is managed by the coupling facility.

### Steps for diagnosing sysplex routing problems

Determine why packets are not distributed properly in your sysplex.

**Procedure**

Perform the following steps:
1. Run the Netstat VIPADyn VIPAROUTE/-v VIPAROUTE command on the distributing stack to see what type of route is used for distributing packets to target stacks.

```
D TCPIP,TCPCS,NET,VIPADYN,VIPAROUTE EZD0101I NETSTAT CS V1R7 TCPCS
VIPA ROUTE:
  DESTXCF: 193.1.3.94
  TARGETIP: 213.5.1.1
  RTSTATUS: ACTIVE
  DESTXCF: 193.1.4.94
  TARGETIP: 213.6.2.2
  RTSTATUS: INACTIVE
  DESTXCF: 2EC0::943:F003
  TARGETIP: 1EC0::5:1:1
  RTSTATUS: ACTIVE
  DESTXCF: 2EC0::943:F004
  TARGETIP: 1EC0::6:2:2
  RTSTATUS: INACTIVE
4 OF 4 RECORDS DISPLAYED
```

Figure 48. Netstat VIPADyn example

- If there is no VIPA ROUTE entry, IP packets that are distributed by Sysplex Distributor to target stacks use dynamic XCF interfaces. Use the Netstat ROUTe/-r command on the distributing stack to see other routing failure problems.

- If there is a VIPA ROUTE entry defined for a target stack and the RtStatus field shows Active, IP packets that are distributed by Sysplex Distributor to that target stack use the normal IP routing tables to determine the best available route.

- If there is a VIPA ROUTE entry defined for that target stack and the RtStatus field shows Unavail, the defined target IP address in the route entry is not available yet. This could be because the target stack is currently active, but the target IP address is not defined in that target stack. All packets to that target stack use dynamic XCF interfaces. This is likely to be a configuration error that should be investigated. EZD1173I is issued when the stack detects this problem.

- If there is a VIPA ROUTE entry defined for a target stack and the RtStatus field shows Inactive, no route exists to that target stack. See z/OS Communications Server: IP System Administrator's Commands for more information about the RtStatus field.

2. Run the Netstat ROUTe/-r command on the distributing stack to see details of the routing information. The following shows an example of this information.

```
D TCPIP,TCPCS,NET,ROUTE EZD0101I NETSTAT CS V1R7 TCPCS
IPV4 DESTINATIONS
  DESTINATION         GATEWAY          FLAGS     REFCNT  INTERFACE
  193.1.1.94/32       0.0.0.0          H         000000  EZASAMEMVS
  193.1.1.94/32       0.0.0.0          UH        000000  EZAXCFC6
  193.1.1.94/32       0.0.0.0          UH        000000  EZAXCFC7
  193.1.3.94/32       0.0.0.0          UHS       000000  EZAXCFC7
  193.1.4.94/32       0.0.0.0          UHS       000000  EZAXCFC7
  203.1.1.94/32       0.0.0.0          H         000000  VIPLCB01015E
  213.4.1.1/32        0.0.0.0          H         000000  LTRLE1A
  213.4.2.2/32        0.0.0.0          H         000000  LTRLE2A
  213.5.1.1/32        0.0.0.0          HZ        000001  LTRLE1A
  213.6.2.2/32        0.0.0.0          HZ        000001  LTRLE2A
IPV6 DESTINATIONS
  DESTIP:   ::1/128
    GW:     ::
    INF:   LOOPBACK6       REFCNT:  000000
    FLGS:   UH                MTU: 65535
  DESTIP:   1EC0::4:1:1/128
    GW:     ::
    INF:   V6TRLE1A         REFCNT:  000000
    FLGS:   UH                MTU: 14336
  DESTIP:   1EC0::4:2:2/128
    GW:     ::
    INF:   V6TRLE2A         REFCNT:  000000
    FLGS:   H                 MTU: 0
  DESTIP:   1EC0::5:1:1/128
    GW:     ::
    INF:   V6TRLE1A         REFCNT:  000001
    FLGS:   UH                MTU: 14336
  DESTIP:   1EC0::6:2:2/128
```
3. Run the Netstat VCRT/-V DETAIL command on the distributing stack to see the routing information for each connection. The following shows an example of this information.

```
D TCPIP,TCPCS,NET,VCRT,DETAIL
EZD0101I NETSTAT CS V1R7 TCPCS
DYNAMIC VIPA CONNECTION ROUTING TABLE:
Dest: 203.38.1.1..801
  Source: 192.168.2.76..1029
  DestXCF: 193.1.3.94
  PolicyRule: *NONE*
  PolicyAction: *NONE*
  Intf: LTRLE1A
  VipaRoute: Yes  Gw: 0.0.0.0
  Dest: 203.38.1.1..801
  Source: 192.168.2.76..1028
  DestXCF: 193.1.7.94
  PolicyRule: *NONE*
  PolicyAction: *NONE*
  Intf: EZASAMEMVS
  VipaRoute: No   Gw: 0.0.0.0
  Dest: 203.38.1.2..9001
  Source: 192.168.2.76..1031
  DestXCF: 193.1.4.94
  PolicyRule: *NONE*
  PolicyAction: *NONE*
  Intf: LTRLE2A
  VipaRoute: Yes  Gw: 0.0.0.0
  Dest: 203.38.1.2..9001
  Source: 192.168.2.76..1030
  DestXCF: 193.1.6.94
  PolicyRule: *NONE*
  PolicyAction: *NONE*
  Intf: EZASAMEMVS
  VipaRoute: No   Gw: 0.0.0.0
4 OF 4 RECORDS DISPLAYED
```

*Figure 49. Netstat VCRT/-V detail example*

**Results**

See “Routing failures” on page 690 for additional information about routing failures.

**Steps for diagnosing Tier 1 z/OS sysplex distribution problems**

For an in-depth explanation of distribution to Tier 1 z/OS targets, see the “Sysplex distribution optimizations for multitier z/OS workloads” section in *z/OS Communications Server: IP Configuration Guide*.

**For Tier 1 sysplex distribution**

On the Tier 1 distributor, run the Netstat VIPADCFG/-F DETAIL command to see the Tier 1 configuration statement information.

- In the VIPA DEFINE section of the report, verify the new flag field, 1, which indicates that this is a VIPA definition for a Tier 1 DVIPA.
- In the VIPA DISTRIBUTE section, verify the Tier 1 configuration parameters.
  - The flag fields show that the targets are Tier1, and that the distribution method uses Server-specific WLM weights (ServerWLM).
The group name is CICSGROUP. The group name is used when a Tier 2 sysplex distributor is being used to correlate Tier 1 targets with their Tier 2 targets. This is explained further in the following Tier 2 distribution.

Dynamic VIPA Information:
VIPA Define:
    IpAddr/PrefixLen: 203.1.181.10/24
    Moveable: Immediate SrvMgr: No Flg: 1
VIPA Distribute:
    Dest:        203.1.181.10..10000
    DestXCF:     ALL
    SysPt: No    TimAff: No Flg: ServerWLM Tier1
    OptLoc: No  GrpName: CICSGROUP
    ProcSecost:
        zAAP: 001 zIIP: 001
        ILWeighting: 0

Run the Netstat VDPT/-O report to see the status of the tier 1 targets. Verify that weight recommendations are nonzero values and that there is a ready server for each tier 1 target. This information is updated in each polling interval. The ready count is 1 for each tier 1 target, which indicates that each has a server listening on port 10000.

Dynamic VIPA Destination Port Table for TCP/IP stacks:
Dest:        203.1.181.10..10000
DestXCF:     193.1.1.108
TotalConn: 0000000000 Rdy: 001 WLM: 16 TSR: 100
Flg: ServerWLM, Tier1
Dest:        203.1.181.10..10000
DestXCF:     193.1.1.181
TotalConn: 0000000000 Rdy: 001 WLM: 08 TSR: 100
Flg: ServerWLM, Tier1

Tier 2 sysplex distribution

- A Tier 1 target might distribute connections to Tier 2 targets using a Tier 2 sysplex distributor.
- In the VIPA DEFINE section of the report, the flag field, "2", indicates that this is a VIPA definition for a Tier 2 DVIPA.
- Each Tier 2 distributor will send the weight of each ready server to the Tier 1 distributor; the group name is used to correlate a group of Tier 1 targets with their Tier 2 targets.
- OPTLOCAL has been configured (OptLoc: Yes). As connection requests received are received from the Tier 1 targets, Tier 2 distribution targets on the same stack as the Tier 1 target will be preferred.
- On each Tier 2 distributor run the Netstat VIPADCFG/-F DETAIL report to verify the following:
  - The same group name is used on the Tier 1 and corresponding Tier 2 VIPADISTRIBUTE statements. In the example display from the VIPA distribute section, the group name "CICSGROUP" matches the Tier 1 group name.
  - OPTLOCAL has been configured

VIPA Define:
    IpAddr/PrefixLen: 203.2.108.10/24
    Moveable: Immediate SrvMgr: No Flg: 2
VIPA Distribute:
    Dest:        203.2.108.10..10002
    DestXCF:     ALL
    SysPt: No    TimAff: No Flg: ServerWLM Tier2
    OptLoc: Yes  GrpName: CICSGROUP
    ProcSecost:
        zAAP: 001 zIIP: 001
        ILWeighting: 0

On each tier 2 distributor, run the Netstat VDPT/-O report to see the status of each tier 2 target. In the example, there is a nonzero ready count of 1 for the server on destination XCF 193.1.1.108 and the normalized server-specific weight for this target is 16. There is not a ready server on the destination XCF 193.1.1.181. As the tier 1 distributor receives the tier 2 weights, it adds the weight
of the corresponding XCF address. The tier 1 normalized weight for the server on destination XCF 193.1.1.108 is twice that of the server weight on destination XCF 193.1.1.181 because the tier 2 distributor did not have a ready server on destination XCF 193.1.1.181.

Steps for diagnosing Tier 1 non-z/OS sysplex distribution problems

For an in-depth explanation of distribution to non-z/OS targets, see the Sysplex distribution with DataPower® section in z/OS Communications Server: IP Configuration Guide.

Tip: Tier 1 non-z/OS sysplex distribution is available for both IPv4 and IPv6. The following examples describe how to diagnose IPv4 distribution problems with DataPower, but this function applies to IPv6 as well.

For Tier 1 sysplex distribution

On the tier 1 distributor, run the Netstat VIPADCFG/-F DETAIL report to see the tier 1 configuration statement information.

- In the VIPA DEFINE section of the report, verify the new flag field, 1, which indicates that this is a VIPA definition for a tier 1 DVIPA.
- In the VIPA DISTRIBUTE section, verify the tier 1 configuration parameters.
  - The flag fields show that the targets are Tier1, and that the distribution method is target controlled (TargCtrl). Target controlled distribution means that the tier 1 targets will send weight recommendations to the distributor. The other routing types supported are ROUNDROBIN and WEIGHTEDACTIVE.
  - The routing type used to send packets to the non-z/OS tier 1 targets is GRE. GRE is the only type that is supported.
  - When the RtgType is GRE, a control connection is established from the distributor to each target. In this example, the destination port (CtrlPort) that will be used for the control connection is 1702. The control connection will be used to receive:
    - Weight recommendations from the target (since the distribution method is TargCtrl) - the distributor will load balance across the tier 1 targets using these weights similar to how the distributor uses WLM weight recommendations to load balance across z/OS targets
    - Connection awareness information (since the routing type is GRE) - this information will indicate if the target has a ready server listening on port 9000, and will also be used to indicate when connections are established and terminated.
  - The group name is CICSGROUP. The group name is used when a tier 2 sysplex distributor is being used to correlate tier 1 targets with their tier 2 targets. This is explained further in the following tier 2 distribution section.

Dynamic VIPA Information:
VIPA Define:
  IpAddr/PrefixLen: 9.42.130.251/24
  Moveable: Immediate  SrvMgr: No  Flg: 1
VIPA Distribute:
  Dest:  9.42.130.251...9000
  DestXCF:  9.42.105.53
  SysPt:  No  TimAff: No  Flg: TargCtrl Tier1
  OptLoc:  No
  GrpName: CICSGROUP  RtgType: GRE CtrlPort: 01702
  Dest:  9.42.130.251...9000
DestXCF: 9.42.105.73  
SysPt: No  TimAff: No  Flg: TargCtrl Tier1  
OptLoc: No  
GrpName: CICSGROUP  RtgType: GRE CtrlPort: 01702  
Dest: 9.42.130.251..9000  
DestXCF: 9.42.103.215  
SysPt: No  TimAff: No  Flg: TargCtrl Tier1  
OptLoc: No  
GrpName: CICSGROUP  RtgType: GRE CtrlPort: 01702  
Dest: 9.42.130.251..9000  
DestXCF: 9.42.103.216  
SysPt: No  TimAff: No  Flg: TargCtrl Tier1  
OptLoc: No  
GrpName: CICSGROUP  RtgType: GRE CtrlPort: 01702  
Dest: 9.42.130.251..9000

Run the Netstat ALLCONN/-a report to verify that a control connection is active to each non-z/OS target. The foreign socket destination IP address and destination port correspond to the DestXCF IP address (of the non-z/OS target) and the control port of 1702 from the VIPA distribute section. In this example report, there are four TCP connections in established state to each of the configured Tier 1 targets.

```
USER1@VIC018:/:> netstat -a
MVS TCP/IP NETSTAT CS VIR11  TCPIP Name: TCPCS  17:23:36
User Id  Conn     State
-------  ----     -----  
TCPCS    00000014 Establsh  
Local Socket:   9.42.104.4..1025  
Foreign Socket: 9.42.103.216..1702  
TCPCS    00000018 Establsh  
Local Socket:   9.42.104.4..1027  
Foreign Socket: 9.42.105.73..1702  
TCPCS    00000019 Establsh  
Local Socket:   9.42.104.4..1028  
Foreign Socket: 9.42.105.53..1702  
TCPCS    00000017 Establsh  
Local Socket:   9.42.104.4..1026  
Foreign Socket: 9.42.103.215..1702
```

Run the Netstat VDPT/-O report to see the current status of the Tier 1 targets. Verify the weight recommendations are non-zero and that there is a ready server for each Tier 1 target. This information is updated each polling interval.

- The T1Wt field is the weight recommendation reported by each target. In the example, all are non-zero.
- The ready count is 1 for each Tier 1 target indicating that each has a server Listening on port 9000.
- The CWt field is a CPC weight. This field should be non-zero if Tier 2 distributors are configured. If there are no corresponding Tier 2 distribution statements, then this field will be zero. This is explained further in the following Tier 2 distribution section.

```
Dynamic VIPA Destination Port Table for non-z/OS targets:  
Dest: 9.42.130.251..9000  
Target Addr: 9.42.103.215  
TotalConn: 0000000000  Rdy: 001  Wt: 03  CWt: 032  
Flg: TargCtrl  
T1Wt: 420  
ActConn: 0000000000

Dest: 9.42.130.251..9000  
Target Addr: 9.42.103.216  
TotalConn: 0000000000  Rdy: 001  Wt: 05  CWt: 032  
Flg: TargCtrl  
T1Wt: 672  
ActConn: 0000000000

Dest: 9.42.130.251..9000  
Target Addr: 9.42.105.53  
TotalConn: 0000000000  Rdy: 001  Wt: 03  CWt: 064  
Flg: TargCtrl  
T1Wt: 420  
ActConn: 0000000000

Dest: 9.42.130.251..9000  
Target Addr: 9.42.105.73  
TotalConn: 0000000000  Rdy: 001  Wt: 03  CWt: 064  
Flg: TargCtrl
```
Tier 2 sysplex distribution

- A Tier 1 target may distribute connections to Tier 2 targets on the same CPC using a Tier 2 sysplex distributor configured with CPCSCOPE. The Tier 2 sysplex distributor will only load balance to z/OS targets that are on the same CPC.

- In the VIPA DEFINE section of the report, the new flag field, 2, indicates that this is a VIPA definition for a Tier 2 DVIPA. The flag, "C", indicates that the Tier 2 DVIPA is configured with CPCSCOPE.

- Each Tier 2 distributor will send a combined CPC weight of all ready servers to the Tier 1 distributor; the group name is used to correlate a group of Tier 1 targets with their Tier 2 targets.

- On each Tier 2 distributor run the Netstat VIPADCFG/-F DETAIL report to verify that the same group name is used on the Tier 1 and corresponding Tier 2 VIPADISTRIBUTE statements. In the example report from the VIPA distribute section, the group name "CICSGROUP" matches the Tier 1 group name.

- A combined weight will be used to update a Tier 1 target with a matching group name if this Tier 2 distributor (and therefore its Tier 2 targets) are on the CPC used by that Tier 1 target. A VIPADEFINE CPCSCOPE definition is required to determine the CPC used by a Tier 1 target. If the IP address of the target is in the same subnet of this DVIPA, then its targets are on that CPC.
  - In the example report from the VIPA define section, DVIPA 9.42.103.17 is a CPCSCOPE DVIPA because the flag field is "C".
  - The subnet for this DVIPA is 9.42.103.xx/24. So all Tier 1 targets (from the Tier 1 Netstat VDPT/-O report above) in this subnet are using the same CPC as that stack.
  - The Tier 1 targets in this subnet are 9.42.103.215 and 9.42.103.216. So as combined weights are received from a Tier 2 distributor, with the same CPC ID as the stack in which the CPCSCOPE definition was defined, the Tier 1 combined weight fields (CWt) for those targets (in the CPCSCOPE subnet) are updated with those weights.

- In this example, the CPCSCOPE DVIPA is configured on the same stack as the Tier 2 VIPADISTRIBUTE statement. So this Tier 2 distributor will be providing the combined weights for the non-z/OS targets in the CPCSCOPE DVIPA subnet, 9.42.103.215 and 9.42.103.216. Ideally the CPCSCOPE DVIPA would be defined on the same stack as the Tier 2 Distributor, and VIPABACKUP statements for these DVIPAs would be on the same stacks with the same ranks. However the CPCSCOPE DVIPA could be defined on any stack as long as it is in the same CPC as the Tier 2 distributor.

VIPA Define:
IpAddr/PrefixLen: 9.42.103.17/24
Moveable: Immediate  SrvMgr: No  Flg: C
IpAddr/PrefixLen: 203.2.108.3/24
Moveable: Immediate  SrvMgr: No  Flg: 2C
VIPA Distribute:
Dest: 203.2.181.3..11000
DestXCF: ALL
SysPt: No  TimAff: No  Flg: ServerWLM Tier2
OptLoc: No
GrpName: CICSGROUP

- On each Tier 2 distributor, run the Netstat VDPT/-O DETAIL report to see the status of each Tier 2 target. In the example, there is a non-zero ready count of 1 for each server, and there is a non-zero normalized server-specific weight for each target.

- The combined weight in the Tier 1 VDPT (CWt) displays for the Tier 1 targets on that CPC, 9.42.103.214 and 9.42.103.216 is the total weight of the Tier 2 ready servers, 32.

Dynamic VIPA Destination Port Table for TCP/IP stacks:
Dest: 203.2.108.3..11000
DestXCF: 193.1.1.108
TotalConn: 0000000000  Rdy: 001  WLM: 16  TSR: 100
Flg: ServerWLM, Tier2
TCSR: 100  CER: 100  SEF: 100
Weight: 64
Raw          CP: 64 zAAP: 00 zIIP: 00
Proportional CP: 63 zAAP: 00 zIIP: 00
Abnorm: 0000        Health: 100
ActConn: 0000000000
QosPlcAct: *DEFAULT*
W/Q: 16
Dest:        203.2.108.3..11000
DestXCF:   193.1.1.181
TotalConn: 0000000000 Rdy: 001  WLM: 16 TSR: 100
Flg: ServerWLM, Tier2
    TCSR: 100  CER: 100 SEF: 100
Weight: 64
    Raw          CP: 64 zAAP: 00 zIIP: 00
    Proportional CP: 63 zAAP: 00 zIIP: 00
    Abnorm: 0000        Health: 100
    ActConn: 0000000000
    QosPlcAct: *DEFAULT*
    W/Q: 16
Chapter 12. Diagnosing access control problems

This topic describes selected procedures for TCP/IP Services component trace, packet trace, and Socket API trace.

This topic contains the following sections:

• “Overview of access control support” on page 390
• “Diagnosing multilevel security consistency check messages (EZD1215-EZD1234)” on page 390

Tip: The SAF interface allows security servers to return the following responses to access control questions:

Allow
User is permitted to resource with requested level of access.

Deny
User is not permitted to resource with requested level of access.

No decision
Class is not active or covering profile is not defined.

For many resources, TCP/IP allows access when a No decision is returned. RACF supports the No decision response. Some security server products do not support the No decision response. They always return Deny when a resource has no profile. If you are using one of these other security servers, you must define profiles for these resources to allow any user to use them.

TCP/IP creates resource names in the SERVAUTH class to represent the services it protects.

These resource names are comprised of the following tokens:

• The first token is always EZA or EZB.
• The second token represents the type of services.
• The third token is the eight-character MVS system image name.
• The fourth token is often the TCP/IP job name.

Additional tokens can be defined for more granularity on certain types of services. For more information about services that TCP/IP protects and the resource names used, see the security topic in z/OS Communications Server: IP Configuration Guide.

You define RACF profiles in the SERVAUTH class to control access permissions to these resource names. A discrete profile has the same name as a resource and covers only that resource. A generic profile uses wildcard symbols to cover many resource names. The SERVAUTH class is a general resource class, so you use the RACF RDEFINE, RLIST, RALTER, RDELETE and PERMIT commands to manage these profiles. For more information, see z/OS Security Server RACF Security Administrator's Guide and z/OS Security Server RACF Command Language Reference.

Except for a few documented cases, TCP/IP checks for READ access to resources. Users might be given access to a resource in several ways. A RACF profile defines universal access (UACC) that provides the default level of access for all users not explicitly named. Individual users and user groups might be given a different level of access, higher or lower, with the PERMIT command. Use the WHEN clause to define conditions that must be met before the specified access is granted.

Tip: The RACF WHEN(PROGRAM(...)) clause has restrictions on profiles in the SERVAUTH class. It can be ignored on some resource checks and should only be used for resource names that explicitly document support.

RACF can be configured to write audit messages to the console. The default for profiles in the SERVAUTH class is to write a message when access is denied. These messages indicate the user, resource name, profile name and access level requested. When you first put an access control policy in place, you might want to configure the profile to produce audit messages on successes as well. You might also want to
configure the profile with the WARNING parameter. This causes RACF to write the audit failure messages and then return allow to the resource manager. This allows you to test the effectiveness of a proposed policy without impacting usage.

**Tips:**

- Some policy changes do not take effect until the next time a user logs on or starts a job. After changing the policy, the user might need to log off or a job might need to be canceled and restarted.

- TCP/IP caches results when it checks access to NETACCESS resources. This cache is purged when a NETACCESS statement is found in a file used with the VARY TCPIP,OBEYFILE command. It is also purged when an ENF signal is received from RACF indicating that the SERVAUTH class or SECLABEL class has been refreshed. If your security server does not produce this ENF signal then, after making policy changes, you must issue the VARY TCPIP,OBEYFILE command with a file containing the NETACCESS statement to cause TCP/IP to purge cached responses.

Several of the TCP/IP services that provide access control check socket calls made through several different interfaces. When access to a resource is denied, the errno returned is EACCES. The errno2 field provides additional information about the failure. Programs that provide diagnostic logs should include the errno2 field. For information about the contents of the value returned, see z/OS UNIX System Services Programming: Assembler Callable Services Reference.

**Tip:** Many C programs use the perror() or strerror() library service to display errors encountered. There is an environment variable_EDC_ADD_ERRNO2, which when set to 1, appends the current errno2 value to the end of the perror() string as shown below:

```
EDC5121I Invalid argument. (errno2=0x0C0F8402)
```

TCP/IP access control failures are recorded in the event trace (SYSTCPIP) for TCP/IP stacks with the ACCESS option.

### Overview of access control support

Communications Server is a resource manager that provides access control support over many of its services.

This can be a powerful tool to prevent unwanted usage of communications services. At times, it might also prevent intended usage. TCP/IP uses Security Access Facility (SAF) interfaces to ask your installed security server access control questions.

**Note:** The examples and terminology in this topic assume you are using RACF. However, you can use any SAF-conforming security server.

### Diagnosing multilevel security consistency check messages (EZD1215-EZD1234)

Secure communication in a multilevel secure environment requires configuration of several statements in the TCPIP.PROFILE and security server resource profiles in the SERVAUTH, SECLABEL and STARTED classes. Inconsistencies in this configuration can allow unintended communication or prevent intended communication. When the RACF MLACTIVE option is set, TCP/IP checks the TCPIP.PROFILE and security server resource profiles for consistency. Consistency checking occurs at TCP/IP initialization, when a VARY TCPIP,OBEYFILE command is processed and when RACF sends an ENF signal specifying that a RACLIST REFRESH was done on the SERVAUTH or SECLABEL class.

TCP/IP writes an informational message to the job log for each inconsistency detected. If inconsistencies are found, a final message, EZD1217I, summarizing the number of problems found is written to the system console. You should check the job log for messages in the range EZD1219I-EZD1234I whenever message EZD1217I appears on the system console. You should correct your configuration as indicated by the job log messages until TCP/IP no longer detects any errors.
TCP/IP’s default behavior is to continue running when inconsistent security configurations are detected. If you plan to run in a multilevel-secure environment, it is recommended that you specify GLOBALCONFIG MLSCHKTERMINATE in your TCPIP.PROFILE when running production workloads and GLOBALCONFIG NOMLSCHKTERMINATE while you are making planned changes to your security environment.

**Steps for verifying the configuration**
Verify that the TCP/IP stack is configured as intended.

**Before you begin**
See z/OS Communications Server: IP Configuration Guide for information about networking in a multilevel-secure environment.

**Procedure**
Perform the following steps:

1. TCP/IP stack is running under the intended user ID. If the stack is a submitted job, check the USER= parameter on the job card. If the stack is a started procedure, check the STDATA segment of the profile in the STARTED class.

2. TCP/IP stack is running with the intended security label. If the stack is a submitted job, check the SECLABEL= parameter on the job card. If the stack is a started procedure or SECLABEL= was not specified on the job card, check the default security label in the USER profile. Verify that the user ID is permitted to the SECLABEL profile. If running with the RACF SECLBYSYSTEM option, verify that the security label is active on this system image.

3. TCP/IP stack recognizes the multilevel-secure environment. The TCPIP.PROFILE must contain a valid NETACCESS statement with the following:
   - INBound
   - OUTBound
   - At least one valid security zone definition

4. TCP/IP stack has the intended IP addresses defined. Verify the IP addresses on DEVICE and INTERFACE statements in the TCPIP.PROFILE. Verify the IP addresses on VIPDEFINE, VIPABACKUP, VIPARANGE and VIPADISTRIBUTE statements in the TCPIP.PROFILE. Verify that IP addresses are manually configured for IPv6 interfaces. Verify that the INTFID keyword is specified on all IPv6 interfaces. Verify that the IPADDR keyword is specified on all IPv6 interfaces that support autoconfiguration.

5. TCP/IP stack has IP addresses mapped into the intended network security zones. Verify that the base IP address, mask and zone name are correct on each line in NETACCESS statement in the TCPIP.PROFILE. Verify that these addresses are in security zones:
   - INADDR_ANY (IPv4 0.0.0.0/32, IPv6 ::/128)
   - LOOPBACK (IPv4 127.0.0.1/8, IPv6 ::1/128)
   - Any required Multicast (IPv4 224.0.0.0/4, IPv6 FF00::/8)

**Tips:**
- The D TCPIP,,N,ACC,NETW console command displays the current NETACCESS statement configuration. The SERVAUTH profile name covering the security zone resource name and the security label defined on that profile are also shown.
- The security zone that a IP address is currently configured into is displayed by the D TCPIP,,N,ACC,NETW,ipaddress console command.

6. SERVAUTH resources are covered by the intended profile. The RLIST SERVAUTH resource_name AUTHUSER RACF command displays the discrete or generic profile that most closely matches the specified resource name. It also displays the universal access, the security label, the access list and the conditional access list for that profile.
Line print requester (LPR) and line printer daemon (LPD) compose a functional unit in which the LPR client sends data files to a printer controlled by an LPD server. These files can be in ASCII form or extended binary-coded decimal interchange code (EBCDIC) form.

In most environments, customers have different types of LPR clients and LPD servers, running on platforms, such as MVS, OS/2, AIX®, and UNIX. However, all print client and servers must follow the standards contained in RFC1179. Some clients and servers provide more than what is required by the RFC, while some clients and servers are restricted or limited, which can cause errors or require more configuration to work.

On platforms, such as MVS, UNIX, and AIX, you can start the LPR client program with command prompts, through batch (in MVS), or through shell scripts (in UNIX/AIX®). The MVS LPD server allocates temporary data sets to process incoming print requests from various clients. These data sets use the TCP/IP high-level qualifiers (HLQs) or the prefix defined in the LPD server cataloged procedure.

The MVS LPD server can also act as a client when a remote print server is defined in the LPD configuration file as a service. In this case, when the LPD server receives an incoming print job, it opens a new connection through a client port, and sends the data to the remote print server. When a remote print server is used, LPD specifications, such as line size and page size, do not apply. Instead, the specifications of the remote server apply.

For information about configuring your LPD server, see z/OS Communications Server: IP Configuration Reference. For information about using the client-related LPR, LPQ, and LPRM commands, see z/OS Communications Server: IP User's Guide and Commands.

Problems with the print function are easy to diagnosis if the problem is within the LPR client or the LPD server. More difficult problems can be encountered in the TCP/IP layer or in sockets. In addition, incorrectly built or defined translation tables can produce unpredictable results, such as abends, misprinted characters, and hang conditions (caused by delayed acknowledgments).

**Diagnosing LPR client and LPD server problems**

Problems with LPR and LPD generally fall into one of the following categories:

- Abends
- Timeouts, hangs, and waits
- Incorrect output

These categories are described in the following subtopics.

**Abends**

When an abend occurs during LPD processing, messages and other error-related information are sent to the MVS system console. If this information is insufficient to solve the problem, use the information provided in a dump. To produce a dump, code a SYSMDUMP DD or SYSABEND DD statement in the LPD cataloged procedure. If you do not do the coding before the abend occurs, code the statement after the abend, re-create the abend or wait for it to occur again. For information about analyzing dumps produced during LPD processing, see z/OS Problem Management.

It can also be helpful to obtain and analyze information from the following sources:

- LPD trace in the SYSPRINT data set
- Output of LPD started task
Steps for diagnosing timeouts, hangs, and waits

Timeouts, hangs, and waits occur when the LPD server does not respond to client requests for a data packet, an acknowledgment that a data packet was received, or a reply to a command. Similarly, the LPD server can time out a connection if the LPR client does not respond.

Before you begin

Determine whether one or more of the following problems caused a timeout, hang, or wait:

- Incorrect host name or IP address specified on the LPR command
- Malfunctioning remote server or remote host
- Problems with the network (for example, network congestion), bridge, gateway, or router in the routing path
- Problems with the device or channel attached to the host
- Corrupted TCP/IP address space
- Incorrectly built or defined translation tables
- Malfunctioning LPR client

Procedure

Perform one or more of the following steps to diagnose timeouts, hangs, and waits.

1. Check to see whether the target LPD print server is running, has enough paper, and is not jammed.
2. Check the LPR and LPD traces for possible error messages, or for the last activity performed by LPR or LPD (for example, waiting for a connection, port availability, or an acknowledgment). Be aware that when sending a print request to a remote printer through the LPD server, the LPR client can show a successful data transfer even though there might be a problem connecting to the remote printer.
3. Check the IP address or host name used with the LPR command.
4. Check the LPR, LPD, and packet traces. If the packet trace shows a problem during binding or connecting, then check the socket trace.
5. Verify that the translation tables are built correctly. Test them using the hlq.STANDARD.TCPXLBIN table supplied with TCP/IP.

Results

Be aware that waits can occur because some LPD servers do not send acknowledgments until data is printed. In this situation, the LPR client does not show successful data transfer until it receives the acknowledgment.

Incorrect output

LPR problems with incorrect output fall into one of the following categories:

- Garbled data sent from the LPR client or received by the LPD server
- Truncated or missing print data
- LPR works with some options, but not others

These categories are described in the following topics.

Steps for diagnosing garbled data

Determine why data is not properly translated or transferred.

Procedure

Perform the following steps:
1. Determine whether the binary option or the default EBCDIC was used when the data file was printed. If the binary option was used, the LPR client did not translate the data. If EBCDIC was used, check for erroneous control characters or conflicting combinations of options.

2. Check to see whether other files print correctly from the same client and to the same server. Check to see whether the problem file prints correctly to other servers.

3. Verify that the translate tables for the sender and receiver are reciprocals of each other. Determine which characters are consistently garbled and examine those entries in the tables. To determine the name of the translation table used by the LPR client, check the LPR messages issued at startup.

4. Check the IP packet trace to determine exactly what data was sent from the client and acknowledged by the LPD server.

5. If data shown in the IP packets from the LPR client to the server is correct, there might be an error on the server or printer. Check the server traces and setup on the printer or LPD server. Some servers require certain printer names or options to be specified on the LPR (lp from omvs) commands.

**Steps for diagnosing truncated or missing print data**

Determine why print data is truncated or missing.

**Procedure**

Perform one or more of the following steps:

1. Check to see whether the value for the record length is valid. The value is specified using the WIDTH option and variable on the LPR command.

2. If MVS displays truncated records, check the value of the LINESIZE option on the SERVICE statement in the LPD configuration file.

3. If you use the FILTER L or FILTER R options on the LPR command, check to see whether the control characters on the first column of the source file are valid. LPR issues a message indicating whether a record of data has been ignored.

4. Using a packet trace and the file size listed in the LPR trace control record, verify that the correct number of bytes were sent by the LPR client and received by the LPD server.

5. Check the LPD trace for error messages. Verify that the Job xxx Received and Job xxx Finish Printing messages were received.

6. If sending a print request to a remote printer through the LPD server, check the LPD trace to determine whether all data were sent successfully to the remote printer. If not or if data are incorrect, check the printer for errors or restrictions on the type of data it supports (for example, postscript only, text only).

7. Check for partial temporary data sets and either rename them or delete them. The LPD server creates temporary data sets when connections are broken, and the server does not completely process a print job. (Depending on the LPR client, the server can requeue the job for printing at a later time.) When the connection is restored, the daemon checks for temporary data sets and processes them. After processing, they are erased.

The temporary data sets are stored on a volume with a data set prefix you define in the LPD cataloged procedure. Following are samples of these data sets:

```
TCPUSR4.PRT1.QUEUE                                 WRKLB2
TCPUSR4.RALVM12.CFnnnn                                BROWSED    WRKLB2
TCPUSR4.RALVM12.DFAnnnLU                             BROWSED    TCPWRK
TCPUSR4.RALVM12.JFnnn                                 WRKLB2
```

The QUEUE... represents, in this sample PRT1's print queue file. It will contain the name of the JOB files that have not been completely processed yet.

The CF... represents the CONTROL FILE. Contains the control data/commands sent to LPD.

The DF... represents the DATA FILE. The actual data sent to be printed.

The JF... represents the JOB FILE. Contains names of the above files that have not been processed yet.

where nnn is the three digit job number.
Occasionally, depending on the precipitating incident and the time the connection was broken, the LPD server creates only a portion of one or more data sets. When partial temporary data sets are created, the server issues allocation or failure-to-erase messages. If you receive any of these messages, search for the partial data sets and either rename or delete them. After doing this, you might need to reissue the print request or requests.

The LPD trace and the system log at the time a connection is broken show the status of all print jobs (and the status of some data sets) and identify the owners of the print requests.

**Steps for diagnosing LPR working with some options only**

Determine why the LPR command works with some options but not with others.

**Procedure**

Perform one or more of the following steps:

1. If some print requests do not work with certain LPR options, check the LPR trace for error messages.
2. If the LPR command from batch fails, but works under TSO, check for possible errors in the batch-job output and for error messages in the LPR trace.

**Results**

For information about the LPR command, see z/OS Communications Server: IP User’s Guide and Commands.

**LPR client traces**

This topic provides information about activating LPR client traces. It also provides samples of trace output with explanations of selected messages.

**Step for activating LPR client traces**

You can activate LPR client traces by specifying the TRACE option in addition to the usual processing parameters on the LPR command.

For example, enter the following command to start the LPR client with trace on:

```
LPR filename (Printer p1 Host h1 TRACE
```

**Step for creating client trace output**

LPR trace output is sent to SYSOUT and can be displayed on the LPR client console. Figure 50 on page 397 is a sample of an LPR trace created by way of TSO with the following command:

```
LPR soto.files(lpconfig) (p prtl h 9.67.113.60 TRACE
```
EZB0915I Begin "LPR" to printer "prt1" at host "9.67.113.60"

EZB0920I Requesting TCP/IP service at 96155 18:52:53
EZB0921I Granted TCP/IP service at 96155 18:52:53
EZB0922I Resolving 9.67.113.60 at 96155 18:52:53
EZB0924I Host 9.67.113.60 name resolved to 9.67.113.60 at 96155 18:52:53
EZB0925I TCP/IP turned on.

EZB0961I Control file name is cfA827MVSA
EZB0962I Data file name is dfA827MVSA Port Number=721. Remote IP Addr=9.67.113.60

EZB0916I Sending command 2 argument: prt1 Port Number=721. Remote IP Addr=9.67.113.60
EZB0917I Command successfully sent Port Number=721. Remote IP Addr=9.67.113.60
EZB1012I Receiving ACK Port Number=721. Remote IP Addr=9.67.113.60
EZB1013I ReceiveACK: TRUE for byte value 00 Port Number=721. Remote IP Addr=9.67.113.60
EZB0997I Byte size check starts at 96155 18:52:54
EZB0998I Byte size check ends at 96155 18:52:54
EZB0999I Send command starts at 96155 18:52:54 Port Number=721. Remote IP Addr=9.67.113.60

EZB0916I Sending command 3 argument: 7434 dfA827MVSA Port Number=721. Remote IP Addr=9.67.113.60
EZB0917I Command successfully sent Port Number=721. Remote IP Addr=9.67.113.60
EZB1012I Receiving ACK Port Number=721. Remote IP Addr=9.67.113.60
EZB1013I ReceiveACK: TRUE for byte value 00 Port Number=721. Remote IP Addr=9.67.113.60

Figure 50. Example of LPR trace output (Part 1 of 2)

Figure 51. Example of LPR trace output (Part 2 of 2)
Following are short descriptions of the numbered items in the trace:

1. Indicates the translation table used by the LPR client. In this print request, no translation tables were defined by the person submitting the request.

2. Indicates LPR port used to connect to the LPD server with the IP address 9.67.113.60. The LPR port range is from 721 through 731.

3. Indicates the LPR command sent to the LPD server identifying the name of the print queue where the output was sent. See RFC1179 for details on commands and subcommands issued between LPR and LPD.

4. Indicates the command that provided the LPD print server with the byte size (7434) and name of the data file (dfA827MVSA) that was sent.
   - The character string dfA indicates that this was a data file.
   - The number 827 was the three-digit job number that was randomly generated by the LPR client or specified in the LPR command using the JNUM option.
   - MVSA was the name of the host from which the print request came.

5. Indicates the client is waiting for the LPD server to acknowledge the sending command in item 4. The message on the following line (TRUE (00)) indicates that the client received an acknowledgment. A FALSE message or any value other than zero terminates the LPR print request.

6. Indicates that the LPR client started and then stopped sending the data file.

7. Indicates that the LPR client notified the LPD server, by way of an acknowledgment, that the complete file was sent. The LPR client waits for the server to acknowledge receipt of the entire data file.

8. Indicates that the client received an acknowledgment from the server that the entire data file was received.

9. Confirms that the data file was sent to the LPD server.

10. Specifies one of the several control records sent by the LPR client. (The records are described in detail in RFC1179.) This control record is mandatory and represents the name of the data file created by the LPD server. The name is preceded by the filter specified on the LPR command. The letter f denotes the default filter.

11. Specifies the byte size (153) and the name of the control file (cfA827MVSA) that was sent.

12. Indicates that the LPD server received the command and expected the control file to be sent.

13. Indicates that the LPR client sent the control file and an acknowledgment that it finished sending the entire file. The last line in the block indicates that the client was waiting for an acknowledgment from the server.

14. TRUE (00) indicates that the client received an acknowledgment from the LPD server that the control file was received.

15. Confirms that the control file was sent to the LPD server. The job was then terminated.
Figure 52 on page 399 is a sample LPR trace showing a print request in which the FILTER X option was specified on the LPR command. Since the LPD server does not support this type of filter, it rejects the print request. (For an example of an LPD trace that shows that this job was rejected, see Figure 57 on page 407.) The LPR trace does not show an error because it can send a print request to non-IBM LPDs that support other filters (for example, FILTER X). For detailed information about filters, see RFC1179 and to z/OS Communications Server: IP Configuration Reference.

The trace was produced using the following command issued through TSO by user ID TCPUSR4:

```
LPR test (p TIANNA h 9.67.113.60 filter x TRACE
```

```
EZB0915I Begin "LPR" to printer "TIANNA" at host "9.67.113.6 0"
EZB1057I Loaded translation table from "TCP31S.STANDARD.TCPXLBIN".
EZB0920I Requesting TCP/IP service at 96155 19:22:15
EZB0921I Granted TCP/IP service at 96155 19:22:15
EZB0922I Resolving 9.67.113.60 at 96155 19:22:15
EZB0924I Host name resolved to 9.67.113.60 at 96155 19:22:15
EZB0925I TCP/IP turned on.
EZB0926I Host "MVSA" Domain "TCP.RALEIGH.IBM.COM" TCPIP Service Machine TCP31S
EZB0927I Trying to open with local port 721 to foreign host address 9.67.113.60
EZB0928I Connection open from local port 721 to foreign host address 9.67.113.60 :
EZB1009I Data file sent. Port Number = 721. Remote IP Addr = 9.67.113.60
EZB1011I Queuing control line "HMVSA.TCP.RALEIGH.IBM.COM"
EZB1011I Queuing control line "PTCPUSR4"
EZB1011I Queuing control line "JTCPUSR4.TEST"
EZB1011I Queuing control line "CMVSA.TCP.RALEIGH.IBM.COM"
EZB1011I Queuing control line "LTCPUSR4"
EZB1011I Queuing control line "xdfA947MVSA"
EZB1011I Queuing control line "UdfA947MVSA"
EZB1011I Queuing control line "NTCPUSR4.TEST"
EZB0916I Sending command 2 argument: 122 cfA947MVSA Port Number = 721. Remote IP Addr = 9.67.113.60
EZB0917I Command successfully sent Port Number = 721. Remote IP Addr = 9.67.113.60 :
EZB1018I Control file sent Port Number = 721. Remote IP Addr = 9.67.113.60
```

Figure 52. Example of LPR trace with filter x option

Following are short descriptions of the numbered items in the trace:

1. Indicates that the print request was issued to a printer named TIANNA at IP address 9.67.113.60.

2. Indicates that the data file was sent. The error was not recognized until the LPD server tried to process the print job. (See Figure 57 on page 407.)

3. Indicates control commands sent to the LPD server. For details about these commands, see RFC1179.

4. Represents the name of the data file. The character string xdf indicates that the x filter was used.

5. Indicates that the control file was sent to the LPD server. The job was then terminated.
Figure 53 on page 400 is a sample showing a print request using the following command: `lpr test (p njeSOTO host MVSA)` without the TRACE option. The output shows an error because the printer name was not entered entirely in capital letters.

1. EZB1006E Host MVSA did not accept printer name njeSOTO.
   Port Number = 721 Remote IP Addr = 9.67.113.60

2. EZB1049E Send printer command did not receive ACK. ACK message = .
   Port = 721 Remote IP Addr = 9.67.113.60

Figure 53. Example of LPR output with unknown printer

Following are short descriptions of the numbered items in the trace:

1. Indicates that a SERVICE statement for a printer named njeSOTO did not exist in the LPD server configuration file.

2. Indicates that the LPD server did not send a positive response to the LPR client. The job was then terminated.

Figure 54 on page 400 is a sample LPR trace output produced with the following command: `lpr test (p TIANNA host 9.67.113.60 JNUM 111 LANDSCAPE TRACE`

The trace output shows the scanning that occurred to identify the first available port.

1. EZB0988I PostScript program is 635 bytes
   EZB0915I Begin "LPR" to printer "TIANNA" at host "9.67.113.60"
   EZB0857I Loaded translation table from "TCP31S.STANDARD.TCPXLBIN".
   EZB0920I Requesting TCP/IP service at 96155 19:35:12
   EZB0921I Granted TCP/IP service at 96155 19:35:12
   EZB0922I Resolving 9.67.113.60 at 96155 19:35:12
   EZB0924I Host 9.67.113.60 name resolved to 9.67.113.60 at 96155 19:35:12
   EZB0925I TCP/IP turned on.
   EZB0926I Host "MVSA" Domain "TCP.RALEIGH.IBM.COM" TCPIP Service Machine TCP31S
   EZB0927I Trying to open with local port 721 to foreign host address 9.67.113.60
   EZB0927I Trying to open with local port 722 to foreign host address 9.67.113.60
   EZB0927I Trying to open with local port 723 to foreign host address 9.67.113.60
   EZB0927I Trying to open with local port 724 to foreign host address 9.67.113.60
   EZB0928I Connection open from local port 724 to foreign host address 9.67.113.60
   EZB0961I Control file name is cfa111MVSA
   EZB0962I Data file name is dfa111MVSA Port Number = 724. Remote IP Addr = 9.67.113.60
   EZB0916I Sending command 2 argument: TIANNA Port Number = 724. Remote IP Addr = 9.67.113.60

2. EZB1011I Queueing control line "HMVSA.TCP.RALEIGH.IBM.COM"
   EZB1011I Queueing control line "PTCPUSR4"
   EZB1011I Queueing control line "JTCPUSR4>TEST"
   EZB1011I Queueing control line "CMVSA.TCP.RALEIGH.IBM.COM"
   EZB1011I Queueing control line "LTCPUSR4"
   EZB1011I Queueing control line "dfaf111MVSA"
   EZB1011I Queueing control line "Udfaf111MVSA"
   EZB1011I Queueing control line "NTCPUSR4.TEST"
   EZB0916I Sending command 2 argument: 122 cfa111MVSA Port Number = 7 24.

Figure 54. Example of LPR trace with JNUM, LANDSCAPE, and TRACE options

Following are short descriptions of the numbered items in the trace:

1. Indicates that the LPR client inserted a landscape header, written in postscript, at the beginning of the data file.

2. Indicates that the LPR client was attempting to use the first available client port. The port range for the LPR client is 721 through 731. If no ports are available, an error message is displayed.
Indicates that a connection was opened using port 724.

Indicates that the value specified for JNUM (111) was used to build the control and data file names.

Indicates the name of the file containing the three-digit job number that was used with the file name sent to the print server.

Following is a clipping of the header that was inserted into the data file. For more information about header files, see z/OS Communications Server: SNA Customization.

Figure 55 on page 401 is a sample of LPR trace output for the following command with the XLATE option:

```
LPR test (p TIANNA h MVSA trace xlate GXS
```

In this sample, the server was not running, so the connection was not established. For detailed information about using and creating your own translate tables, see z/OS Communications Server: SNA Customization.

```
EZB0915I Begin "LPR" to printer "TIANNA" at host "MVSA"
EZB1057I Loaded translation table from "TCPUSR4.GXS.TCPXLBIN".
EZB0920I Requesting TCP/IP service at 96155 20:04:14
EZB0921I Granted TCP/IP service at 96155 20:04:15
EZB0922I Resolving MVSA at 96155 20:04:15
EZB0924I Host MVSA name resolved to 9.67.113.60 at 96155 20:04:17
EZB0925I TCP/IP turned on.
EZB0926I Host "MVSA" Domain "TCP.Raleigh.ibm.com" TCPIP Service Machine TCP31S
EZB0927I Trying to open with local port 721 to foreign host address 9.67.113.60
EZB0916E Failed to Open connection to Port Number = 515. Return
Code = -1. Error Number = 61. Port Number = 721.
Remote IP Addr = 9.67.113.60
```

Figure 55. Example of LPR trace with XLATE option

Following are short descriptions of the numbered items in the trace:

1. Indicates the name of the translation table used by the LPR client. To avoid problems such as errors and data corruption, be sure that the LPD server is using the equivalent code pages.

2. Indicates the time the LPR client started trying to resolve the specified host name. The LPR client checks the name server table, the site, and address information files to resolve the host name.

3. Indicates the amount of time the LPR client took to resolve the specified host name. To reduce the amount of time, use the host IP address instead of the host name.

4. Indicates that the connection was not established. (In this sample, the LPD server was not running.) For a list of error numbers and their definitions, see z/OS Communications Server: IP and SNA Codes.

**LPD server traces**

This topic includes information about activating LPD server traces. It also provides samples of LPD trace output with explanations of selected messages.
**Step for activating server traces**

You can activate the tracing facilities within the LPD server in any of the following ways:

- Include the TRACE parameter in the LPSERVE PROC statement in the LPD server cataloged procedure.
  
  Be sure that a slash (/) precedes the first parameter and that each parameter is separated by a blank. For example:

  ```
  //LPSERVE PROC MODULE='LPD',PARMS='/TRACE'
  ```

- Enter the SMSG `procname` command, where `procname` is the name of the procedure used to start the LPD server.

- Specify the DEBUG statement in the LPD configuration file, LPDDATA.

**Step for creating server trace output**

LPD server traces go to the SYSPRINT data set. You can also define a DD card in the LPD cataloged procedure to write output to another data set. This section contains some samples of LPD server trace output.

Figure 56 on page 402 is a sample of an LPD trace invoked by specifying the DEBUG option in the LPD configuration file, LPDDATA.

```
EZB0832I
EZB0621I LPD starting with port 515
EZB0679I Allocated ObeyBlock at 00005B70
EZB0679I Allocated ObeyBlock at 00005B60
EZB0679I Allocated ObeyBlock at 00005B50
EZB0628I Associated PrinterBlock at 00005BC0
EZB0629I prt1 added.
EZB0641I Service prt1 defined with address
EZB0628I Associated PrinterBlock at 00005630
EZB0629I PRT1 added.
EZB0641I Service PRT1 defined with address
EZB0628I Associated PrinterBlock at 000053A0
EZB0629I TIANNA added.
EZB0641I Service TIANNA defined with address
EZB0628I Associated PrinterBlock at 00005110
EZB0629I PRT2 added.
EZB0641I Service PRT2 defined with address
EZB0628I Associated PrinterBlock at 000B1D40
EZB0629I njesoto added.
EZB0641I Service njesoto defined with address
EZB0628I Associated PrinterBlock at 000B1AB0
EZB0629I rda added.
EZB0686I Host "9.37.33.159" resolved to 9.37.33.159. Printer name is "lpt1".
EZB0641I Service POST defined with address
EZB0628I Associated PrinterBlock at 000B1820
EZB0629I POST added.
```

**Figure 56. Example of LPD trace specified with the DEBUG option**

```
EZB0686I Host "9.67.105.55" resolved to 9.67.105. 55. Printer name is "LPT2".
EZB0641I Service POST defined with address
EZB0697I ...End of Printer chain...
EZB0626I Associated ConnectionBlock at 00147E08
EZB0627I Passive open on port 515
EZB0705I 06/03/96 18:49:15
EZB0834I Ready
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 1 NotificationConnection state changed (8681)
EZB0779I New connection state Open (8673) on connection 1 with reason OK.
```
EZB0782I Connection open.  Reading command.
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0711I New command 2 data "2".
EZB0798I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification FSend response (8692)
EZB0799I Reading additional data on 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0754I New subcommand 3 operands "7434 dfA827MV SA".
EZB0723I Allocated StepBlock at 000B1320
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 2 Notification Connection state changed (8681)
EZB0779I New connection state Trying to open (8676) on connection 2 with reason OK.
EZB0626I Allocated ConnectionBlock at 0015BE08

EZB0627I Passive open on port 515
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 2 Notification Connection state changed (8681)
EZB0779I New connection state Open (8673) on connection 2 with reason OK.
EZB0799I Connection open.  Reading command.
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification FSend response (8692)
EZB0799I Reading additional data on 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 2 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 2
EZB0711I New command 4 data "A".
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 2 Notification FSend response (8692)
EZB0763I Closing connection 2
EZB0789I GetNextNote with ShouldWait of TRUE

EZB0798I GetNextNote returns.  Connection 2 Notification Connection state changed (8681)
EZB0779I New connection state Receiving only (8674) on connection 2 with reason OK.
EZB0799I GetNextNote with ShouldWait of TRUE
EZB0789I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0789I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote returns.  Connection 2 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote returns.  Connection 2 Notification Data delivered (8682)

EZB0754I New subcommand 2 operands "153 cfA827MVS A".
EZB0723I Allocated StepBlock at 000B1168
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification FSend response (8692)
EZB0799I Reading additional data on 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.  Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0798I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification FSend response (8692)
EZB0799I Reading additional data on 1
EZB0798I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Connection state changed (8681)
EZB0799I New connection state Sending only (8675) on connection 1 with reason OK.
EZB0798I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Connection state changed (8681)
EZB0799I New connection state Connection closing (8670) on connection 1 with reason OK.
EZB0798I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Connection state changed (8681)
EZB0799I New connection state Nonexistent (8672) on connection 1 with reason OK.
EZB0772I End Connection 1 for OK.

9
EZB0776I Released StepBlock at 000B1320
9
EZB0719I Allocated JobBlock at 00147798
10
EZB0723I Allocated StepBlock at 000B1320
10
EZB0716I Job 827 received prt1 MVSA
10
EZB0734I Job 827 added to work queue
12
EZB0716I Job 827 scheduled prt1 MVSA
EZB0776I Released StepBlock at 000B1168
EZB0777I Released ConnectionBlock at 0014AE08
EZB0824I ProcessWork starting on job queue
13
EZB0731I Work Queue start
13
EZB0732I $ 827 JOBstartPRINTING
EZB0733I Work Queue end
EZB0825I Job 827 for prt1 dispatched in state JOBstartPRINTING
EZB0716I Job 827 printing prt1 MVSA
EZB0827I ProcessWork end with queue
EZB0731I Work Queue start
13
EZB0732I $ 827 JOBcontinuePRINTING
EZB0733I Work Queue end
EZB0789I GetNextNote with ShouldWait of FALSE
EZB0824I ProcessWork starting on job queue
EZB0731I Work Queue start
EZB0732I $ 827 JOBcontinuePRINTING
EZB0733I Work Queue end
EZB0825I Job 827 for prt1 dispatched in state JOBcontinuePRINTING
flpNewBlock: State first call IsAtEof FALSE
15
flpNewBlock: State build IsAtEof FALSE
flpNewBlock: State check last IsAtEof FALSE
...
flpNewBlock: State build IsAtEof FALSE
flpNewBlock: State check last IsAtEof FALSE
...
EZB0825I Job 827 for prt1 dispatched in state JOBcontinuePRINTING
:
flpNewBlock: State build IsAtEof TRUE
flpNewBlock: State check last IsAtEof TRUE
EZB0827I ProcessWork end with queue
EZB0731I Work Queue start
EZB0732I $ 827 JOBcontinuePRINTING
EZB0733I Work Queue end
EZB0825I Job 827 for prt1 dispatched in state JOBcontinuePRINTING
EZB0827I ProcessWork end with queue
EZB0731I Work Queue start
EZB0732I $ 827 JOBfinishPRINTING
Following are short descriptions of the numbered items in the trace:

1. Indicates that a control block was allocated for each service defined in the LPD configuration file. TIANNA is the name of one of the local printers.

2. Indicates that the remote printer, LPT2, was defined in a SERVICE statement with the name POST. LPT2 has the IP address 9.67.105.55.

3. Indicates that the LPD server listened on port 515 and that port 515 was opened.

4. Indicates that the LPD server waited for work.

5. Indicates that a connection was opened for an incoming LPR client and that the LPD server was receiving a command from that client.

6. Indicates that a subcommand was received from an LPR client. The subcommand indicates LPD was receiving a data file named dfA827MVSA, containing 7434 bytes of data. For details on commands and subcommands, see RFC117.

7. Indicates that the LPD server had a passive open connection on the restricted LPD port, 515.

8. Indicates that the LPD server was receiving a control file named cfA827MVSA, containing 153 bytes of data.
Note: Data files use the naming convention of dfx. Control files use the naming convention cf\x.  

9 Indicates the control blocks that were allocated and released as files were received and processed. Control blocks are used primarily by IBM support for debugging purposes, in coordination with dumps.

10 Indicates that all data files for a particular job were received.
Note: Job number 827 is a three-digit job number generated by the LPR client.

11 Indicates that job 827 was added to this print queue. The LPD server maintains a work queue of jobs.

12 Indicates that job 827 was scheduled to be spooled to the output queue.

13 Indicates that the LPD server was processing print jobs from the work queue, and started sending print data to the JES output queue. The message JOBstartPRINTING does not mean that the file is physically printing.

14 Indicates that data was being sent for output. Depending on the size of the file, you might see this status many times for a single job.

15 Indicates checking for the end of the file as it is being processed. The number of IsAtEof entries depends on the data and size of the file.

16 Indicates that all data was processed and placed in the output queue.

17 Indicates that job 827 was completely processed by the LPD server and removed from the print queue, prt1, on host MVSA. Temporary data sets and control blocks for this job were also erased or released.

18 Indicates that the LPD server completed the jobs in that queue and scans the work queue again.

19 Indicates that the LPD server was waiting for more work to do.

20 Indicates that the LPR-to-LPD connection was closed normally.

21 Indicates that someone stopped the LPD server normally.

Figure 57 on page 407 is a sample of LPD trace output showing that job 947 failed to print because the client passed a filter that was not supported by the LPD server. In cases such as these, you can lose
printouts. In this case, the LPD trace showed why, but the LPR trace did not show an error. (See Figure 52 on page 399 for the corresponding LPR trace output.)

Figure 57. Example of an LPD server trace of a failing job

EZB0831I IBM MVS LPD Version V2R10 on 05/05/98 at 19:21:46
EZB0832I
EZB0621I LPD starting with port 515
EZB0834I

EZB0628I Allocated PrinterBlock at 000053A0
EZB0629I TIANNA defined with address
EZB0641I Service TIANNA defined with address

EZB0627I Passive open on port 515
EZB0705I 06/03/96 19:21:47
EZB0834I

EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.Connection 0 Notification Connection state changed(8681)
EZB0779I New connection state Trying to open (8676) on connection 0 with reason OK.
EZB0626I Allocated ConnectionBlock at 0014AE08
EZB0627I Passive open on port 515
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.Connection 0 Notification Connection state changed(8681)
EZB0779I New connection state Open (8673) on connection 0 with reason OK.
EZB0782I Connection open. Reading command.
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0627I Passive open on port 515
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns.Connection 0 Notification Connection state changed(8681)
EZB0779I New connection state Open (8673) on connection 0 with reason OK.

EZB0754I New subcommand 3 operands "333819 dfA947MV SA".

EZB0754I New subcommand 2 operands "122 cfA947MVSA".

EZB0776I Released StepBlock at 00081438
EZB0719I Allocated JobBlock at 00147798
EZB0723I Allocated StepBlock at 00081438

EZB0716I Job 947 received TIANNA MVSA

EZB0734I Job 947 added to work queue

EZB0716I Job 947 scheduled TIANNA MVSA
EZB0776I Released StepBlock at 00081280
EZB0777I Released ConnectionBlock at 0014AE08
EZB0824I ProcessWork starting on job queue
EZB0731I Work Queue start
EZB0732I $ 947 JOBstartPRINTING
EZB0733I Work Queue end
EZB0825I Job 947 for TIANNA dispatched in state JOBstartPRINTING
EZB0716I Job 947 printing TIANNA MVSA

EZB0801I Filter "x" not supported. Job abandoned.
EZB0827I ProcessWork end with queue
EZB0731I Work Queue start
EZB0732I $ 947 JOBfinishPRINTING
EZB0733I Work Queue end
EZB0798I GetNextNote with ShouldWait of FALSE
EZB0798I GetNextNote returns.Connection 0 Notification Connection state changed(8681)
EZB0779I New connection state Connection closing (8670) on connection 0 with reason OK.
EZB0824I ProcessWork starting on job queue
EZB0731I Work Queue start
EZB0732I $ 947 JOBfinishPRINTING
EZB0733I Work Queue end

EZB0825I Job 947 for TIANNA dispatched in state JOBfinishPRINTING
EZB0716I Job 947 sent TIANNA MVSA

EZB0769I Job 947 removed from work queue
EZB0751I Released StepBlock at 00081438

EZB0716I Job 947 purged TIANNA MVSA
EZB0771I Released JobBlock at 00147798
EZB0827I ProcessWork end with queue
EZB0731I Work Queue start
EZB0733I Work Queue end

Diagnosing line print requester and daemon (LPR and LPD) problems 407
Following are short descriptions of the numbered items in the trace:

1. Indicates that the LPD server received a command indicating the byte size and name of a data file sent by an LPR client.

2. Indicates that the LPD server received a command indicating the byte size and name of a control file sent by an LPR client.

3. Indicates that print job 947 was received, placed in the print queue named TIANNA on host MVSA, and was scheduled to be processed.

4. Indicates that the LPD server did not support filter x and discarded the print job.

5. Indicates that the job was finished. The flag JOBfinishPRINTING indicates the job is to be removed from the work queue and purged.

6. Indicates that the job was removed from the work queue and that the control blocks were released.

7. Indicates that the job was purged.

Figure 58 on page 409 is a sample of an LPD trace output generated by specifying the DEBUG statement in the LPD configuration file (LPDDATA). This sample shows that an LPR client issued a request, through an LPD server, to a printer defined as a remote server. (The LPD server acted as an LPR client by sending the request to a remote server.) Since the remote server was not running, the print job was purged.

Initially, the LPR client was unaware that the server was not running because the LPD server correctly acknowledged receipt of the data files and control files. Furthermore, the LPR trace did not indicate any problems. However, if you specify the option FAILEDJOB MAIL on the SERVICE statement for the remote printer, notification is sent to the user ID of the LPR client. For notification to be sent, Communications Server Simple Mail Transfer Protocol (CSSMTP) must be running.

Note: The FAILEDJOB DISCARD option is the default.
The LPR lpd.config (p SOTO h MVS7 command was used to generate the trace output. SOTO is the name of the printer specified on the SERVICE statement, and MVS7 is the host on which the LPD server is running.

```
1 EZB0831I IBM MVS LPD Version V2R10
   on 05/05/98 at 19:50:58
EZB0832I EZB0621I LPD starting with port 515
EZB0679I Allocated ObeyBlock at 00005B70
EZB0679I Allocated ObeyBlock at 00005B60
EZB0679I Allocated ObeyBlock at 00005B50
EZB0628I Allocated PrinterBlock at 000058C0
EZB0629I  prt1 added.
EZB0641I Service prt1 defined with address
EZB0628I Allocated PrinterBlock at 00005630
EZB0629I   PRT1 added.
EZB0641I Service PRT1 defined with address
EZB0628I Allocated PrinterBlock at 00005110
EZB0629I   PRT2 added.
EZB0641I Service PRT2 defined with address
EZB0628I Allocated PrinterBlock at 0000B140
EZB0629I   njesoto added.
EZB0641I Service njesoto defined with address
EZB0628I Allocated PrinterBlock at 0000B1A0
EZB0629I   SOTO added.
EZB0686I Host "9.37.34.39" resolved to 9.37.34.39. Printer name is "lpt1".
2 EZB0641I Service SOTO defined with address
EZB0628I Allocated PrinterBlock at 0000B120
EZB0629I   POST added.
EZB0686I Host "9.67.105.55" resolved to 9.67.105.55. Printer name is "LPT2".
3 EZB0641I Service POST defined with address
EZB0628I Allocated PrinterBlock at 0000B1A0
EZB0629I   NJSOTO added.
EZB0686I Host "9.37.34.39" resolved to 9.37.34.39. Printer name is "lpt1".
4 EZB0641I Service SOTO defined with address
EZB0628I Allocated PrinterBlock at 0000B120
EZB0629I   POST added.
EZB0686I Host "9.67.105.55" resolved to 9.67.105.55. Printer name is "LPT2".
EZB0641I Service POST defined with address
EZB0697I   ...End of Printer chain...
EZB0626I Allocated ConnectionBlock at 00147E88
EZB0627I Passive open on port 515
EZB0705I 06/05/98 19:50:00
EZB0834I Ready
EZB0789I GetNextNote with ShouldWait of TRUE
   ...Connection 1...
EZB0789I GetNextNote returns. Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
5 EZB0754I New subcommand 3 operands "14221 dfA502MVS 7".
EZB0723I Allocated StepBlock at 000B1438
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0754I New subcommand 3 operands "14221 dfA502MVS 7".
EZB0723I Allocated StepBlock at 000B1438
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 1
EZB0763I Closing connection 1
EZB0798I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Connection state changed (8681)
EZB0779I New connection state Connection closing (8670) on connection 1 with reason OK.
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0798I GetNextNote returns. Connection 1 Notification Connection state changed (8681)
EZB0779I New connection state Nonexistent (8672) on connection 1 with reason OK.
EZB0772I End Connection 1 for OK.
EZB0719I Allocated JobBlock at 00147798
```
EZB0716I Job 502 received SOTO MVS7
EZB0734I Job 502 added to work queue
EZB0716I Job 502 scheduled SOTO MVS7
EZB0824I ProcessWork starting on job queue
EZB0731I Work Queue start
EZB0732I $502 JOBstartSENDING
EZB0733I Work Queue end
EZB0825I ProcessWork starting on job queue
EZB0731I Work Queue start
EZB0733I Work Queue end
EZB0827I ProcessWork end with queue
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 1 Notification Connection state changed (8681)
EZB0779I New connection state Nonexistent (8672) on connection 1 with reason Foreign host did not respond within OPEN
EZB0772I End Connection 1 for Foreign host did not respond within OPEN timeout (8560).
EZB0705I 06/05/96 19:52:22
EZB0773I Connection 1 terminated because "Foreign host did not respond within OPEN timeout (8560)."

EZB0744I 748656 HELO MVS7.tcp.raleigh.ibm.com
EZB0744I 748656 MAIL FROM:<LPDSRV3@MVSA>
EZB0744I 748656 RCPT TO:<TCPUSR4@MVS7.tcp.raleigh.ibm.com>
EZB0744I 748656 DATA
EZB0744I 748656 To:<TCPUSR4@MVS7.tcp.raleigh.ibm.com>
EZB0744I 748656 Your job to print the files "TCPUSR 4.LPD.CONFIG" on SOTO at MVSA has failed for this reason: Remote connection terminated (Foreign host did not respond within OPEN timeout (8560)).

EZB0744I 748656 OPEN timeout (8560)).
EZB0771I Released StepBlock at 000B1848
EZB0771I Released StepBlock at 000B1820
EZB0716I Job 502 purged SOTO MVS7
EZB0771I Released JobBlock at 001477B8
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 2 Notification Connection state changed (8681)
EZB0779I New connection state Nonexistent (8672) on connection 2 with reason OK.
EZB0772I End Connection 2 for OK.
EZB0771I Released ConnectionBlock at 0014DE08
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 0 Notification Connection state changed (8681)
EZB0779I New connection state Nonexistent (8672) on connection 0 with reason OK.
EZB0779I New connection state Try to open (8676) on connection0 with reason OK.
EZB0826I Allocated ConnectionBlock at 00147E08
EZB0627I Passive open on port 515
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 0 Notification Connection state changed (8681)
EZB0779I New connection state Open (8673) on connection 0 with reason OK.
EZB0702I Connection open. Reading command.
EZB0789I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 0 Notification Data delivered (8682)
EZB0767I Timer cleared for connection 0
EZB0711I New command 4 data "4".
EZB0789I FSend of response sent
EZB0790I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 0 Notification FSend response (8692)
EZB0763I Closing connection 0
EZB0790I GetNextNote with ShouldWait of TRUE
EZB0790I GetNextNote returns. Connection 0 Notification Connection state changed (8681)
EZB0779I New connection state Receiving only (8674) on connection0 with reason OK.
EZB0789I GetNextNote with ShouldWait of TRUE
Following are short descriptions of the numbered items in the trace:

1. Indicates the date and time the LPD server was activated. This information can be compared to the date and time on an LPR trace to assure that both traces were generated for the same incident.

2. Indicates the IP address of the host. If the name of the host was specified instead of the IP address, this message would indicate if the IP address of the host was resolved.

3. Indicates that the name SOTO was defined on the SERVICE statement for the remote printer, lpt1, which had the address 9.37.34.39.

4. Indicates the byte size and the name of the data file sent from the LPR client on host MVS7.

5. Indicates the byte size and name of control file sent from the LPR client on host MVS7.

6. Indicates that the connection between the LPR client and the LPD server was closing, after the server received the data and control files.

7. Indicates that the print job was received, placed in the LPD print queue, represented by SOTO, and scheduled to be sent to its destination.

8. Indicates that the LPD server started to send print job 502 to the remote server.  
   **Tip:** If the printer was local, rather than remote, the message would have read 502 JOBstartPRINTING.

9. Indicates that the LPD server, acting as a client, was opening a connection to the remote printer using local port 721.

10. Indicates that the LPD server removed the job from its work queue.

11. Indicates that the connection to the remote server timed out.

12. Indicates that the remote server did not respond to the request to open.

13. Indicates that the FAILEDJOB MAIL option was defined under the SERVICE statement and that CSSMTP was running. The text in these messages was sent to the user ID of the LPR client.

14. Indicates that the print job was completely purged.

15. Describes additional activity between the LPD server and other clients.
Chapter 14. Diagnosing File Transfer Protocol (FTP) problems

This topic describes how to diagnose problems with the z/OS Communications Server FTP server and FTP client. If, after reading this topic, you are unable to solve your problem and you need to call the IBM Software Support Center, see one or both of the following sections for the documentation you need to provide: “Documenting server problems” on page 439 and “Documenting FTP client problems” on page 461.

This topic assumes your security product is RACF. However, you can use any SAF-compliant security product.

FTP server

This topic contains the following subtopics:

- “Structural overview” on page 413
- “Definitions and setup” on page 414
- “Error exit codes” on page 414
- “Name considerations for z/OS UNIX FTP” on page 414
- “Translation and data conversion support” on page 415
- “Db2 query support” on page 417
- “JES support” on page 419
- “Common z/OS UNIX FTP problems” on page 420
- “Diagnosing FTP server problems with traces” on page 432
- “Documenting server problems” on page 439

Structural overview

The z/OS model for the FTP server includes a daemon process and a server process. The daemon process starts when you start your cataloged procedure (for example, START FTPD) and it listens for connection requests on a specific port. The port is the well-known port 21 unless otherwise specified. For methods of choosing a different port number, see the information about configuring ETC.SERVICES and configuring the FTPD cataloged procedure in z/OS Communications Server: IP Configuration Guide. When the daemon accepts an incoming connection, it creates a new process (server's address space) for the FTP server, which handles the connection for the rest of the FTP login session. Each login session has its own server process.

The server process inherits the accepted connection from the daemon process. This connection is called the control connection. The server receives commands from the client and sends replies to the client using the control connection. The control connection port is the same as the daemon's listening port.

The client and server use a different connection for transferring data; this connection is called the data connection. By default, the data port is one less than the control connection port. For example, if the control connection port is 21, the data port is 20. An FTP client can override the default data port by directing the server to run in passive mode. In passive mode, the server uses an ephemeral port for the data port. Passive mode is requested by firewall-friendly clients and by clients initiating three-way data transfers.
Definitions and setup

This topic describes the definitions and setup for the FTP server.

Start procedure

The sample start procedure for the FTP server is EZAFTPAP (alias FTPD) in the SEZAINST data set. Changes might be necessary to customize the start procedure for your MVS host system.

Keep in mind the following for the FTP server start procedure:

- The library containing FTPD and FTPDNS must be APF authorized and must be either in the MVS link list or included on the STEPLIB DD statement.
- The C runtime libraries are needed for FTPD and FTPDNS. They must be APF authorized. If the C runtime library is not in the MVS link list, it must be included on the STEPLIB DD statement.
- If the FTP server is used for SQL queries, the Db2® DSNLOAD library must be APF authorized and must be either in the MVS link list or included on the STEPLIB DD statement.
- Several start options are available for the FTP server. If specified in the start procedure, these values override the default values for the FTP server and any values specified in the FTP.DATA data set.

For more information about the FTP server start procedure, see z/OS Communications Server: IP Configuration Reference.

FTP.DATA data set

The FTP.DATA data set is an optional data set that allows the FTP server configuration parameters to be customized. See z/OS Communications Server: IP Configuration Reference for more information about the FTP.DATA data set.

TCPIP.DATA data set

The TCPIP.DATA data set provides the following information to the FTP server:

- High-level qualifier to be used for configuration data sets
- Whether messages are to be written in uppercase or mixed-case
- Which DBCS translation tables are to be used

For more information about the TCPIP.DATA data set, see z/OS Communications Server: IP Configuration Reference.

Error exit codes

z/OS UNIX FTP uses the following error exit codes:

12  
Daemon initialization failed; unable to accept an incoming connection. An EZY message identifying the specific problem is sent to syslogd.

24  
The client session's initialization terminated because the FTP server load module cannot be loaded or executed. Message EZYFT53E is sent to syslogd.

28  
Daemon initialization was terminated because the IBM TCP/IP is not enabled in the IFAPRDxx parmlib member. Message EZYFT54E is sent to syslogd and the operator console.

Name considerations for z/OS UNIX FTP

This topic explains the MVS and z/OS UNIX file system naming conventions.

MVS naming conventions

Restrictions: MVS data set names used with all FTP commands sent to the z/OS UNIX FTP server must meet MVS data set naming conventions as follows:
• Data set names cannot be longer than 44 characters.

If the path name parameter sent with an FTP command is not enclosed in single quotation marks, the path name is appended to the current working directory to create the data set name. The combination of the current working directory and the path name cannot be longer than 44 characters. Issue the PWD command to display the current working directory.

• Each qualifier in a data set name, or each member name for a partitioned data set, must conform to the following:
  – No longer than 8 characters.
  – Begin with a letter or the special characters $, @, or #.
  – Contain only numbers, letters, or the special characters $, @, #, -, or }.

• Generation data group data set names must be in the format gdg_name(generation_level). The generation_level is either 0, +nn, or -nn, where nn is the generation number. For example, the GDG data set MYGDG could be specified as MYGDG(0) for the current generation level, MYGDG(-1) for the next to the latest generation level, or MYGDG(+1) for the new generation level.

z/OS UNIX file system naming conventions

Guidelines: The following list describes some naming conventions you should know about when using z/OS UNIX file system files with the z/OS UNIX FTP server:

• The z/OS UNIX file system name is case-sensitive.

• If a name begins with a single quotation mark, specify QUOTESOVERRIDE FALSE in FTP.DATA, or use the SITE NOQUOTESOVERRIDE command.

• Names can contain imbedded blanks for special characters.

  Tip: Some FTP clients might truncate trailing blanks.

• The LIST and NLST subcommands, including all client subcommands that invoke the NLST subcommand, such as MGET or MDELETE, require special handling for certain special characters. For more information, see z/OS Communications Server: IP User's Guide and Commands.

• The START and SITE parameters have additional restrictions on the path name used with SBDATACONN. See z/OS Communications Server: IP Configuration Reference and z/OS Communications Server: IP User's Guide and Commands.

• When specifying a z/OS UNIX FTP subcommand with a file name containing special characters, some FTP clients might:
  – Truncate trailing blanks
  – Compress multiple internal blanks
  – Interpret special characters to have special meanings

  Unique specification of the file name such as enclosing in double or single quotation mark, or escaping special characters, might be necessary to make the client send the file name to the server correctly. See your client documentation to see whether this is necessary.

Translation and data conversion support

This topic describes translation and data conversion support for the FTP server.

Double-byte character set (DBCS) support

If you enter quote type b <n> at the client and if the DBCS translate table has not been loaded, the following reply is displayed:

504-Type not Supported. Translation table not loaded.

Do one or both of the following:
• Check the LOADDBCSTABLES statement in the TCPIP.DATA configuration file. If the statement wraps to the next line, parameters on the continued line are ignored. If all the parameters for the LOADDBCSTABLES statement do not fit on one line, use multiple LOADDBCSTABLES statements.

• Check the precedence order for TCPIP.DATA to ensure that the file being used contains the LOADDBCSTABLES statement or statements. Be aware that the location of TCPIP.DATA statements can be influenced in multiple ways, for example, by a GlobalTCPIPData specification or the RESOLVER_CONFIG environment variable. See z/OS Communications Server: IP Configuration Reference for the TCPIP.DATA search order.

Single-byte character (SBCS) support

Data conversion occurs for single-byte data on the data connection when ENCODING=SBCS is in effect and the data type is ASCII. For more information, see the FTP.DATA statement ENCODING in the z/OS Communications Server: IP Configuration Reference and the SITE ENCODING command in the z/OS Communications Server: IP User's Guide and Commands.

If you choose SBDATACONN as a statement in the FTP.DATA file or with the SITE SBDATACONN command, the FTP server builds a translation table using the code pages specified by SBDATACONN. If you receive the following reply to the SITE command, ask for a trace of the server with the UTL option to determine which characters cannot be translated.

200

Some characters cannot be translated between codepage_1 and codepage_2.

If none of the untranslatable characters appear in the data, the data transfers are not affected. If, however, one of the untranslatable characters does appear, the data transfer fails and the client receives the following reply:

557

Data contains codepoints that cannot be translated.

You can avoid the failure if you specify a substitution character to replace non-translatable characters. For details on how to ask for character substitution, see SBSUB and SBSUBCHAR as FTP.DATA statements in the z/OS Communications Server: IP Configuration Reference and as parameters on the SITE command in z/OS Communications Server: IP User’s Guide and Commands. If substitution occurs during the transfer, the client receives the following reply:

250

One or more characters were substituted during the transfer.

When substitution occurs at the destination of a data transfer, a subsequent transfer of the resulting data does not produce an exact copy of the original. For example, if you put a file to the server and one or more characters are substituted, the untranslatable characters are overlaid in the server copy with the substitution character. You cannot restore the original file by getting it from the server.

Multibyte character set (MBCS) support

Data conversion occurs for multibyte data on the data connection when ENCODING=MBCS is in effect and the data type is ASCII. For more information, see the FTP.DATA statement ENCODING in z/OS Communications Server: IP Configuration Reference and the SITE ENCODING command in z/OS Communications Server: IP User's Guide and Commands.

If you choose ENCODING=MBCS, you must specify MBDATACONN with a statement in the FTP.DATA file or with the SITE MBDATACONN command to name the code pages for the multibyte data transfer. If you attempt an ASCII data transfer with ENCODING=MBCS and no MBDATACONN specified, the client receives the following reply:

504

Multibyte encoding set but code pages are not defined.

If the multibyte data that you transfer has codepoints that cannot be translated, the transfer fails and the client receives the following reply:

557

Data contains codepoints that cannot be translated.
You can determine which bytes of the data cannot be translated by repeating the transfer with the DUMP
42 extended trace option active at the server.

Db2 query support

This topic describes how to use FTP server Db2 query support and how to diagnose SQL problems.

Steps for using FTP server SQL support

Complete these steps so that you can use the FTP server to submit queries to the Db2 subsystem.

Procedure

Perform the following steps:

1. Start the Db2 subsystem.
2. BIND the DBRM called EZAFTPMPQ. This must be done whenever the part EZAFTPMPQ.CSQLMVS has
   been recompiled.
   
   The DBRM must be bound into the plan named EZAFTPMPQ, unless the keyword DB2PLAN was used in
   your FTP.DATA file to specify a different plan name.
   
   If you are running multiple instances of the z/OS UNIX FTP server at different maintenance levels, you
   must use DB2PLAN in FTP.DATA for each server and specify unique plan names.
3. Grant execute privilege to the public for the plan created in the previous step.

Results

To submit a query to Db2 through the FTP server, issue the following commands as necessary:

- SITE FILETYPE=SQL
- SITE DB2® = db2name, where db2name is the name of a Db2 subsystem at the host
- RETR fname1fname2, where fname1 is a file at the host that contains a SQL SELECT statement

Symptoms of SQL problems

Table 27 on page 417 and Table 28 on page 418 show some symptoms and possible causes of SQL
problems. Table 27 on page 417 shows problems that generate a reply beginning with 55x.

<table>
<thead>
<tr>
<th>Reply</th>
<th>Output file</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reply 551: Transfer aborted: SQL PREPARE/DESCRIBE failure</td>
<td>The output file contains the SQL code and error message returned by the Db2 subsystem.</td>
<td>• A syntax error in the SQL statement in the host file.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The time stamp in the load module is different from the BIND time stamp built from the DBRM (SQL code = -818). This occurs if a BIND was not done for the EZAFTPMPQ DBRM that corresponds to the current load module, or if the server is not configured to use the correct Db2 plan name. If this is the problem, every SQL query submitted through the FTP server fails.</td>
</tr>
</tbody>
</table>
### Table 27. SQL problems generating 55x replies (FTP Server) (continued)

<table>
<thead>
<tr>
<th>Reply</th>
<th>Output file</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reply 551: Transfer aborted: unsupported SQL statement</td>
<td>No output is sent from the host.</td>
<td>The file type is SQL, but the host file being retrieved does not contain an SQL SELECT statement.</td>
</tr>
<tr>
<td>Reply 551: Transfer aborted: attempt to connect to <code>db2name</code> failed (<code>code</code>)</td>
<td>No output is sent from the host.</td>
<td>• The site <code>db2name</code> specifies a nonexistent Db2 subsystem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The Db2 subsystem has not been started.</td>
</tr>
<tr>
<td>Reply 551: Transfer aborted: SQL not available. Attempt to open plan <code>&lt;planname&gt;</code> failed (DB2_reason_code).</td>
<td>No output is sent from the host.</td>
<td>• BIND was not done for the specified plan.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• BIND was done for plan name other than EZAFTPMQ, but FTP.DATA does not contain a DB2PLAN statement to specify this planname.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• User does not have execute privilege for the Db2 plan being used by the FTP server.</td>
</tr>
<tr>
<td>Reply 550: SQL query not available. Cannot load CAF routines.</td>
<td>No output is sent from the host.</td>
<td>The DSNLOAD library is not in the link list or the FTP server STEPLIB.</td>
</tr>
</tbody>
</table>

**Note:** For more information about the messages, see [z/OS Communications Server: IP and SNA Codes](https://www.ibm.com/support/knowledgecenter/en/POWER8/zos820/zh1505a.htm).

Table 28 on page 418 shows other SQL problems.

### Table 28. Other SQL problems (FTP Server)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output file contains only the SQL SELECT statement.</td>
<td>• The file type is SEQ, rather than SQL. If the file type is SEQ, a retrieve is done, but the host file is just sent back to the client. The query is not submitted to the Db2 subsystem.</td>
</tr>
<tr>
<td></td>
<td>• The SELECT is for a VIEW for which the user ID does not have Db2 select privilege. The Db2 subsystem returns an empty table.</td>
</tr>
<tr>
<td>Client closes the connection because server is not responding.</td>
<td>The processing time needed by Db2 and FTP or both for the SQL query has exceeded the client’s time limit for send or receive. An FTP server trace with the options FSC and SQL indicates the amount of SQL activity through FTP and the approximate time when each query was processed.</td>
</tr>
</tbody>
</table>
**JES support**

This topic describes the procedures to follow when JES output is not found and when remote job submission functions fail.

**JES output not found (zero spool files)**

In some cases, the server is in JESINTERFACELEVEL=1 and FILETYPE=JES, and a job has been submitted, but the output of the job cannot be found. You get zero spool files from a DIR command.

Use the following checklist to investigate:

1. Is the job name correct? The job name must consist of the user ID followed by a single character.
2. Was the job output spooled to the hold queue? The server can retrieve only job output that is in the hold queue. For JES/3, output must be assigned to an output queue held for external writer.
3. Did you set SBSENDEOL to a value other than CRLF for your original outbound file transfer? If so, it is not be possible to restart the file transfer. You should send the entire file to the server again.

If JESINTERFACELEVEL=2, ensure the JESJOBNAME, JESSTATUS and JESOWNER filters are set correctly with the STAT command.

If the server is in JESINTERFACELEVEL=2 and FILETYPE=JES, and a job has been submitted, but the output of the job cannot be found (that is, you get zero spool files from a DIR command), check the 125 reply message to verify that the JESOWNER, JESJOBNAME, and JESSTATUS filters are set to values that apply to your job.

If the JESJOBNAME=USER1* and the job submitted was USER2A, use the SITE command to set the JES filter to the appropriate value to find the job requested. If the SITE command does not allow the end user to change the values of the three JES filters, see z/OS Communications Server: IP User's Guide and Commands to determine whether the proper Security Access Facility resources allow changing of the JES filters for the user.

**Remote job submission functions fail**

For problems with remote job submission, run the FTP JES trace to check for the following:

- Cannot allocate internal storage
- JES is not communicating
- JES unable to find output for the specified job ID
- Unable to acquire JES access
- Unknown return code from GET JES spool request
- JES unable to provide spool data set name now
- JES unable to get a job ID for a PUT or GET request
- JES PUT or GET aborted, job not found
- JES PUT or GET aborted, internal error
- JES PUT or GET aborted, timeout exceeded
- JES internal reader allocation failed
- JES user exit error

To trace the FTP JES activity, use the DEBUG=(JES) or DUMP=(JES) options of FTP syslog tracing. See “Diagnosing FTP server problems with traces” on page 432 for information about activating FTP syslog tracing.

**FTP connection stops during FILETYPE=JES processing**

This problem occurs due to extended periods of inactivity on the control or data connection while the FTP client is waiting for the FTP server to complete the job. Significant delays are possible during FILETYPE=JES processing due to conditions such as heavy system utilization and dispatching priorities.
You can avoid timeouts by using keepalive packets on the control and data connection. You can activate keeplive packets by:

- Coding the INTERVAL parameter on the TCPCONFIG statement in the TCP/IP profile (PROFILE.TCPIP). See z/OS Communications Server: IP Configuration Reference for more information about the TCPCONFIG statement.

- Coding the FTPKEEPALIVE statement in FTP.DATA. This activates keep alive packets for the control connection only, and overrides the TCPCONFIG INTERVAL statement. See z/OS Communications Server: IP Configuration Reference for more information about the FTPKEEPALIVE statement.

- Configuring the DATAKEEPALIVE option to activate keepalive packets for the data connection only. This overrides the TCPCONFIG INTERVAL statement in the stack. You can configure DATAKEEPALIVE by coding a statement in FTP.DATA, by using the site subcommand from the z/OS FTP client, or by sending a SITE command with the DATAKEEPALIVE parameter to the FTP server. See z/OS Communications Server: IP Configuration Reference for more information about the DATAKEEPALIVE statement.

Logging FTP server activity

The z/OS FTP server provides a way to log standardized information for the following types of activity:

- Connections from the client end user to the server
- Authentication of the client/server session (for example, through the use of Transport Layer Security)
- Access to the FTP server through User ID/password verification
- Allocation of MVS data sets and z/OS UNIX file system files
- Deallocation of MVS data sets and z/OS UNIX file system files
- Data transfers
- JES job submissions
- SQL queries
- Abnormal end (ABEND) conditions
- Confidence levels assigned to file transfers when CHKCONFIDENCE TRUE has been coded in FTP.DATA

Set the following server’s FTP.DATA statements to enable logging:

<table>
<thead>
<tr>
<th>FTPLOGGING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANONYMOUSFTPLOGGING</td>
</tr>
</tbody>
</table>

For more information about these statements, see z/OS Communications Server: IP Configuration Reference.

Until the client sends the USER command to the server, the server cannot know whether this is an anonymous login. Therefore, up to the point the server processes the USER command, the FTPLOGGING statement and ANONYMOUSFTPLOGGING statement produce identical results.

This information is recorded in the SYSLOGD file. The data has an identification field that allows correlation of all entries for a specific login session.

For more information about configuring the SYSLOGD file, see z/OS Communications Server: IP Configuration Guide.

See z/OS Communications Server: IP Configuration Reference for the server’s FTPDATA configuration.

Common z/OS UNIX FTP problems

This topic describes some common z/OS UNIX FTP problems.

FTP daemon initialization problems

You might encounter the following problems when the FTP daemon is initialized.
No "Initialization Complete" message

If the EZY2702I Server-FTP Initialization completed at ... message does not appear on the system console within a few minutes after starting the FTP daemon, verify that the daemon background job is still running. For example, if you started FTP with a procedure called FTPD, you can use the D A,L command to see whether the job FTPD1 is active.

If the background daemon job is running (for example, FTPD1), verify that TCP/IP is running. If it is not, start TCP/IP. The FTP initialization completes when TCP/IP starts.

If the background daemon job is not running, check the system console for nonzero exit codes from the background job. Look for messages in message or trace output from syslogd for an EZY error message from FTP. The following are possible exit codes and the appropriate responses:

• 0012

FTP is unable to use the port specified for the control connection. Look in the syslogd messages for the specific reason. Possible errors include the following:
  - EZYFT13E bind error...Operation not permitted
    Ensure that FTP has BPX.DAEMON authority.
  - EZYFT13E bind error...Address already in use
    Ensure that FTP is trying to use the correct port. The FTP server trace with the INT option indicates the port the daemon expects to use. If this is the correct port, you can use the TSO NETSTAT CONN command to determine the job that is currently using that port.
  - EZYFT13E bind error...Permission denied
    Ensure that the port you want FTP to use has been reserved for the FTP background job name. For example, if your start procedure is called FTPD and you want FTP to use port 21, the PORT statement in your hlq.PROFILE.TCPIP data set must specify 21 TCP FTPD1.

• 0028

This FTP daemon is not available because the IBM TCP/IP is not enabled.

Incorrect configuration values

If you experience incorrect configuration values, check the following:

• Look in the syslogd output for message EZY2640I to verify that configuration values are coming from your intended FTP.DATA file. Verify that no errors were encountered reading this file.
• Determine whether your FTP.DATA file has sequence numbers. If it does, any statement with an optional parameter omitted picks up the sequence number as the parameter value.
  For example, the BLKSIZE statement has an optional parameter size. If you specify the size, the sequence number is ignored. If you do not specify the size, the system assumes that the sequence number is the size, causing an error.

FTP daemon not listening on expected port

If the daemon is not listening on the expected port, verify that the correct port number is specified. Following is the preference order for a port number:

1. PORT start parameter
2. /etc/services
3. hlq.ETC SERVICES
4. A default port number of 21

AUTOLOG does not start the FTP daemon

If your start procedure name contains fewer than 8 characters, ensure that the AUTOLOG and PORT statements in the hlq.PROFILE.TCPIP data set specify the FTP background job name. For example, if your
start procedure is called FTPD, your hlq.PROFILE.TCPIP data set should specify FTPD1, as shown in the following examples:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AUTOLOG</strong></td>
<td>FTPD JOBNAME FTPD1 ENDAUTOLOG</td>
</tr>
</tbody>
</table>
| **PORT** | 20 TCP OMVS NOAUTOLOG ;FTP data port  
21 TCP FTPD1 ;FTP control port |

**User exit routine is not invoked**

If the user exit routine is not invoked, check the FTP trace in syslogd to see whether the exit routine was loaded. FTCHKIP is loaded once by the FTP daemon during initialization. The remaining user exits (FTCHKPWD, FTCHKCMD, FTCHKJES, FTPPOSTPR, and FTPSMFEX) are loaded in the FTP server address space for each client session.

For example, check for one of the following responses:

```
main: ret code from fnndemбр() for FTCHKIP is: 4
main: user exit FTCHKIP not found. Bypassing fetch().
```

or

```
main: ret code from fnndemбр() for FTCHKCMD is: 0
main: chkcmdexit successfully loaded
```

If you have user-written exit routines and the FTP server is not able to find them, ensure that the user-written exit routines exist in an APF-authorized partitioned data set which is in the search order.

**FTP Messages and FTP trace entries**

If messages and trace entries do not appear in the syslog output file, do one or more of the following:

- Ensure that syslogd is configured for daemon entries. The file /etc/syslog.conf must have an entry for daemon.info to get FTP messages or an entry for daemon.debug to get FTP messages and trace entries.
- Ensure that the files specified for daemon entries exist at the time that syslogd started. If not, you need to create the files and recycle syslogd.
- Ensure that the files specified for daemon entries have appropriate permission bits (for example, 666).
- Ensure that syslogd is active.

If messages and trace entries display on the system console, it means that syslogd cannot write to the files specified for daemon entries and that /dev/console is defined. Check that syslogd is configured correctly and that the files specified for daemon entries have appropriate permission bits (for example, 666).

If you consider the volume of EZYFT47I messages logged by the server during initialization to be excessive, you can suppress these messages by adding a SUPPRESSIGNOREWARNINGS statement to the server’s FTP.DATA. However, if you use this statement, the FTP server does not warn you when it ignores statements coded in FTP.DATA.

**Guideline:** Add SUPPRESSIGNOREWARNINGS to FTP.DATA only after you have verified all statements in FTP.DATA are correct.

**FTP server abends**

If the FTP server abends, check the following:

- S683 or U4088 abend validating user ID or password.
  - Ensure that the sticky bit has been turned on for the files /usr/sbin/ftpd and /usr/sbin/ftpdns.
  - Ensure that the FTPD and FTPDNS modules reside in an APF authorized partitioned data set, which is specified in the MVS linklist.
Ensure that all programs loaded into the FTP address space are APF authorized and are marked as controlled. This means that any FTP user exits, the SQL load library, and the loaded run-time library need to be marked as controlled, using the RACF RDEFINE command. For more information, see z/OS UNIX System Services Planning, or see the RACF publications.

**FTP session problems**
The following topics describe some common FTP session problems.

**Connection terminated by the server after user enters user ID**
The system console might display one of the following nonzero exit codes from the FTP server address space:

**0012**
This exit code indicates a socket error. See the syslogd messages for the specific error.

**0024**
This exit code indicates that the system was unable to load the server load module /usr/sbin/ftpdns. Ensure that the symbolic link or links for ftpdns are correct, that ftpdns exists in the z/OS UNIX file system and that the sticky bit is on, and that FTPDNS exists in the search order.

If your system is not configured to display exit codes, check the syslogd output for an FTP error message.

**Connection terminated by the server after user enters password**
If the server terminates a connection after the user enters a password, ensure that the FTP load modules (FTPD and FTPDNS) reside in the APF authorized data set. Also, check that all programs accessed by the FTP address space are APF authorized and marked as “controlled.” Additional symptoms include the following:

- The FTP daemon is running, but the FTP server address space abends.
- The FTP server trace is active with the ACC option, and the last FTP trace entry reads:

  RA0nnn pass: termid is …

**Connection terminated by the server after user enters any subcommand**
If the server terminates a connection after the user enters a subcommand, either one or both of the following events might occur:

- FTP server address space shows an exit code of 0000.
- Last FTP server trace entry for the client session is RXnnnn Server thread terminates rc = -2. The preceding entries indicate a “select” error due to a bad file descriptor.

These events indicate that the server inactive time limit has probably expired with no activity from the client. If this happens frequently, check the inactive time set for the server. If necessary, increase it, and recycle the FTP daemon.

**Password validation fails; session continues**
If password validation fails and the session continues, you receive the following reply:

```plaintext
530 PASS command failed
```

Additional replies might be generated if ACCESERRORMSGS TRUE is coded in FTP.DATA.

If you receive this reply, do one or more of the following:

- Ensure all libraries, possibly indicated by ICH420I message, used by FTP are controlled and APF authorized.
- Ensure FTP is authorized if you are using BPX.DAEMON.
- Ensure that the FTP daemon has been started from a user ID running with superuser authority if the daemon has been started from the z/OS UNIX shell.
• Ensure that an OMVS segment is defined for the login user ID, or that automatic assignment of unique UNIX identities support is enabled.
• Obtain additional information about the error by enabling tracing with the ACC option.
• Ensure that the password or password phrase used to log in to FTP was entered correctly and is not expired.
• If you have activated mixed-case passwords in RACF or in another SAF-compliant security product, verify that you entered the password in the correct case. Password phrases used to log in to a z/OS FTP server are always case-sensitive even when mixed-case passwords are not enabled in your security product.
• If your password is comprised of more than one token, verify that your FTP client supports multiple token passwords. The z/OS FTP client supports multiple token passwords if you enclose the password with quotation marks when you code it in the NETRC file or data set, or enter it in response to a prompt.

Anonymous login fails
If an anonymous login fails, use the following checklist to investigate:

1. Ensure that you have specified ANONYMOUS as a start parameter or in FTP.DATA.
2. Check the setting of the ANONYMOUSLEVEL variable in FTP.DATA. If ANONYMOUSLEVEL is not explicitly set in FTP.DATA, its value is equal to one.
3. If you have activated mixed-case passwords in RACF or in another SAF-compliant security product, verify the following:
   • The anonymous password in FTP.DATA is coded in the correct case
   • The anonymous password passed to the FTP daemon by the FTPD start procedure is coded in the correct case
   • The anonymous password specified by the MVS operator to override the parameters specified in the FTPD start procedure was coded in the correct case.
   
   Rule: Enclose the FTP parameters in single quotes when overriding the parameters specified in the FTPD start procedure while mixed-case passwords are enabled.

If ANONYMOUS is set in FTP.DATA, and the STARTDIRECTORY is in the z/OS UNIX file system, and ANONYMOUSLEVEL is two or three, verify that the required executable files are installed in the anonymous user's root directory. If the required executable files are not installed in the anonymous user's home directory, SYSLOGD contains error messages. For information about setting up the anonymous user's root directory, see z/OS Communications Server: IP Configuration Guide.

If you did not specify a user ID on the ANONYMOUS start parameter or on the FTP.DATA statement, ensure that the user ID ANONYMO is defined to TSO and RACF, and that it has a defined OMVS segment or that automatic assignment of unique UNIX identities support is enabled. For information about the z/OS UNIX environment and its security considerations, see z/OS UNIX System Services Planning.

If you did specify a user ID on the ANONYMOUS start parameter or on the FTP.DATA statement, ensure that the specified user ID is defined to TSO and RACF, and that the specified user ID has a defined OMVS segment or that automatic assignment of unique UNIX identities support is enabled.

If ANONYMOUSLEVEL is two or three, verify that the STARTDIRECTORY value is compatible with the ANONYMOUSFILEACCESS value and that the FILETYPE value is compatible with the ANONYMOUSFILETYPESEQ, ANONYMOUSFILETYPEJES, and ANONYMOUSFILETYPESQL values.

If ANONYMOUSLEVEL=3 and if ANONYMOUS or ANONYMOUS/USERID/PASSWORD is coded, the user is prompted to enter an e-mail address as a password. Verify that the e-mail address entered by the user is consistent with the requirements of the EMAILADDRCHECK statement in FTP.DATA. If ANONYMOUS/USERID is coded, the user must provide the password for USERID. See z/OS Communications Server: IP Configuration Reference for more information about these FTP.DATA statements.
Wrong initial working directory

If the initial working directory is userid instead of a z/OS UNIX file system directory, ensure that the STARTDIRECTORY statement is specified in the FTP.DATA data set and that the $HOME directory (defined or defaulted) exists for the login user ID.

Unable to open data connection message from server

If, after issuing a command such as RETR, STOR, or LIST, the client receives the message 425 Unable to open data connection from the server, check the FTP server trace for an error.

Tip: The trace option SOC should be active when you diagnose data connection errors.

See “Diagnosing FTP server problems with traces” on page 432 for information about starting the FTP server trace. One possible trace entry is data_connect: bind() error...permission denied. If you see this trace entry, ensure that the FTP data connection port is reserved to OMVS in the PROFILE.TCPIP data set.

PORT

20 TCP OMVS NOAUTOLOG ;FTP data port
21 TCP FTPD1 ;FTP control port

Another possible trace entry is data_connect: seteuid(0) error...Permission denied. If you see this trace entry when the trace option ACC is active, ensure that FTP has BPX.DAEMON authority.

AT-TLS problems

The FTP server and client provide a level of security using the Application Transport Transparent Layer Security (AT-TLS) protocol. The FTP server and client use the services of System SSL as described in z/OS Cryptographic Services System SSL Programming. This document describes how system SSL works and also contains a topic about obtaining diagnostic information.

If you are experiencing problems with the AT-TLS support, gather AT-TLS trace information from FTP by activating security processing trace. You activate the trace before the FTP server starts by adding the DEBUG SEC statement to the server's FTP.DATA file or after the server starts (and before client connection) by using the MODIFY jobname,DEBUG=(SEC) operator command.

One of the common problems with the AT-TLS handshake is a mismatch in the ciphersuites supported by client and server. For a list of ciphersuites supported by z/OS FTP, see z/OS Communications Server: IP Configuration Reference.

SSL_NULL_MD5 ; 01
SSL_NULL_SHA ; 02
SSL_RC4_MD5_EX ; 03
SSL_RC4_MD5 ; 04
SSL_RC4_SHA ; 05
SSL_RC2_MD5_EX ; 06
SSL_DES_SHA ; 09
SSL_3DES_SHA ; 0A

Tip: Each ciphersuite has an associated number that is known to AT-TLS.

The following is a portion of the FTP server trace for a successful AT-TLS negotiation. In this example, the server of the FTP.DATA file was coded to accept only ciphersuites (cipherspecs) 01 and 02:

auth: entered with mechname TLS
ftpAuth: keyring = /u/user33/keyring/key.kdb
ftpAuth: stash = /u/user33/keyring/key.sth
ftpAuth: environment_open()
ftpAuth: connect as a server
ftpAuth: environment_init()
ftpAuth: environment initialization complete
authClient: secure_socket_open()
authClient: cipherspecs = 0102
authClient: secure_socket_init()
tlsLevel: using TLSV1 with SSL_NULL_MD5 (01)
If the client were coded to not accept ciphersuites 01 and 02, the trace would look like this:

auth: entered with mechname TLS
ftpAuth: keyring = /u/user33/keyring/key.kdb
ftpAuth: stash   = /u/user33/keyring/key.sth
ftpAuth: environment_open()
ftpAuth: connect as a server
ftpAuth: environment_init()
tpAuth: environment initialization complete
uthClient: secure_socket_open()
uthClient: cipherspecs = 0102
uthClient: secure_socket_init()
uthClient: init failed with rc = 402 (GSK_ERR_NO_CIPHERS)
ndSecureConn: entered
EYFT96I TLS handshake failed

Data transfer problems
This topic describes various problems involving data transfer.

**PASV and EPSV commands fail because no PASSIVEDATAPORTS are available**

If you code the PASSIVEDATAPORTS statement in the server's FTP.DATA, you must code enough ports to accommodate the server workload. Otherwise, EPSV and PASV commands to the server fail. Syslog tracing or CTRACE indicates bind() failed with errno 1116 - address not available, and errno2 of JRBINDNoPort.

To transfer data in passive mode, the FTP server must obtain a port from the PASSIVEDATAPORTS range. Therefore, allow at least one port per simultaneous data transfer. For example, if you expect one hundred users to log in to FTP at once to transfer data, code at least one hundred ports on the PASSIVEDATAPORTS statement.

The PASSIVEDATAPORTS statement does not preclude other applications from obtaining ports in the coded range. To prevent other applications from consuming ports in the PASSIVEDATAPORT range to the exclusion of FTP, code a PORTRANGE statement in PROFILE.TCPIP with the AUTHPORT parameter, specifying some or all ports in the PASSIVEDATAPORTS range. See z/OS Communications Server: IP Configuration Reference for more information about the PORTRANGE statement and PROFILE.TCPIP.

TCP/IP does not release ports that the FTP server has released until the connection associated with the port has exited the TIMEWAIT state. If all the PASSIVEDATAPORTS connections are in TIMEWAIT state, the server is not able to obtain a port to process a PASV or EPSV command. You can verify the connections are in TIMEWAIT state by issuing the `netstat -a` command from the USS shell. To correct this problem, increase the number of ports coded on the PASSIVEDATAPORTS statement.

**Load module transfer failures**
This topic describes failures when transferring MVS load modules.

If the MVS load module transfers, but is not executable on the target system:

- Ensure that all hosts involved in the load module transfer are at the Communications Server for OS/390 V2R10 level or higher.
  - For proxy transfers, both servers and the client must be Communications Server for OS/390 V2R10 or higher.
- Ensure that the user did not attempt an operation that is not supported by load module transfer:
  - Ensure that the user did not attempt to rename the load module on transfer.
  - Ensure that the working directory on both the current and target systems is a load library of the correct type. An MVS load library for purposes of this support is a PDS with RECFM=U or a PDSE. Files can only be transferred between the same types of load libraries. This means that a PDS load library member must be transferred to another PDS, and a PDSE load library member must be transferred into another PDSE. The FTP client displays a terminal message EZA2841I Local directory might be a load library when a user changes local directory into a PDS or PDSE eligible for load module transfer support. The FTP server sends a 250-The working directory might be a load library reply to the client when a CWD command is processed that causes the server
working directory to become a PDS or PDSE eligible for load module transfer support. If both the message and the reply are not seen when changing directories before a transfer, load module transfer processing is not be used to transfer any files between the two directories.

- Ensure that the load modules are transferred by member names only. The current working directory on both the target and destination systems must be the load library. Fully qualifying the member names is not permitted.

- Ensure that there are no problems with the IEBCOPY invocation. If an error is detected with an IEBCOPY invocation, the FTP server or client furnishes the IEBCOPY SYSPRINT output as messages to either the console (in the server's case) or the terminal session (in the client's case). Specify the FSC(2) debug option for the general trace for the FTP client and for the FTP server to display the IEBCOPY SYSPRINT output for both successful and unsuccessful transfers. At the client, enter debug fsc(2) before the transfer. See “Start tracing” on page 432 for information about how to set the trace for the server.

If the MVS load module fails to transfer, check the following:

1. If Reload of the load library failed or Unload of the load library failed messages or replies are seen, then these messages indicate a problem with a call to the IEBCOPY system utility. Ensure that the IEBCOPY system utility is installed on the system and available to be called from application programs. If so, examine the FTP debug trace to determine whether IEBCOPY was successfully invoked (see the “Diagnosing FTP server problems with traces” on page 432 for information about activating FTP syslog tracing.) (Some client environments, particularly REXX scripts running under the UNIX System Services shell, are not fully authorized to call IEBCOPY). If IEBCOPY was successfully invoked, examine the IEBCOPY SYSPRINT output (described above) to see whether IEBCOPY reported any errors.

2. If allocation failure messages or replies are seen, then:
   - If the data set whose allocation failed is either the source or destination load library, ensure that no other process has allocated the load library for exclusive use.
   - If no data set name appears, or if the data set name ends in the characters XLMT, ensure that sufficient temporary DASD is available on the system. Load module transfer requires the use of sufficient temporary DASD to hold all data that could be transferred in one transfer command. Consider breaking up large mget or mput transfers into smaller groups to reduce the amount of required temporary DASD. If sufficient temporary DASD is not immediately available, then the setting of the AUTOMOUNT/NOAUTOMOUNT site option regulates whether FTP attempts to mount additional temporary storage to complete a load module temporary file allocation request.

3. If ABEND X'B3700000' occurs, this can indicate that a DASD storage shortage happened when FTP used IEBCOPY to copy the data from the original load module to a temporary data set. Ensure that all the members in the original load module PDS or library have correct size information in the directory. Do not transfer nonexecutable load modules, or load modules of size 0 or undefined size.

If the MVS load module transfer hangs, the system is probably waiting for temporary DASD to be mounted. If your system does not respond promptly to mount requests for temporary DASD, consider setting the NOAUTOMOUNT (LOC)SITE option about the hanging system, and breaking up large load module transfer mgets and mputs into smaller requests to reduce the requirement for temporary DASD.

**Data set allocation fails**

If data set allocation is failing (MKD, STOR/STOU, or APPE), check for the following:

- Issue the STAT command and check for problems with the variables that define data set characteristics (LRECL, RECFM, BLKSIZE, PRIMARY, SECONDARY, or DIRECTORY).
  - Do they all have a valid value defined?
  - If the variable is not listed in the STAT command output, no value is assigned to this variable. If no value is assigned to the variable, the value must be picked up from another source — either a model DCB or SMS. Does either the DCBDSN or DATACLASS (SMS) parameter have a valid value to provide a source for the missing variables?
– If an SMS data class is specified, is SMS active at the server system? (current SMS status is displayed as part of the output for the STAT command).
– If an SMS data class is specified, do the data class definitions contain values for the missing variables?
– Are both PRIMARY and SECONDARY either specified or not specified? If either PRIMARY or SECONDARY are specified, neither of the values is picked up from an SMS data class. Both must be unspecified to pick up the value from SMS or both must be specified to override the SMS values.
– If a model DCB is specified, are the characteristics of this data set valid for the data set being allocated?

• Issue the STAT command and check the PRIMARY, SECONDARY, and SPACETYPE values to determine how large the new data set is. The VOLUME and UNIT value of the STAT command indicate where the data sets are allocated. (If neither volume or unit is shown by the STAT command, data sets are allocated on the system default SYSDA DASD.) Does the server system have sufficient space where the data sets are allocated to allocate the data set? The SITE QDISK command provides information about the space available at the server system.
• Ensure that the destination at the server site is writable. Check with the operator at the server system to verify that the destination of the new data set is not write protected.

**Data set allocation not picking up correct characteristics**

If the data set is being allocated successfully, but the resulting data set does not have the expected data set characteristics, check for the following:

1. All values obtained from SITE variables
   • Issue the STAT command to verify that the settings of all the SITE variables are correct. If any variables are missing from the STAT output, check for values specified for the DCBDSN or DATACLASS parameters. If a value is specified for the DCBDSN data set, go to Step “3” on page 429. If a value is specified for the DATACLASS parameter, go to Step “2” on page 428.
   • Check for variables overridden by a client. The VM and MVS FTP clients automatically issue SITE commands when doing a STOR, STOU, or APPE command. The values sent automatically by the client could be overriding values set by specific SITE commands issued by the user. To prevent the VM or MVS client from automatically sending new SITE settings, issue the SENDSITE command at the client.

2. Values from SMS
   If the DATACLASS parameter has been specified, but the actual data set characteristics do not match the values in the specified SMS data class, issue the STAT command and check the information shown in the output from the STAT command for the following:
   • Is SMS active at the server system? If SMS is not active, the SMS data class cannot be used to define the data set.
   • Are values specified for any of the data set characteristic variables (DSNTYPE, LRECL, RECFM, BLKSIZE, PDSTYPE, PRIMARY, SECONDARY, RETPD, or DIRECTORY)? If these keywords are missing from the STAT output, or if the value ‘SYSTEM’ is displayed, no value is assigned to them and the data set characteristics should be picked up from the SMS data class. If, however, a value is present for any of these variables, the setting shown by the STAT command overrides any information in the SMS data class. To pick up the value from the data class, issue the SITE command with the keyword with no value (for example, SITE RECFM) to turn off the parameter setting.
   • Is a value specified for the DCBDSN parameter? If a DCBDSN data set is specified, the values for LRECL, RECFM, BLKSIZE, and RETPD are obtained from the model DCB data set and overrides any values in the SMS data class. Issue the SITE DCBDSN command to turn off the DCBDSN parameter setting.
   • Check for variables overridden by a client. The VM and MVS FTP clients automatically issue SITE commands when doing a STOR, STOU, or APPE command. The values sent automatically by the client could be overriding values set by specific SITE commands issued by the user. To prevent the
MVS or VM client from automatically sending new SITE settings, issue the SENDSITE command at the client.

3. Values from DCBDSN

If the DCBDSN parameter has been specified, but the actual data set characteristics do not match the characteristics of the specified data set, issue the STAT command, and check the information shown in the output from the STAT command the following:

- Are values specified for any of the data set characteristic variables (LRECL, RECFM, BLKSIZE, or RETPD)? If these keywords are missing from the STAT output, no value is assigned to them and the data set characteristics are picked up from the DCBDSN data set. If, however, a value is present for any of these variables, the setting shown by the STAT command overrides the values of the DCBDSN data set. To pick up the value from the DCBDSN data set, issue the SITE command with the keyword with no value (for example, SITE RECFM) to turn off the parameter setting.

- Are variables being overridden by a client? The VM and MVS FTP clients automatically issue SITE commands when doing a STOR, STOU, or APPE command. The values sent automatically by the client could be overriding values set by specific SITE commands issued by the user. To prevent the VM or MVS client from automatically sending new SITE settings, issue the SENDSITE command at the client.

**MVS data set not found**

If the server is not able to find the MVS data set, check for the following problems:

- Can the server find the data set to list it? Issue the DIR command to display the data set.
- Is the MVS data set at the server in the catalog? The server can only locate cataloged MVS data sets. Check the user level of access to the catalog. FTP servers at the z/OS V1R2 level and later display only the data sets to which the user has access.
- Was the *pathname* on the FTP command entered in single quotation marks? If not, the path name specified is appended to the end of the current working directory. Issue the PWD command to display the current working directory. If current_working_directory.pathname is not the correct name of the file, either change the current working directory with the CWD command or issue the correct data set name in single quotation marks as the *pathname*.

**RETR, STOR, RNFR, RNTO, APPE, or DELE of data set fails**

If RETR, STOR, RNFR, RNTO, APPE, or DELE for the data set fails, check for the following problems:

1. Is the data set protected by a security system, such as RACF or permission bits or a retention period?
2. Is the data set being used at the server site by another program or user?
3. Was the data set available to the system, or was it migrated or on an unmounted volume?
4. Did the data set or member exist?
5. For RETR or STOR commands, did a REST command immediately precede the RETR or STOR?

   If so, the client is attempting to restart a file transfer. The server cannot detect certain REST argument errors until the RETR or STOR command is processed. If the trace options CMD and FSC are active, the server reply and server trace output provide insight into whether the REST command is implicated. Verify that the client and server have reestablished the original file transfer environment before attempting the restart.

The following problems apply to MVS data sets only:

1. Did the specified path name follow MVS data set naming conventions?
2. Was the requested data set a type of supported data set organization (PS, PDS, or PDS member) on a supported device type (DASD or tape)?
3. Were the path name specifications consistent with the type of data set? For example, if a member was requested, was the data set a PDS?
**REST fails**

Use the STAT command to determine the current mode.

If mode is Block, report the problem to IBM.

If the mode is Stream, check the following:

- Verify that the server is configured for stream mode restarts. The server FEAT reply includes REST STREAM if the server is configured correctly.
- Inspect the REST reply for more insight into the reason the server rejected the REST command. See z/OS Communications Server: IP and SNA Codes for more information about FTP server replies.

**Data transfer terminated**

If data transfer terminated, check for the following problems:

1. Is the data set at the server large enough to receive the data being sent? If not, use the SITE command to change the space allocation for new data sets.
2. If storing a member of a PDS, is there room in the PDS for an additional member? Is there room in the PDS directory for another directory entry?
3. Did the client send an ABOR command?
4. Is the file type correct? For example, if filetype=SQL when it should be set to SEQ or JES, the host file being retrieved is assumed to be a SQL statement and FTP attempts to connect to Db2 and submit the statement to Db2 for processing.

**Client abends during RETR command data transfer**

If the client abends while processing a RETR command, issue the STAT command, and check the value of the checkpoint interval. If this value is greater than zero and data is being transferred in EBCDIC, either block mode or compressed mode, the server is sending checkpoint markers with the data being transferred. If the client being used does not support checkpoint/restart, this checkpoint information can cause unpredictable results, such as abends or data errors at the client. Change the setting of the checkpoint interval by issuing SITE CHKPTINT=0.

**Data set disposition incorrect when transfer fails**

If the data set disposition is incorrect when transfer fails, check for the following problems:

- Data sets cataloged instead of deleted
  
  - Issue the STAT command and check the setting of the conditional disposition. If the STAT command output indicates New data sets will be catalogued if a store operation ends abnormally, the server catalogs new data sets, even if the data transfer fails. To change this setting, issue the SITE CONDDISP=DELETE command.
  
  - Did the transfer fail because the FTP server was either abending or being terminated by a STOP or CANCEL command? If this is the case, the data set is kept.
  
  - Is the client sending checkpoint information? If the data is being transferred in EBCDIC, either in block mode or compressed mode and the client has sent at least one checkpoint marker, the FTP server keeps the data set even if the conditional disposition is set to delete.

- Data sets deleted instead of cataloged
  
  - Issue the STAT command and check the setting of the conditional disposition. If the STAT command output indicates New data sets will be deleted if a store operation ends abnormally, the server deletes new data sets if the data transfer fails. To change this setting, issue the SITE CONDDISP=CATALOG command.

**Checkpoint markers do not appear to be sent**

Issue the STAT command and check the settings for data transfer. Checkpoint information is only transferred in EBCDIC, with either block or compressed mode. The checkpoint interval must be greater than zero.
The sender of the data initiates the checkpoint information. Therefore, checkpointing must be set on at the client for a STOR, STOU, or APPE, (for the MVS FTP client, this is done by issuing the LOCSITE CHKPTINT=nn command with a value larger than zero) and set on at the server (by issuing the SITE CHKPTINT=nn command with a value larger than zero) for a RETR.

**LOADLIB directory information is not sent with module transfer**

Issue the STAT command and check the settings for data transfer. Load module directory information is only sent for EBCDIC with a mode of either block or compressed.

**Restriction:** The client you are using must support the SDIR command.

**Server PDS member statistics not created or updated**

ISPFStats must be set to TRUE to create or update the statistics for the PDS Member when using PUT, MPUT, GET, MGET, or APPEND subcommands. For PUT, MPUT, or APPEND, make sure the server’s ISPFStats is set to TRUE. Issue the STAT command to determine this. If it is not set to TRUE, you can set it by using the SITE subcommand. For example, SITE ISPFStats sets ISPFStats to TRUE, and SITE NOISPFStats sets ISPFStats to FALSE.

**Result:** If the PDS directory block is full, PDS member statistics are not updated.

**File transfers to the BatchPipe subsystem fail**

If a file transfer to a batch pipe fails, the problem could be that the batch pipe reader has not been started. Verify that the batch pipe reader is active.

**Guideline:** In a JESMAS environment, if you use FTP to submit a job starting the batch pipe reader, the job can run on any system in the JESMAS environment unless you include this JCL statement in your job:

```
/*J0BPARM SASAFF=*        
```

If your file transfer runs on a different system in the JESMAS environment, the JWT time limit will expire, and the FTP server JOB will appear to hang. You can avoid this by adding the JCL statement:

```
/*J0BPARM SASAFF=*        
```
to your batch pipe job.

When a file transfer to a batch pipe fails with an allocation error, the problem could be that the BatchPipe subsystem has not been started. Verify that the BatchPipe subsystem is started. For example:

```
put 'user3.source.data' 'user3.subsys.output1'
>>> SITE FIXrecfm 80 LRECL=80 RECFM=FB BLKSIZE=12960
 200 SITE command was accepted
>>> PORT 9,42,104,22,4,15
 200 Port request OK.
>>> STOR 'user3.subsys.output1'
550 Allocation of USER3.SUBSYS.OUTPUT1 failed while executing STOR command.
Command:
```

You can activate the FTP server trace to obtain more information about the failure. See “Diagnosing FTP server problems with traces” on page 432 for information about activating the FTP server trace. Inspect the SYSLOG output for messages related to the file transfer failure.

A sample syslog output is:

```
Mar 2 16:29:47 MVS117 ftps[21]: GU1850 logALLOC: ALLOC  error in routine alloc_dasd
Mar 2 16:29:47 MVS117 ftps[21]: GU1850 logALLOC: SVC99 ALLOC failed with rc 4
Mar 2 16:29:47 MVS117 ftps[21]: GU1852 logALLOC: dname   = USER3.SUBSYS.OUTPUT1
Mar 2 16:29:47 MVS117 ftps[21]: GU1852 logALLOC: 599ERROR = 04AC
Mar 2 16:29:47 MVS117 ftps[21]: GU2088 logDynErrMsg: entered
Mar 2 16:29:47 MVS117 ftps[21]: GU2088 logDynErrMsg: DATA SET USER3.SUBSYS.OUTPUT1 NOT ALLOCATED, SYSTEM OR INSTALLATION ERROR+
Mar 2 16:29:47 MVS117 ftps[21]: GU2088 logDynErrMsg: DYNAMIC ALLOCATION REASON CODE IS X’000004AC’
Mar 2 16:29:47 MVS117 ftps[21]: RS3033 mvs_store_data: allocation failed (4)
```
Allocation of USER3.SUBSYS.output1 failed (error code 04AC info code 0000 S99ERSN 00000000)

Error code 04AC means that the subsystem is not operational.
When FTPLOGGING is set to TRUE in the server's FTP.DATA file, the error messages will be logged in SYSLOGD. You can look up the messages and error codes.

Diagnosing FTP server problems with traces
Syslog tracing is available to aid in debugging z/OS UNIX FTP server problems. The following methods are available to start, stop, or modify syslog daemon and server tracing:

- TRACE start option
- FTP.DATA DEBUG statement
- FTP.DATA DUMP statement
- MODIFY jobname,DUMP operator command
- MODIFY jobname,DEBUG operator command
- Server SITE DEBUG command
- Server SITE DUMP command

See the following for more information:

- See “Start tracing during FTP initialization” on page 433 and z/OS Communications Server: IP Configuration Reference, for details about the TRACE start option and FTP.DATA statements.
- See “Controlling the FTP server traces with MODIFY operator command” on page 434 and z/OS Communications Server: IP System Administrator's Commands for details about the MODIFY operator command.

After a client has logged in to FTP, the client can issue SITE DEBUG or SITE DUMP commands to change tracing for that session only.

Where to find traces
The z/OS UNIX FTP server sends its trace entries to syslogd. As shown in the following example, the daemon.debug statement in /etc/syslog.conf specifies where syslogd writes FTP trace records:

```bash
# All ftp, rexecd, rshd
# debug messages (and above)
# priority messages) go
# to server.debug.a
#
daemon.debug /tmp/syslogd/server.debug.a
```

All z/OS UNIX FTP trace entries are written to the same z/OS UNIX file system file.

**Note:** The TRACE parameter and MODIFY operator command options are issued to the FTP daemon and affect all client sessions that connect to the z/OS UNIX FTP server while tracing is active.

See the z/OS Communications Server: IP Configuration Guide for more information about syslogd.

Start tracing
This topic discusses the following methods of starting the FTP server traces:

- During FTP initialization
- After FTP initialization
**Start tracing during FTP initialization**

You can use the TRACE start parameter, the TRACE statement, or the DEBUG and DUMP statements in FTP.DATA to begin tracing during FTP daemon initialization. This continues tracing for all FTP events for all FTP sessions.

Tracing remains active until you issue a MODIFY operator command to end it. See “Controlling the FTP server traces with MODIFY operator command” on page 434.

**Tip:** When you issue a MODIFY operator command to end tracing, tracing does not occur for any subsequent client sessions; however, tracing continues for any sessions that were already connected.

**Start tracing after FTP initialization**

After initialization, you can enable tracing using an MVS MODIFY operator command to the FTP server listener process. See “Controlling the FTP server traces with MODIFY operator command” on page 434. Previously established FTP connections are not affected by a MODIFY operator command. Only FTP connections that are established after the MODIFY operator command was issued are subject to tracing.

If you have coded DEBUGONSITE TRUE and DUMPSONSITE TRUE in the server’s FTP.DATA file, you can use the SITE DEBUG command and the SITE DUMP command, respectively, to change tracing after you log in to FTP. For example, if you want to add JES general tracing and JES extended tracing, enter the following:

```
SITE DEBUG=(JES) DUMP=(JES)
```

If you want to restrict the use of the SITE command to change the tracing and your installation has a security product that supports the SERVAUTH class, you can provide additional levels of access control. If the installation has activated the SERVAUTH class and provided a profile for the SITE DEBUG command, only users who have read access to the profile are allowed to use the SITE DEBUG command. The profile name is:

```
EZB.FTP.systemname.ftpd daemonname.SITE.DEBUG
```

For example, if the procedure FTPD is used to start the server on system MVS164, the profile name is:

```
EZB.FTP.MVS164.FTPD1.SITE.DEBUG
```

The user’s SITE DEBUG command is rejected if the security product determines that the user does not have read access to the profile.

If the installation has activated the SERVAUTH class and provided a profile for the SITE DUMP command, only users who have read access to the profile are allowed to use the SITE DUMP command. The profile name is:

```
EZB.FTP.systemname.ftpd daemonname.SITE.DUMP
```

For example, if the procedure FTPD is used to start the server on system MVS164, the profile name is:

```
EZB.FTP.MVS164.FTPD1.SITE.DUMP
```

The user’s SITE DUMP command is rejected if the security product determines that the user does not have read access to the profile.

**Stop tracing**

Use the MODIFY operator command to stop global tracing. For example, your FTP jobname is FTPD1. You can issue the F FTPD1,DEBUG=(NONE) command to stop global tracing. Previously established FTP connections that were started with tracing enabled continue to produce trace output until the connections are terminated, but new connections start without tracing enabled.

If you have coded DEBUGONSITE TRUE in the server's FTP.DATA, the FTP client can use a SITE DEBUG=NONE command to stop tracing. The SITE command affects only tracing for the current FTP session.
Tracing activity for one user

A filter can be specified so that the traces are active only for certain clients that log in. Trace data can include both general and JES-related activity and includes data such as parameter lists and storage areas. The filtering can be done by either IP address of the client or by user ID for the session. Use the IPADDR(filter) and USERID(filter) operands on the FTP SITE command, or on MODIFY operator command, to enable trace filtering.

A client could use the SITE DEBUG and SITE DUMP subcommands to write excessive debugging information to the syslog and effectively disable the syslog function. To prevent this, a RACF profile controls whether a client is allowed to use these parameters on the SITE subcommand. FTP uses the SERVAUTH resource class. The resource name is EZB.FTP.<systemname>.<ftpd daemonname>.SITE.<tracename>. The lowest level is tracename, which is either DEBUG or DUMP.

Controlling the FTP server traces with MODIFY operator command

To start the general trace for the FTP server for all user IDs during initialization, specify the TRACE parameter either as a start option in the FTP server start procedure, or code a DEBUG BAS statement in FTP.DATA.

After initialization, use the MODIFY operator command to control the general and extended tracing for the FTP server. The command supports the following parameters:

- DEBUG for general tracing
- DUMP for extended tracing

Each allows a filter to be specified so that the traces are active for certain clients that log in. The filtering can be done by either IP address of the client or by user ID for the session.

Guideline: The jobname is the name associated with the FTP daemon background job. It is documented in message EZYFT411 in SYSLOGD. If you started the z/OS UNIX server using a procedure named FTPD, the job name to use for the MODIFY operator command is probably FTPD1. As client sessions connect to the FTP server, the session process adopts the trace options currently active. These options remain in effect for the life of the client session process, regardless of subsequent MODIFY operator commands issued to the FTP daemon.

Controlling general tracing

To control the general trace, enter one of the following:

```plaintext
MODIFY jobname,DEBUG=(option_1,option_2,...,option_n,USERID(filter_name))
MODIFY jobname,DEBUG=(option_1,option_2,...,option_n,IPADDR(filter))
```

Where options are one of the following:

- ?
  - Displays the status of the general traces.
  - The status of the trace is displayed as a response to all uses of the operator MODIFY DEBUG command. The ? allows you to get the status without making a change.

- ACC
  - Shows the details of the login process.

- ALL
  - Sets all of the trace points.
  - When the ALL parameter is processed, both the FSC and the SOC trace are set to level 1.

- BAS
  - Sets a select group of traces that offer the best overall details without the copious output generated by certain trace options. Specifying this value is the same as the following:

```plaintext
MODIFY jobname,DEBUG=(CMD,INT,FSC,SOC)
```
CMD
Shows each command and the parsing of the parameters for the command.

FLO
Shows the flow of control within FTP. It is useful to show which services of FTP are used for an FTP request.

FSC(n)
Shows details of the processing the following file services commands
- APPE
- STOR
- STOU
- RETR
- DELE
- RNFR
- RNTO

This trace can be very intense; therefore, it allows you to specify levels of granularity for the trace points. The level 1 tracing that is specified by entering FSC or FSC(1) is the level normally used unless more data is requested by TCP/IP service group. The variable n can be a number in the range 1–8.

Level 1
Covers the major steps of the file services processing, which includes the following:
- Entry to a command processor
- Determination of the type of file being processed
- Choice of allocation method
- Choice of open method
- Choice of transfer routine
- Recognition of end of file or data
- Close and deallocation
- Call for SMF processing

Level 2
Provides more details for the major steps that are executed. These should be one-time events that enhance the information for the steps of level 1 tracing. An example would be some additional information about the allocation process.

Level 3
Provides trace information of repetitive events that occur during the processing. For example, a trace for each full buffer (180K) of data that is received. Another example is a trace for each restart marker that is sent. The rate of repetition should be low enough that this level does not flood the trace.

Level 4
Provides trace information of repetitive events that occur at a higher rate than those of level 3. For example, a trace for each time data must be moved to the top of a buffer before the next receive_data.

Level 5
Provides trace information of repetitive events that occur at a higher rate than those of level 4. This is the most intense and covers events such as the processing of each block of data.

Tip: This level of tracing produces an extremely large amount of data and should not be used for large file transfers.

INT
The INT trace shows the details of the initialization and termination of the FTP session.
The JES trace shows details of the processing for JES requests, such as when SITE FILETYPE=JES is in effect.

NONE
This value is used to turn off all of the traces.

PAR
The PAR trace shows details of the FTP command parser. It is useful for debugging problems in the handling of the command parameters.

SEC
The SEC trace shows the processing of security functions such as AT-TLS and GSSAPI negotiations.

SOC(n)
The SOC trace shows details of the processing during the setup of the interface between the FTP application and the network as well as details of the actual amounts of data that is processed. This trace can be very intense; therefore, it allows you to specify levels of granularity for the trace points. The level 1 tracing that is specified by entering SOC or SOC(1) is the level normally used unless more data is requested by the TCP/IP service group. The variable n can be a number from 1 to 8.

Level 1
Covers the major steps of the socket services processing. Connection initiation and closing steps are included.

Level 2
Adds more detail for level 1 events. For example, it traces the three steps that occur when a data connection is closed.

Level 3
The events for this trace are the send() and recv() calls for the data connection.

SQL
Shows details of the processing for SQL requests, such as when SITE FILETYPE=SQL is in effect.

UTL
Shows the processing of utility functions such as CD and SITE.

USERID(filter_name)
Filters the trace for user IDs matching the filter_name pattern.

If the user ID matches the filter at the time the clients log in, their tracing options are set to the current value of the options. Otherwise, tracing options are not set. Clients can use the SITE command to set their options after login if the initial ones are not appropriate. An example for the USERID filter is MODIFY jobname,DEBUG=(CMD,USERID(USER3*)) , which activates the CMD trace for a user whose ID starts with USER3.

IPADDR(filter)
This optional parameter filters the trace for IP addresses matching the filter pattern.

If the IP address matches the filter at the time clients connect, its tracing options are set to the current value of the options. Otherwise, tracing options are not set. Clients can use the SITE command to set their options after connect if the initial ones are not appropriate. An example of the IPADDR filter is MODIFY jobname,DEBUG=(JES,IPADDR(9.67.113.57)), which activates the JES trace for a client whose IP address is 9.67.113.57. Another example is MODIFY jobname,DEBUG=(JES,IPADDR(FEDC:BA98:7654:3210:FEDE:BA98:7654:3210)). This activates the JES trace for a client whose IP address is FEDC:BA98:7654:3210:FEDE:BA98:7654:3210.

If the filter is an IPv4 address, submasking can be indicated by using a slash followed by a dotted decimal submask. For example, 192.48.32/255.255.255.0 allows addresses from 192.48.32.0 to 192.48.32.255.

If the filter is an IPv6 address, network prefixing can be indicated by using a slash followed by a prefix length. For example, FEDC:BA98::0/32 allows all IP addresses from FEDC:BA98::0 to FEDC:BA98::FFFF:FFFF:FFFF:FFFF.
The specification of the trace on the MODIFY operator command is not additive. That is, the trace setting is that of the last MODIFY operator command. For example:

```
MODIFY FTPDJG1,DEBUG=(NONE)  
+EZYFT82I Active traces: NONE
MODIFY FTPDJG1,DEBUG=(CMD)  
+EZYFT82I Active traces: CMD
MODIFY FTPDJG1,DEBUG=(FSC,USERID(USER33))  
+EZYFT82I Active traces: FSC(1)  
+EZYFT89I Userid filter: USER33
MODIFY FTPDJG1,DEBUG=(SOC)  
+EZYFT82I Active traces: SOC(1)
```

**Guidelines:** The following are some guidelines to use for migrating from previous versions of the MODIFY operator command:

- **MODIFY jobname,TRACE**
  This is still accepted and is equivalent to `MODIFY jobname,DEBUG=(BAS)`. The old response message EZY2704I is replaced by EZYFT82I.

- **MODIFY jobname,NOTRACE**
  This is still accepted and is equivalent to `MODIFY jobname,DEBUG=(NONE)`. The old response message EZY2705I is replaced by EZYFT82I.

- **MODIFY jobname,JTRACE**
  This is still accepted and is equivalent to `MODIFY jobname,DEBUG=(CMD,FSC,JES)`. The old response message EZY2710I is replaced by EZYFT82I.

- **MODIFY jobname,NOJTRACE**
  This is still accepted and is equivalent to `MODIFY jobname,DEBUG=(NONE)`. The old response message EZY2711I is replaced by EZYFT82I.

- **MODIFY jobname,UTRACE=USER33**
  This is rejected as an obsolete command. Its function can be replaced with the following pair of commands:

```
MODIFY jobname,DEBUG=(ALL,USERID(USER33))  
MODIFY jobname,DUMP=(ALL,USERID(USER33))
```

- The use of the ALL parameter can produce an extensive amount of trace data and should not be specified on a routine basis.

- **MODIFY jobname,NOUTRACE**
  This is rejected as an obsolete command. If complete tracing was activated as suggested in the previous step, then the tracing can be stopped as follows:

```
MODIFY jobname,DEBUG=(NONE)  
MODIFY jobname,DUMP=(NONE)
```

### Controlling extended tracing

To control the extended trace, enter one of the following:

```
MODIFY jobname,DUMP=(option_1,option_2,...,option_n,USERID(filter_name))
MODIFY jobname,DUMP=(option_1,option_2,...,option_n,IPADDR(filter))
```

Where options are one of the following:

- **id**
  Specifies the ID number of a specific extended trace point that is to be activated in the FTP code. The ID number has a range of 1–99.

- **?**
  Displays the status of the extended traces.
ALL
Activates all of the trace points.

NONE
Resets (turns off) all extended traces.

FSC
Activates all of the extended trace points in the file services code. The numbers activated are 20–49.

SOC
Activates all of the extended trace points in the network services code. The numbers activated are 50–59.

JES
Activates all of the extended trace points in the JES services code. The numbers activated are 60–69.

SQL
Activates all of the extended trace points in the SQL services code. The numbers activated are 70–79.

USERID(filter_name)
Filters the trace for user IDs matching the filter_name pattern.

If a client's user ID matches the filter when the client logs into the server, its tracing options are set to
the current value of the options. Otherwise, tracing options are not set. Clients can use the SITE
command to set their options after login if the initial ones are not appropriate. An example for the
USERID filter is MODIFY jobname,DEBUG=(21,USERID(USER33)), which activates the dumpID 21
trace for a user if his user ID is USER33.

IPADDR(filter)
Filters the extended trace for IP addresses matching the filter pattern.

If the client's IP address matches the filter when the client connects to the FTP server, its extended
tracing options are set to the current value of the options. Otherwise, tracing options are not set.
Clients can use the SITE command to set their options after connect if the initial ones are not
appropriate.

An example of the IPADDR filter is MODIFY jobname,DUMP=(JES,IPADDR(9.67.113.57)), which
activates the JES extended trace for a client whose IP address is 9.67.113.57. Another example is
This activates all file services extended traces for a client whose IP address is

If the filter is an IPv4 address, submasking can be indicated by using a slash followed by a dotted
decimal submask. For example, 192.48.32/255.255.255.0 allows addresses from
192.48.32.00 to 192.48.32.255.

If the filter is an IPv6 address, network prefixing can be indicated by using a slash followed by a prefix
length. For example, FEDC:BA98::0/32 allows all IP addresses from FEDC:BA98::0 to

The specification of the trace on the MODIFY operator command is not additive. That is, the trace setting
is that of the last MODIFY operator command. For example:

```
MODIFY FTPDJG1,DUMP=(NONE)
+EZYFT83I Active dumpIDs: NONE
MODIFY FTPDJG1,DUMP=(21)
+EZYFT83I Active dumpIDs: 21
MODIFY FTPDJG1,DUMP=(22)
+EZYFT83I Active dumpIDs: 22
```

Guidelines: The following are guidelines for migrating from the old parameters that were used with the
MODIFY operator command:

- MODIFY jobname,DUMP
  This format is rejected. DUMP requires at least one parameter (see above).
- MODIFY jobname,NODUMP
This is still accepted and is equivalent to MODIFY jobname, DUMP=(NONE). The old response message EZY2656I is replaced by EZYFT83I.

- **MODIFY jobname, JDUMP**
  
  This is rejected as an obsolete command with a suggestion to use the DUMP parameter. For example, use the MODIFY jobname, DUMP=(JES) command.

- **MODIFY jobname, NOJDUMP**
  
  This is rejected as an obsolete command with a suggestion to use the DUMP parameter. For example, use the MODIFY jobname, DUMP=(NONE) command.

### Documenting server problems

If the problem is not caused by any of the common errors described in this section, collect the following documentation before calling the IBM Support Center.

Documentation is divided into the following categories: essential and helpful (but not essential).

- **Essential**
  - Precise description of problem, including expected results and actual results
  - z/OS UNIX FTP server dump (for abends)
  - z/OS UNIX FTP server traces (see “Diagnosing FTP server problems with traces” on page 432 for information about collecting FTP server traces)
  - Minimum for initial problem reporting: DEBUG BAS

- **Helpful**
  - FTP client output
    - If the FTP client is a z/OS client, include a trace in the output by one of these methods:
      - Coding DEBUG statements in the client’s FTP.DATA file. See z/OS Communications Server: IP Configuration Reference for information about the DEBUG statement.
      - Invoking the FTP client with the -d or TRACE invocation option. See z/OS Communications Server: IP User’s Guide and Commands for more information.
      - Specifying a DEBUG subcommand in the client command input stream before the affected transfer. Use this option only if the problem does not involve the initial establishment of the FTP control session.
  - Server FTP.DATA data set
  - TCPIP.DATA data set
  - PROFILE.TCPIP data set
  - ETC.SERVICES data set
  - The reply from the STAT or XSTA command issued to the server.

**Guidelines:**

- Issue the STATus subcommand from the z/OS FTP client to retrieve STAT command output from the server. From non-z/OS clients, you may have to issue QUOTE STAT to retrieve the output from the server.
- Issue the STATus subcommand with a parameter from the z/OS FTP client to issue the XSTA command to the server. The XSTA command retrieves output related to that parameter only. From z/OS clients prior to V1R8, or from non-z/OS clients, issue QUOTE XSTA (parameter) to retrieve the output from the server.
- Any console messages issued for resources experiencing errors.
- If applicable, sample data to re-create the problem
FTP client

This topic describes the following subtopics:

- “Execution environments” on page 440
- “Setup” on page 440
- “Naming considerations” on page 441
- “Directing the client to exit when an error occurs ” on page 441
- “Translation and data conversion support” on page 441
- “File tagging support” on page 442
- “Db2 query support” on page 445
- “Restarting file transfers” on page 447
- “Diagnosing FTP connection and transfer failures with EZA2589E” on page 448
- “Problems starting the client” on page 454
- “Problems logging in to the server ” on page 455
- “Problems transferring data ” on page 457
- “Other problems ” on page 460
- “Diagnosing FTP client problems with tracing” on page 460
- “Documenting FTP client problems” on page 461

Execution environments

The FTP client can run in any of the following environments:

- Interactive (under the TSO or the z/OS UNIX shell)
- Batch (under TSO only)
- REXX exec (under TSO)

When run interactively, you can redirect terminal I/O. When run under TSO, server responses and debug messages can be redirected to a file. For example, you can use the `ftp 9.68.100.23 > 'USER27.FTPOUT'` command to redirect output from a TSO command line to a data set. When run under the z/OS UNIX shell, both input and output can be redirected. To redirect input from the file `/user27/ftpin` and output to the file `/user27/ftpout`, issue the `ftp 9.68.100.23 > /user27/ftpout < /user27/ftpin` command.

Tip: When redirecting output under z/OS UNIX, nothing is displayed on the system console, not even command prompts, and it is difficult to know when input is requested. Consequently, use output redirection only when also using input redirection.

Setup

Use an FTP.DATA data set to customize configuration parameters. You can use a SOCKSCONFIGFILE data set or file to instruct the client to connect to certain FTP servers through a SOCKS server. For information about the FTP.DATA data set and SOCKS configuration data set or file used by the FTP client, see z/OS Communications Server: IP User's Guide and Commands, z/OS Communications Server: IP Configuration Guide, and z/OS Communications Server: IP Configuration Reference.

Message EZY2640I displays the name of the FTP.DATA file. Use the FTP client `locstat` subcommand to display the name of the SOCKS configuration data set or file that is being used.

The TCPIP.DATA configuration file provides information for the FTP client, such as the high-level qualifier to be used for configuration data sets and which DBCS translation tables can be used. For more information about the TCPIP.DATA configuration file, see z/OS Communications Server: IP Configuration Reference.
Tip: The z/OS UNIX search order for the file is used even if the FTP client is invoked under TSO.

You can install the security exits for the FTP client to control FTP client commands or monitor replies from the FTP server. See z/OS Communications Server: IP Configuration Guide, z/OS Communications Server: IP Configuration Reference, and z/OS Communications Server: IP User’s Guide and Commands for more information about the security user exits for the FTP client.

Naming considerations

The FTP client can access both MVS data sets and z/OS UNIX file system files. For more information, see “Name considerations for z/OS UNIX FTP” on page 414.

Directing the client to exit when an error occurs

You can direct the FTP client to exit whenever an error occurs, rather than to continue processing. You also have some control over whether the client exits with a generic return code or with a return code that reflects the type of error that occurred. For a description of all the FTP client return code options, see z/OS Communications Server: IP User’s Guide and Commands.

Translation and data conversion support

This topic describes translation and data conversion support for the FTP client.

Double-byte character set (DBCS) support

If the DBCS translate tables are not available, the client issues the following message after a valid command to establish a double-byte transfer type (for example, SJISKANKI, BIG5, or ‘TYPE B n’) is entered:

"EZA1865I Command not Supported. Translation Table not Loaded.

If this message is displayed, check the LOADDBCSTABLES statement in the TCPIP.DATA file. If the statement wraps to the next line, parameters on the continued line are ignored, and no error message is issued. If all parameters for the LOADDBCSTABLES statement do not fit on one line, use multiple LOADDBCSTABLES statements.

Check the precedence order for the TCPIP.DATA file to ensure that the file being used contains the LOADDBCSTABLES statement or statements. Be aware that the location of TCPIP.DATA statements can be influenced in multiple ways. For example, by a GlobalTCPIPData specification or the RESOLVER_CONFIG environment variable. See z/OS Communications Server: IP Configuration Guide for the TCPIP.DATA search order.

Single-byte character (SBCS) support

Data conversion occurs for single-byte data on the data connection when ENCODING=SBCS is in effect and the data type is ASCII. For more information, see the FTP.DATA statement ENCODING and the LOCSITE ENCODING subcommand in the z/OS Communications Server: IP User’s Guide and Commands.

If you choose SBDATACONN as a statement in the FTP.DATA file or with the LOCSITE SBDATACONN subcommand, the FTP client builds a translation table using the code pages specified by SBDATACONN. If you receive the following message from the LOCSITE subcommand, start the trace with the DEBUG UTL option to determine which characters cannot be translated:

EZYFS08I

Some characters cannot be translated between codepage_1 and codepage_2.

If none of the untranslatable characters appear in your data, your data transfers are not affected. If an untranslatable character is present in the data you are trying to transfer, your data transfer fails and you receive the following message:

EZA2930I

Transfer failed because data cannot be translated.
To avoid the failure, specify a substitution character to replace non-translatable characters. For more information about how to specify character substitution, see SBSUB and SBSUBCHAR as FTP.DATA statements and as parameters on the LOCSITE subcommand in z/OS Communications Server: IP User's Guide and Commands. If substitution occurs during the transfer, you receive the following message:

**EZA2947I**

One or more characters were substituted during the transfer.

When substitution occurs at the destination of a data transfer, a subsequent transfer of the resulting data does not produce an exact copy of the original. For example, if you get a file from the server and one or more characters are substituted, the untranslatable characters are overlaid with the substitution character. You cannot restore the original file by putting it to the server.

**Multibyte character set (MBCS) support**

Data conversion occurs for multibyte data on the data connection when ENCODING=MBCS is in effect and the data type is ASCII. For more information, see the FTP.DATA statement ENCODING and the LOCSITE ENCODING subcommand in z/OS Communications Server: IP User's Guide and Commands.

If you choose ENCODING=MBCS, you must specify MBDATAConn with a statement in the FTP.DATA file or with the LOCSITE MBDATAConn subcommand to name the code pages for the multibyte data transfer. If you attempt an ASCII data transfer with ENCODING=MBCS and no MBDATAConn specified, you receive the following message:

**EZ979793I**

Multibyte encoding requested but code pages are not defined.

If the multibyte data that you transfer has codepoints that cannot be translated, the data transfer fails and you receive the following message:

**EZA2930I**

Transfer failed because data cannot be translated

To determine which bytes of the data cannot be translated, repeat the transfer with the DUMP 42 extended trace option active at the client.

**File tagging support**

When the server writes a z/OS UNIX file system file, it might tag the file using the USS support for file tagging. In some cases you might experience conflicts when you try to read a file that has been tagged. A tagged file has a file tag, which is an attribute that identifies the coded character set ID (ccsid) of the text data within the file. When a tagged file is read from the file system, the data is translated using the ccsid if SBDATAConn has specified a network transfer code page to use with the file's code page. A file might also be untagged or tagged binary.

**ASCII file transfers**

If you put data into a z/OS UNIX file system file when the data type is ASCII, the file is tagged if you have used SBDATAConn to specify the code page for the file system and for the network transfer. That is, you have specified SBDATAConn=(file_system_cp,network_transfer_cp). If the data conversion table is the FTP_STANDARD_TABLES or is specified using XLATE, the file is not tagged. The following client session example shows the effects of combining data type ASCII and SBDATAConn defined tables using code pages:

```plaintext
(01) Command: ascii
(02) >>> TYPE A
(03) 200 Representation type is Ascii NonPrint
(04) Command: site sbd=(ISO8859-1,ISO8859-1)
(05) >>> SITE sbd=(ISO8859-1,ISO8859-1)
(06) 200 Site command was accepted
(07) Command: put a file
(08) >>> PORT 9,67,113,57,4,121
(09) 200 Port request OK.
(10) >>> STOR afile
(11) 125 Storing data set /u/user33/tagging2/afile
(12) 250 Transfer completed successfully.
```
200 bytes transferred in 0.070 seconds. Transfer rate 2.86 Kbytes/sec.

Command: site sbd=(IBM-1047,ISO8859-1)
SITE sbd=(IBM-1047,ISO8859-1)
Site command was accepted

Command: put a file
PORT 9,67,113,57,4,122
Port request OK.
STOR efile
Storing data set /u/user33/tagging2/efile
Transfer completed successfully.
200 bytes transferred in 0.005 seconds. Transfer rate 40.00 Kbytes/sec.

Command: site sbd=FTP_STANDARD_TABLES
SITE sbd=FTP_STANDARD_TABLES
Site command was accepted

Command: put a file
PORT 9,67,113,57,4,123
Port request OK.
STOR ufile
Storing data set /u/user33/tagging2/ufile
Transfer completed successfully.
200 bytes transferred in 0.005 seconds. Transfer rate 40.00 Kbytes/sec.

Command: ls -T
NLST -T
List started OK

T IS08859-1 T=on afile
T IBM-1047 T=on efile
- untagged T=off ufile
250 List completed successfully.

Command: get a file
PORT 9,67,113,57,4,125
Port request OK.
RETR afile
125-Tagged ASCII file translated with current data connection translation table
Sending data set /u/user33/tagging2/afile
Transfer completed successfully.
200 bytes transferred in 0.005 seconds. Transfer rate 38.00 Kbytes/sec.

Command: get e file
PORT 9,67,113,57,4,126
Port request OK.
RETR efile
125-Tagged EBCDIC file translated with table built using file system cp=ISO8859-1,
network transfer cp=ISO8859-1
Sending data set /u/user33/tagging2/efile
Transfer completed successfully.
200 bytes transferred in 0.005 seconds. Transfer rate 40.00 Kbytes/sec.

Command: ebcdic
TYPE E
Representation type is Ebc dic NonPrint

Command: site sbd=(IBM-1047,ISO8859-1)
SITE sbd=(IBM-1047,ISO8859-1)
Site command was accepted

Command: get a file
PORT 9,67,113,57,4,142
Port request OK.
RETR afile
125-Tagged ASCII file translated with table built using file system cp=ISO8859-1,
network transfer cp=ISO8859-1
Sending data set /u/user33/tagging2/afile
Transfer completed successfully.
200 bytes transferred in 0.005 seconds. Transfer rate 38.00 Kbytes/sec.
1. Change the data type to ASCII.
2. Site command requests a file system code page ISO8859-1, an ASCII code page.
3. Put a file and name it afile.
4. Site command requests a file system code page IBM-1047, an EBCDIC code page.
5. Put a file and name it efile.
7. Put a file and name it ufile.
8. Use the `ls` subcommand to determine whether files in a UNIX System Services file system are tagged (that is, have a file tag). You use the `-T` option to request the file tagging information. When options are specified on the `ls` subcommand, name parameters cannot be specified.
9. afile is a tagged file. Its file system code page is ISO8859-1. It is a Text file.
10. efile is a tagged file. Its file system code page is IBM-1047. It is a Text file.
11. ufile is an untagged file. It is not a Text file.
12. Retrieve afile, which is a tagged file.
13. Client receives an indication that the tagged file is translated using the current tables because the current data connection tables were not specified with a network transfer code page (see 6).
14. Since this is an untagged file, no indication is needed about the tables used.
15. Specify translation tables with a file system code page and a network transfer code page.
16. The code page of the tagged ASCII file is used with the network transfer code page to translate the data in the file.
17. The code page of the tagged EBCDIC file is used with the network transfer code page to translate the data in the file.
18. Change the data type to EBCDIC.
The 557 reply informs the client that the data type must be ASCII when the file that is tagged as ASCII is retrieved.

The EBCDIC file is OK to send with data type EBCDIC since no translation occurs and the data is already EBCDIC.

Binary file transfers

If you put data into a z/OS UNIX file system file when the data type is binary, the file is tagged as a binary file. The following client session example shows the effects of the binary file tagging:

Request binary data type.

Use the `ls` subcommand to determine whether files in a UNIX System Services file system are tagged. You use the `-T` option to request the file tagging information. When options are specified on the `ls` subcommand, name parameters cannot be specified.

The tagging information shows that the file is a binary file.

The 557 reply informs the client that the data type must be binary when the file is retrieved.

Db2 query support

This topic describes how to use the FTP client Db2 query support and how to diagnose SQL problems.
Steps for using FTP client SQL support
Complete these steps so that you can use the FTP client to submit queries to the Db2 subsystem.

Procedure
Perform the following steps:
1. Start the Db2 subsystem.
2. BIND the DBRM called EZAFTPMQ. This must be done whenever the part EZAFTPMQ.CSQLMVS has been recompiled.
   The DBRM must be bound into the plan named EZAFTPMQ, unless the keyword DB2PLAN was used in your FTP.DATA file to specify a different plan name.
3. Grant execute privilege to the public for the plan created in the previous step.

Results
To use the FTP client to submit a query to Db2 and send the output to the FTP server, issue the following commands as necessary:
• LOCSITE FILETYPE=SQL
• LOCSITE DB2=\(db2name\) where \(db2name\) is the name of a Db2 subsystem at the local host
• PUT \(fname1\) \(fname2\) where \(fname1\) is a local file that contains a SQL SELECT statement

Symptoms of SQL problems
Table 29 on page 446 and Table 30 on page 447 show some symptoms and possible causes of SQL problems.
Table 29 on page 446 shows problems that generate a reply beginning with 55x.

<table>
<thead>
<tr>
<th>Reply</th>
<th>Output file</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZA2570E: Transfer aborted: SQL PREPARE/DESCRIBE failure</td>
<td>The output file contains the SQL code and error message returned by the Db2 subsystem.</td>
<td>• A syntax error in the SQL statement in the host file. • The time stamp in the load module is different from the BIND time stamp built from the DBRM (SQL code = -818). This occurs if a BIND was not done for the EZAFTPMQ DBRM that corresponds to the current load module, or if the server is not configured to use the correct Db2 plan name. If this is the problem, every SQL query submitted through the FTP server fails.</td>
</tr>
<tr>
<td>EZA2573E: Transfer aborted: unsupported SQL statement</td>
<td>No output is sent from the host.</td>
<td>The file type is SQL, but the host file being retrieved does not contain an SQL SELECT statement.</td>
</tr>
<tr>
<td>EZA2568E: Transfer aborted: attempt to connect to (db2name) failed (code)</td>
<td>No output is sent from the host.</td>
<td>• The locsite (db2name) specifies a nonexistent Db2 subsystem. • The Db2 subsystem has not been started.</td>
</tr>
</tbody>
</table>
Table 29. SQL problems generating 55x replies (FTP Client) (continued)

<table>
<thead>
<tr>
<th>Reply</th>
<th>Output file</th>
<th>Possible causes</th>
</tr>
</thead>
</table>
| EZA2569E: Transfer aborted: SQL not available. Attempt to open plan <planname> failed (DB2_reason_code). | No output is sent from the host | • BIND was not done for the specified plan.  
• BIND was done for plan name other than EZAFTPMQ, but FTP.DATA does not contain a DB2PLAN statement to specify this plan name.  
• User does not have execute privilege for the Db2 plan being used by the FTP server. |
| EZA2740E: SQL query not available. Cannot load CAF routines. | No output is sent from the host. | The DSNLOAD library is not in the link list or the FTP server STEPLIB.                                                                     |

Note: For more information about these messages, see z/OS Communications Server: IP and SNA Codes.

Table 30 shows other SQL problems.

Table 30. Other SQL problems (FTP Client)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible causes</th>
</tr>
</thead>
</table>
| Output file contains only the SQL SELECT statement. | • The file type is SEQ, rather than SQL If the file type is SEQ, a retrieve is done, but the local file is sent to the server. The query is not submitted to the Db2 subsystem.  
• The SELECT is for a VIEW for which the user ID does not have Db2 select privilege. The Db2 subsystem returns an empty table. |
| Connection terminated.                              | The processing time needed by Db2 or FTP or both for the SQL query has exceeded the server time limit for send or receive.  
If you are using the MVS FTP server and the server trace shows a select error due to a bad file descriptor, check the inactive time set for the server and, if necessary, increase the time.  
An FTP client trace indicates the amount of SQL activity through FTP and the approximate time when each query is processed. |

Restarting file transfers

A valid restart of an interrupted file transfer depends on reestablishing the environment that existed at the time the file transfer failed. Environment includes:

• The current FTP.DATA statements  
• The current SITE and LOCSITE settings  
• The sequence of commands (such as Type, Mode, and Structure) that affect the way FTP transfers files  
• The current translation tables in use on the data connection
Restriction: All environment settings must be re-created before attempting to restart a file transfer.

The following sections describe some possible problems that you might encounter.

**Client rejects the RESTART subcommand**

Use the following checklist if the client rejects the RESTART subcommand:

- Verify that you have re-created the original file transfer environment.
- Verify that your environment met all the restrictions for the RESTART subcommand.
- Verify that checkpointing was active during the failed file transfer.
- See z/OS Communications Server: IP User’s Guide and Commands for information about RESTART subcommand restrictions and checkpointing a file transfer.

**Client rejects SRESTART subcommand**

Use the following checklist if the client rejects the SRESTART subcommand:

- Verify that you have re-created the original file transfer environment.
- Verify that the environment met the SRESTART subcommand restrictions.
- See z/OS Communications Server: IP User’s Guide and Commands for information about SRESTART subcommand restrictions. Unlike the restart subcommand, you do not need to activate checkpointing, but you do need to enter the SRESTART parameters correctly.

**Client accepts SRESTART subcommand, but server rejects RESTART**

Use the following checklist if the client accepts SRESTART subcommand, but server rejects RESTART:

- Verify that the server supports stream mode restarts by issuing a FEAT command to the server. The FEAT reply l includes the keyword REST_STREAM if the server supports stream mode restarts.
- Some FTP servers other than z/OS FTP servers reply to the FEAT command with REST_STREAM when they support stream mode restarts in one direction only, such as server to client file transfers. Contact the provider of the FTP server software to verify the server support stream restarts for the direction of the transfer you are attempting.
- Verify that the server has recreated the environment extant during the failed file transfer.
- Did you restart a retrieve and SBSENDEOL is configured to a value other than CRLF at the server, and the server is a z/OS FTP server? If so, you cannot restart the file transfer. Retrieve the file from the server again.

**Diagnosing FTP connection and transfer failures with EZA2589E**

EZA2589E is issued to describe a timeout or interruption while the FTP client was processing. The following example shows the message format:

```
EZA2589E Connection to server interrupted or timed out. operation
```

The message indicates the operation that was in progress when the FTP interruption occurred. Each operation is listed below along with the timer being used and the suggested response. Timers can be set individually in FTP.DATA, or all the timers can be set to one value using the (TI xx or -t xx option when starting the FTP client. See z/OS Communications Server: IP User’s Guide and Commands for more information regarding the timers.

If the message was generated due to a user interruption, such as using Ctrl-C, ensure the FTP client had enough time to complete before being interrupted. In some cases, a packet trace or a CTRACE might be required to determine why the message was issued. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 or INFOAPAR II12014 for instructions for taking packet traces and CTRACES.

For more information about EZA2589E, see z/OS Communications Server: IP Messages Volume 1 (EZA).
Values and explanations for operation in EZA2589E

This topic lists and describes the values for operation in EZA2589E.

Initial Connection

Timer
MYOPENTIME

Explanation
The FTP client is trying to establish a connection with the FTP server. Either the TCP connection has not completed yet or the initial reply from the server has not been received.

User Response
Ensure the remote server responds to a ping request. The value of MYOPENTIME can be increased to allow more time for the server to send the initial reply. If the problem recurs, contact the system programmer.

System Programmer Response
If there are firewalls between the FTP client and FTP server, ensure the firewalls are allowing FTP traffic from the client IP address to the FTP server for the port being used. A packet trace of the failing transfer shows whether the TCP connection has been completed, the IP addresses being used, and any replies sent by the server.

Initial IPv6 connection

Timer
MYOPENTIME

Explanation
The FTP client is trying to establish a connection with an FTP server using an IPv6 address. Either the TCP connection has not completed yet, or the initial reply from the server has not been received.

User Response
Ensure the remote server responds to a ping request. The value of MYOPENTIME can be increased to allow more time for the server to send the initial reply. If the problem recurs, contact the system programmer.

System Programmer Response
If there are firewalls between the FTP client and FTP server, ensure the firewalls are allowing IPv6 FTP traffic from the client to the FTP server for the port being used. A packet trace of the failing transfer shows if the TCP connection has been completed, the IP addresses being used, and any replies sent by the server.

Waiting for data connection

Timer
INACTTIME

Explanation
The FTP client is waiting for the FTP server to establish a data connection. A PORT or EPRT command, shown in a previous EZA1701I message, has been sent to the FTP server indicating the IP address and port on which the client is listening. The server should initiate a TCP connection to the FTP client. This connection has not completed yet.

User Response
Increase the value of INACTTIME and try again. Contact the system programmer if the failure recurs.

System Programmer Response
Ensure that active data connections or PORT or EPRT commands are allowed by any firewalls between the client and server. Take a packet trace of the failure to determine whether the remote FTP server has attempted the connection to the FTP client. If the packet trace does not show an SYN packet arriving from the server to the specified IP address and port, investigate the FTP server and the path to the FTP client to determine whether the connection is being blocked. If the FTP client is not responding to the SYN packet, take a CTRACE (with options TCP and INTERNET)
and a packet trace. Send these to IBM customer service. The FTP client could also be configured to use firewall friendly data connections by issuing the `locsite fwfriendly` subcommand before the `get` or `put` subcommand or by coding FWFRIENDLY TRUE in FTP.DATA. This might allow the data connection to complete because it causes the client to send a PASV or EPSV command instead of a PORT or EPRT command.

**Guideline:** The PORT or EPRT command sent to the server determines the port and IP address the FTP server connects to. For EPRT, the format is EPRT |X|Y|Z|, where X is the address family, Y is the IPv4 or IPv6 address and Z is the port. For the PORT command, the port being used must be calculated. For PORT, the format is a,b,c,d,x,y, where a.b.c.d is the IPv4 address, and (x * 256) + y is the port number.

**Sending a command**

**Timer**
- **INACTTIME**

**Explanation**
The FTP client has timed out sending a command to the FTP server. This indicates that the TCP layer is unable to transmit data to the remote server.

**User Response**
Contact the system programmer.

**System Programmer Response**
Take a packet trace to investigate the TCP traffic between the two hosts.

**Sending ABORT command**

**Timer**
- **INACTTIME**

**Explanation**
The FTP client has timed out sending an ABORT command to the FTP server. This indicates that the TCP layer is unable to transmit data to the remote server.

**User Response**
Contact the system programmer.

**System Programmer Response**
Take a packet trace to investigate the TCP traffic between the two hosts.

**Receiving data**

**Timer**
- **DATACTTIME**

**Explanation**
The FTP client is waiting for data from the FTP server on the data connection. A full buffer of data has not arrived within the DATACTTIME seconds, or the FTP client was interrupted by the user before a full buffer of data arrived. The FTP client issues a recv() call, which returns only when its buffer is full or when the connection has ended. The FTP client uses a default buffer size of 180K. The FTP client is dependent on the data connection closing cleanly. This informs the FTP client that all the data has arrived from the server. If the connection does not close cleanly, this message is issued.

**User Response**
Increase the DATACTTIME to allow more time for data to arrive. If the failure recurs, contact the system programmer.

**System Programmer Response**
Take a packet trace to investigate the data transfer. The packet trace should be analyzed for conditions which would slow down the transfer, such as retransmitted packets or decreasing window sizes. Increasing the DATACTTIME can allow the FTP client more time to recover from these types of network issues. DATACTTIME should also be increased for transfers over low-bandwidth connections, such as dialup. If the packet trace shows that the connection does not
close cleanly (for example, the FIN packet is not properly acknowledged), the remote server might need to be investigated as well.

**Tip:** For best results, specify the Session option when formatting the packet trace.

### Sending data

**Timer**

DATACTTIME

**Explanation**

The FTP client has timed out sending data to the FTP server over the data connection. The FTP client sets a timer to the value of DATACTTIME seconds before issuing a send call. If the send does not complete in that time period or the FTP client is interrupted by the user, the FTP transfer fails. This timeout can be caused by a slowdown in the transfer, such as network congestion or the remote machine not accepting data.

**User Response**

Increase the value of DATACTTIME to allow more time for the data transmission to occur. If the failure recurs, contact the system programmer.

**System Programmer Response**

Take a packet trace to investigate the data transfer. Analyze the trace for causes of a slowdown. For slow networks, such as dialup, increase the DATACTTIME. If the packet trace shows many retransmitted packets, investigate the network to determine why packets are being dropped.

The window size advertised by the FTP server can also slow down the connection. If the FTP server is advertising a small window size, investigate the server to determine whether the window size can be increased. If the FTP server is very busy, causing the window size to decrease or even go to 0, increase the DATACTTIME to allow more time for the server to handle the data.

**Tip:** Specify the Session option when formatting the packet trace for best results.

### Waiting for reply

**Timer**

INACTTIME

**Explanation**

The FTP client is waiting for an expected reply from the FTP server on the control connection. The timer has expired, or the user has interrupted the FTP client before a reply was received. The reply from the FTP server tells the FTP client whether the previous command was successful or not. When a reply is not received, the FTP client must assume that the command was not successful.

**User Response**

INACTTIME could be increased to allow the FTP server more time to reply. If the failure recurs, contact the system programmer.

**System Programmer Response**

For long running jobs, firewalls might timeout the control connection due to inactivity. FTPKEEPALIVE can be coded in FTP.DATA to cause the TCP layer to send KeepAlive packets on the control connection. The firewalls can also be configured with longer inactive times. Use a packet trace to determine whether the replies arrive at the FTP client. If the packet trace does not show the FTP reply, determine where the reply is being rejected. Otherwise, contact the IBM Support Center to investigate the packet trace.

### Sending command to SOCKS server

**Timer**

INACTTIME

**Explanation**

The FTP client has timed out sending a command to the SOCKS server. This indicates that the TCP layer is unable to transmit data to the SOCKS server.

**User Response**

Contact the system programmer.
**System Programmer Response**

Take a packet trace to investigate the TCP traffic between the two hosts. Use the `locstat` subcommand to determine the IP address of the SOCKS server.

**Waiting for reply from SOCKS server**

**Timer**

INACTTIME

**Explanation**

The client is trying to establish a control or data connection to the FTP server through the SOCKS server. The client has sent a connection establishment SOCKS command to the SOCKS server and is waiting for a reply. The FTP client has timed out or been interrupted while waiting for the reply. The SOCKS server might not have replied because it was not processing SOCKS commands in a timely fashion; it was waiting for the remote FTP server to respond, or the SOCKS server did not process the FTP server response in a timely fashion.

**User Response**

INACTTIME can be increased to allow the SOCKS server more time to process commands. If the message occurred while trying to build a data connection through the SOCKS server, issuing the `locsite fwfriendly` subcommand prior to the `put` or `get` subcommand might allow the data connection to be built. If the failure recurs, contact the system programmer.

**System Programmer Response**

Verify with the administrator of the SOCKS server that the server is receiving the commands and processing them in a timely fashion. The IP address of the SOCKS server can be determined with a `locstat` command. Ensure that the SOCKS server can communicate with the FTP server. Firewalls between the SOCKS server and the FTP server must allow FTP connections and FTP data connections. Take a packet trace to trace the network traffic between the FTP client and SOCKS server. An FTP client trace, enabled by coding DEBUG SOC(2) and DUMP 85 in FTP.DATA, shows the SOCKS commands sent to the server. If a firewall is blocking the data connection, issuing the `locsite fwfriendly` subcommand prior to the `put` or `get` subcommand or specifying FWFRIENDLY TRUE in FTP.DATA might allow the data connection to complete.

**Establishing data connection through SOCKS server**

**Timer**

MYOPENTIME

**Explanation**

The FTP client is trying to establish a TCP connection to the SOCKS server so that a data connection can be established to the FTP server. The client has already successfully logged into the FTP server using the SOCKS server. The TCP connection has not completed. The SOCKS server might be too busy to accept new connections in a timely fashion.

**User Response**

The value of MYOPENTIME can be increased to allow more time for the SOCKS server to accept the connection. If the failure recurs, contact the system programmer.

**System Programmer Response**

Contact the administrator of the SOCKS server to determine whether the SOCKS server is accepting new connections. Take a packet trace to verify that the SOCKS server is not responding to the connection attempt.

**Initial connection to SOCKS server**

**Timer**

MYOPENTIME

**Explanation**

The FTP client is trying to establish a TCP connection to the SOCKS server so that a control connection can be established with the FTP server. The TCP connection has not completed. The SOCKS server might be too busy to accept new connections in a timely fashion.
User Response

Use the **locstat** subcommand to determine the IP address of the SOCKS server. Verify that the SOCKS server is reachable by pinging the server. Increasing the value of MYOPENTIME allows the SOCKS server more time to accept the connection. If the problem recurs, contact the system programmer.

System Programmer Response

Verify that the SOCKS server is reachable. Contact the administrator of the SOCKS server to determine whether the SOCKS server is accepting new connections. Take a packet trace to determine whether the TCP connection to the SOCKS server completes. Use the **locstat** subcommand to determine the IP address of the SOCKS server; the port number of the SOCKS server is always 1080.

Diagnosing FTP client user exit problems

This section lists and describes possible problems when you install and use the FTP client security user exits.

**Message EZA1555I is displayed**
The FTP client displays the EZA1555I CSVDYNEX request failed for user exit **exitname**, RETURN CODE: x'rc' REASON CODE x'rsncode' message. This occurs when a DES (Dynamic Exits Services) CSVDYNEX request for the FTP client security exits fails. For more information about the return and reason codes for CSVDYNEX macro, see Return and reason codes in z/OS MVS Programming: Authorized Assembler Services Reference ALE-DYN.

**Message EZA1548I is displayed**
The FTP client displays the EZA1548I User exit **exitname** module **modname** abended with abend code x'rc' and abend reason code x'rsncode' message. This occurs when an FTP client user exit ends abnormally. The MVS console or the system log has the information about the abend code and abend reason code. See z/OS MVS System Codes for an explanation and programmer response.

**Message EZA1545I is displayed**
The FTP client displays the EZA1545I Return code rc from user exit **exitname** module **modname** is ignored message in the following situations:

- When the user exit routine is to modify the arguments of commands such as AUTH, EPRT, EPSV, MODE, PBSZ, PORT, PROT, REST, SITE, STRU, TYPE and XLM. Modifying these command arguments leads to unexpected failures because of desynchronization between the FTP client and server, so the modified arguments of these commands are ignored. Correct the user exit routine so that it does not modify the arguments of these commands.
- When the user exit routine is to reject the QUIT command. Correct the exit routine to accept the QUIT command.
- When the user exit routine is to end the FTP client when the QUIT command is from the QUIT subcommand. The FTP client ends as part of QUIT subcommand processing, and it must send QUIT to the server before the client ends. Correct the exit routine to accept the QUIT command. The exit routine does not need to end the FTP client in this circumstance.
- When the user exit routine is to modify the arguments of RETR or STOR during a load module transfer. Changing the arguments of RETR or STOR during a load module transfer leads to unpredictable results. Correct the exit routine so that it does not modify the arguments of these commands when transferring a load module.
- When the user exit routine is to end the FTP client and the reply is 221 Quit command received, it is from the QUIT subcommand. The FTP client always ends when it completes QUIT subcommand processing. The exit routine does not need to end the FTP client in this circumstance.
• When the user exit routine is to end the FTP client and the reply starts with reply code in the range 100 - 199. It leads to unpredictable results. Correct the exit routine to accept replies with reply codes in the range 100 - 199.

The FTP client exits unexpectedly, without the user issuing a QUIT subcommand

Message EZA1546I appears
The FTP client displays the EZA1546I User exit exitname module modname ended the FTP client - exit reason code x'hexadecimal-rsncode' (decimal-rsncode) message. Inspect the optional EZA1556I and EZA1546I messages that are displayed by the FTP client to determine why the user exit routine ended the FTP client. No further action is needed if the explanation is satisfactory, and it is appropriate for the exit routine to end the FTP client. Otherwise, correct the user exit routine. See FTP client user exits in z/OS Communications Server: IP Configuration Reference for more information.

Message EZA1549I appears
The FTP client displays the EZA1549I User exit exitname module modname returned an invalid return code rc message. This occurs when the FTP EZAFCCMD client user exit returns a value in register 15 that is not 0, 4, 8 or 12, or when the FTP EZAFCREP client user exit returns a value in register 15 that is not 0 or 12. The systems programmer needs to inspect the messages displayed by the FTP client and correct the user exit routine.

The user exit routine that is installed cannot be called
The FTP client displays the EZA1555I CSVDYNEX CALL failed for user exit exitname, RETURN CODE: x'04' REASON CODE: x'00000406' message. This occurs when no active exit routine is associated with the user exit. This can happen when the exit routine ends abnormally, or is deleted by the operator while an FTP client is logged in to an FTP server. If the exit routine ends abnormally, EZA1548I provides information about the abend code and abend reason code. See "Message EZA1548I is displayed" on page 453 for an explanation and response. Otherwise, see Return and reason codes in z/OS MVS Programming: Authorized Assembler Services Reference ALE-DYN for more information.

The FTP subcommand failed

Message EZA1532I appears
The FTP client displays the EZA1532I User exit exitname module modname modified the command arguments message when the FTP EZAFCCMD client user exit modified the command arguments. If the command arguments are modified to an invalid value, the subcommand might fail. You might need to correct the user exit routine modname.

Message EZA1533I appears
The FTP client displays the EZA1533I User exit exitname module modname prevented user userid from sending command command - exit reason code x'hexadecimal-rsncode' (decimal-rsncode) message. Inspect the optional EZA1556I and EZA1533I messages that are displayed by the FTP client to determine why the user exit routine rejected the FTP command. If it is appropriate for the exit routine to reject the FTP command, no further action is needed; otherwise, correct the user exit routine modname.

Problems starting the client
This topic lists and describes possible problems starting the FTP client.

Enabling or suppressing message EZYFT47I during startup
When the FTP client reads a statement in FTP.DATA that is supported by the z/OS FTP server but not by the FTP client, it issues the message EZYFT47I as a warning. For example, if the client finds an ANONYMOUS statement in FTP.DATA, it issues EZYFT47I for that statement because the ANONYMOUS statement has meaning only for the z/OS FTP server.
If you use the same FTP.DATA configuration file for both client and server, you might want to suppress the EZYFT47I messages. You can prevent the client from issuing this warning by coding a SUPPRESSIGNOREWARNINGS statement in FTP.DATA. Code SUPPRESSIGNOREWARNINGS in FTP.DATA only after you verify all statements in FTP.DATA are correct.

If you require message EZYFT47I for diagnostic purposes, verify no SUPPRESSIGNOREWARNINGS statements are coded in FTP.DATA, or else code SUPPRESSIGNOREWARNINGS FALSE in FTP.DATA ahead of those statements you want to debug.

**Abends**

If the client abends immediately after the FTP command is entered and the following message is displayed, ensure that an OMVS segment is defined for the local TSO user ID or that automatic assignment of unique UNIX identities support is enabled:

```
ftp
CEE5101C During initialization, the OpenEdition callable service
BPX1MSS failed. The system return code was 000000156,
the reason code was 0B0C00FB. The application will be
terminated.
IKJ356641I FTP ENDED DUE TO ERROR+
READY
```

**Incorrect configuration values**

Issue the LOCSTAT subcommand to determine the name of the file being used for your local site configuration parameters. If the file you want is not being used, start the FTP client with the -d or TRACE options to trace the client as it follows the search order for the FTP.DATA file. For more information about the search order used by the client, see z/OS Communications Server: IP User’s Guide and Commands.

Determine whether your FTP.DATA file has sequence numbers. If it does, any statement with an optional parameter omitted picks up the sequence number as the parameter value. For example, the BLKSIZE statement has an optional parameter size. If you specify the size, the sequence number is ignored. If you do not specify the size, the system assumes the sequence number is the size, causing an error.

**Problems logging in to the server**

This topic lists and describes possible problems logging in to the server.

**Client ignores SOCKS configuration file**

If you suspect that the client consistently ignores the SOCKS configuration file, use the locstat subcommand to display the name of the SOCKS configuration file.

- If no SOCKS configuration file name appears in the LOCSTAT output, the client is not configured correctly. Verify that a SOCKSCONFIGFILE statement is in FTP.DATA.
- Inspect the client syslog output for error messages relating to SOCKSCONFIGFILE in FTP.DATA. Use the client DEBUG INT statement to trace client initialization, and look for messages relating to the SOCKS configuration.

The FTP client references the SOCKSCONFIGFILE only when it is connecting to servers with IPv4 IP addresses; it is supposed to ignore the SOCKSCONFIGFILE when logging in to an FTP server with an IPv6 IP address. If you specify the FTP server by DNS name, that name might resolve to an IPv6 address rather than to an IPv4 address. Use the locstat subcommand to display the IP address used to log in to the server; the port number of the SOCKS server is always 1080.

**Client connects to wrong SOCKS server**

If the client connects to a wrong SOCKS server; to a SOCKS server when it should not, or ignores SOCKS configuration file some of the time, use the locstat subcommand to display the name of the SOCKS configuration file.

- If the name displayed is not correct, correct the SOCKSCONFIGFILE statement in FTP.DATA.
• If the SOCKS configuration file name displayed by LOCSTAT is correct, inspect the contents of the
SOCKS configuration file.

The client processes the statements in the order they are coded and applies the first statement that
specifies the target FTP server. Check and arrange the statements as appropriate, or add a new
statement specific to the FTP server at the beginning of the file.

Connection through SOCKS server to FTP server fails
A SOCKS connection involves a connection between the client and SOCKS server, and the SOCKS server
and the target server.

When a connection fails, try to isolate the point of failure by checking the following:

• Can client connect to the SOCKS server host?
  Use the client SOC(2) trace and the DUMP 85 trace during connection establishment, and inspect any
  messages to gain insight into whether the client was able to connect to the SOCKS server.

• Is the link between the client and the SOCKS server good?
  Use ping to test the link.

• Is the SOCKS server active?

• Is the SOCKS server configured to reject the connection?
  Contact the administrator of the SOCKS server for assistance.

• Is the link between the SOCKS server and the FTP server good?
  Ask the administrators of the SOCKS server and the FTP server to verify the link.

• Is the FTP server active and accepting connections?
  Contact the administrator of the FTP server. For the z/OS FTP server, activate the trace and check the
  syslog to determine whether the FTP server received a connection from the SOCKS server on behalf of
  the client.

Message EZA2589E appears while trying to log in
See “Diagnosing FTP connection and transfer failures with EZA2589E” on page 448.

Server rejects password or password phrase
The z/OS FTP server supports case-sensitive passwords when your RACF administrator has enabled
mixed-case passwords. Verify that you have entered the password correctly, and in the correct case.
Password phrases used to log in to a z/OS FTP server are always case-sensitive.

If you are using a NETRC file or data set to provide the FTP login password, verify that the password is
coded correctly and in the correct case.

If the z/OS FTP server rejects a mixed-case or lower-case password that it formerly accepted, it is
possible your RACF administrator has disabled RACF mixed-case password support. In that case, it is not
possible to log in with any ID whose password has been set to mixed or lower case. Ask your RACF
administrator to reset the password.

If the server rejects a password of more than one token, verify that you enclosed the password phrase
with quotation marks when you entered it, or when you coded it in the NETRC file or data set.

FTP clients send passwords to the FTP server as ASCII-encoded data. The server must translate the
password or password phrase to its native EBCDIC code page because passwords and password phrases
are defined to your z/OS security product as EBCDIC strings. If any character of the password phrase does
not translate into the correct character, the password will not match the password assigned to the user
ID, and logging in will fail. A character might not translate correctly for the following reasons:

• The client and server are using different ASCII code pages for the control connection. Verify that the
  client and server are using the same code page for the control connection.
• The client is EBCDIC-based and is using a different EBCDIC code page than the server. Verify that the client and server are using the same native code page.

• The client and server are using matching code pages, but one or more characters in the password phrase does not translate into the correct character. Verify that each character assigned to the password phrase can be translated from EBCDIC to ASCII, and from ASCII back to the original EBCDIC character.

**Unknown host error message**

The FTP client displays EZA1551I Unknown Host: <hostname> if it receives a negative response from the resolver. This occurs when the hostname specified on the FTP command cannot be resolved either by the name server or the local resolution file.

**Rule:** The FTP client always uses the z/OS UNIX search order for TCPIP.DATA, even when FTP is invoked from TSO.

Use the host IP address instead of the hostname on the FTP command, or see Chapter 37, "Diagnosing resolver problems," on page 767 for information about diagnosing name server problems.

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**Problems transferring data**

This topic lists and describes possible problems transferring data.

Many data transfer problems that apply to a server apply also to a client. See “Cannot establish conversion between <codeset> and UCS-2 ” on page 457 for more information.

**Cannot establish conversion between <codeset> and UCS-2**

If you invoke the FTP client under TSO, and issue a TYPE U2 or UCS2 subcommand, the following message might be issued:

```
EZA2749E Cannot establish conversion between <codeset> and UCS-2.
```

To transfer data encoded in UCS-2 during an FTP session, invoke the FTP command with the _ICONV_UCS2_PREFIX environment variable, specifying the prefix used for your runtime library. Following is an example:

```
FTP ENVAR("_ICONV_UCS2_PREFIX=CEE.OSVIR4") / <host_ip_addr> <port>
```

**Secure IPv4 FTP session cannot transfer data through an NAT firewall**

If you are using an encrypted FTP control connection, as is the case when using AT-TLS security, and the client sends PASV or PORT to establish a data connection for file transfer, and a NAT (network address translation) firewall exists between the client and server, you might find that while you could sign into the server, you cannot establish the data connection for the transfer. This is because a NAT firewall monitors the FTP control connection as well as the IP headers, changing IP addresses as needed. If the control connection is encrypted, the NAT cannot monitor and change the IP addresses exchanged between the FTP client and server by PASV and PORT.

Use the locsite subcommand with the EPSV4 parameter, or code EPSV4 TRUE in FTP.DATA, to direct the client to use EPSV instead of PORT or PASV on IPv4 sessions to establish the data connection. The EPSV command exchanges only port numbers between FTP client and server, so the NAT firewall does not need to translate IP addresses. The server must support EPSV on IPv4 sessions for this solution to be effective.

If the server does not support the EPSV command, you can use the PASSIVEIGNOREADDR configuration option to ignore the IP address that is returned on a PASV command reply and use only the port. For more information about the EPSV command, see RFC 2428. For more information about the LOCSITE subcommand, see z/OS Communications Server: IP User's Guide and Commands and z/OS Communications Server: IP System Administrator's Commands. For more information about the EPSV4 or PASSIVEIGNOREADDR statement in FTP.DATA, see z/OS Communications Server: IP Configuration Reference.

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Diagnosing File Transfer Protocol (FTP) problems 457
Firewall does not permit FTP client to establish a data connection

You might be able to log in to an FTP server through a firewall, but find you cannot transfer files using a passive data connection. The reason is that the ephemeral ports chosen for the data connection are outside the range of ports permitted by the firewall.

If the client sends EPSV or PASV to the server to start the data connection, FTP is establishing a passive data connection, or is operating in passive mode. In passive mode, the server chooses the ephemeral port for the data connection. Ephemeral port numbers are part of EPSV and PASV replies the server sends to the client. You can configure the z/OS FTP server to use only a specific range of ephemeral ports for the data connection that are compatible with what you have configured for your firewall by coding the PASSIVEDATAPORTS statement in FTP.DATA. See z/OS Communications Server: IP Configuration Reference for information about the PASSIVEDATAPORTS statement. Alternatively, you can restrict the range of ephemeral ports that are available to TCP/IP by coding the EPHEMERALPORTS parameter on the TCPCONFIG configuration statement. See the description of the EPHEMERALPORTS parameter in the TCPCONFIG configuration statement section in z/OS Communications Server: IP Configuration Reference for more information about the EPHEMERALPORTS parameter.

Result: Both FTP and non-FTP applications use ephemeral ports that are within the EPHEMERALPORTS range.

If the client sends PORT or EPRT to the server to start the data connection, the client is said to be establishing an active data connection, or operating in active mode. Active mode FTP is not recommended for sessions through firewalls. Use the locsite subcommand with the FWFRIENDLY parameter, or code FWFRIENDLY TRUE in FTP.DATA, to direct the client to operate in passive mode.

Server rejects PORT or EPRT command with 504 replies

Data transfer command sequences that use the PORT or EPRT command fails when the server that receives the PORT or EPRT command is configured to reject all or certain PORT and EPRT commands. The reply code 504 indicates a problem of this nature.

For an ordinary transfer of data between client and server, the z/OS FTP client sends the PORT command to server when:

• The server does not support the EPSV command or the FTP session protocol is IPv4, and
• The client is not configured to be firewall-friendly

You can correct this problem in one of the following ways:

• Make the client firewall-friendly. Do this for the z/OS FTP client by coding FWFRIENDLY TRUE in the client FTP.DATA or by using a LOCSITE FWFRIENDLY subcommand before attempting the data transfer. The client sends EPSV or PASV to the server instead of PORT and the problem is avoided.
• Log in to the server using the server IPv6 address. The client uses EPSV instead of PORT and the problem is avoided.

Restriction: The server must have an IPv6 address.

• Change the server configuration so that it does not reject PORT or EPRT commands.
• Change the server so that it supports the EPSV command. The z/OS FTP server supports the EPSV command.

To change the client, see z/OS Communications Server: IP User's Guide and Commands for information about the FWFRIENDLY statement and the LOCSITE subcommand.

If you used the proxy subcommand to start the transfer, you are transferring data between two servers instead of between client and server. For a transfer of data between two servers, the client must send PORT or EPRT to one of the servers, and PASV or EPSV to the other server. If the server receiving the PORT or EPRT command is configured to reject the PORT or EPRT command, the proxy transfer fails with a 504 reply.

You can fix this problem in one of the following ways:
• Reverse the order in which you open the server connections. That is, if you opened a connection to ServerA and proxy opened a connection to ServerB, open the connection to ServerB and proxy open the connection to ServerA. The client then sends PORT or EPRT to the other server during the proxy transfer. Provided the other server does not also reject PORT or EPRT, this avoids the problem.

  **Restriction:** If the file you are transferring is a load module, changing the order in which you open server connections does not always cause the client to send PORT or EPRT to the other server.

• Transfer the file to a client, and then to the other server.

• Change the server so that it does not reject PORT and EPRT commands.

The following are z/OS server FTP.DATA statements that can be coded to reject PORT and EPRT commands:

**PORTCOMMAND**
- Reject all PORT and EPRT commands.

**PORTCOMMANDPORT**
- Reject PORT and EPRT commands whose port number argument is a well-known port number.

**PORTCOMMANDIPADDR**
- Reject PORT and EPRT commands whose argument is an IP address that is different from the client's IP address.

See z/OS Communications Server: IP Configuration Guide for more detail.

**Message EZA2589E appears when trying to transfer data**

See “Diagnosing FTP connection and transfer failures with EZA2589E” on page 448.

**Message EZA1771I is displayed**

The FTP client displays the EZA1771I subcommand fails: name is of an unsupported type message. This message is issued when the data set being transferred is not supported by the MVSGet or MVSPut subcommand. The supported data set types are z/OS physical sequential data set, z/OS partitioned data set, z/OS libraries, and z/OS generation data sets. See the MVSGET subcommand or the MVSPut subcommand in z/OS Communications Server: IP User's Guide and Commands for more information.

**Message EZA1776I is displayed**

The FTP client displays the EZA1776I subcommand fails: the target generation data set must be a positive relative reference message. This message is issued when the MVSGet or MVSPut subcommand is being transferred into a generation data set by using a negative or current reference. See z/OS DFSMS Using Data Sets for information about Processing Generation Data Groups.

**Message EZA1777I is displayed**

The FTP client displays the EZA1777I subcommand fails: the target generation data set cannot be a library message. This message is issued when the MVSGet or MVSPut subcommand is transferring a library into a generation data set. But the generation data sets cannot be PDSEs, UNIX files, or VSAM data sets. See z/OS DFSMS Using Data Sets for information about Processing Generation Data Groups.

**Message EZA1778I is displayed**

The FTP client displays the EZA1778I the target generation data set must be referenced using its absolute name when the source data set is a PDS message. When FTP is transferring a PDS into a generation data set, you must reference the generation data set by its absolute data set name. See z/OS DFSMS Using Data Sets for information about Processing Generation Data Groups.
The target data set does not match the source data set using the MVSGet or MVSPut subcommand

FTP can determine approximate values for only the primary and secondary allocation and space type, but it uses an allocation that is large enough to contain the data. For complete control over the initial allocation, use the locsite (site) subcommand with the get (put) subcommand instead of the MVSGet (MVSPut) subcommand.

The MVSGet or MVSPut subcommand fails when transferring a physical sequential extended format data set

When the source data set is of physical sequential extended format, the target data set is allocated as if the DSNTYPE with SYSTEM value was configured. If the system default DSNTYPE value is not EXTREQ or EXTPREF, the source data set might exceed the architecture size limit of the system default DSNTYPE, and the transfer fails.

REStart the failed PDS and library data sets transfer for the MVSGet or MVSPut subcommand

The MVSGet or MVSPut subcommand supports checkpointing for block mode restart of interrupted file transfer for physical sequential data sets only.

Other problems

This topic lists and describes other problems diagnosing FTP connection and transfer failures.

Client PDS member statistics not created or updated

ISPFStats must be set to TRUE to create or update the statistics for the PDS Member when using GET and MGET subcommands. When the PDS directory block is full, PDS member statistics are not updated. Use the locstat subcommand to verify that the client’s ISPFSstats setting is TRUE. Use the LOCSITE ISPFStats subcommand change the ISPFSstats value. See z/OS Communications Server: IP User’s Guide and Commands for information about using the LOCSITE subcommand.

Diagnosing FTP client problems with tracing

You can activate tracing on startup by doing the following:

- Coding DEBUG statements in FTP.DATA. See the DEBUG statement in z/OS Communications Server: IP Configuration Reference for more information.
- Starting the FTP client with the -d command-line option. See z/OS Communications Server: IP User’s Guide and Commands for more information about the FTP environment.

Alternatively, you can activate tracing by toggling tracing on or off during an FTP session with the DEBUG subcommand.

You can activate FTP client extended trace at startup by coding one or more DUMP statements in FTP.DATA. See the DUMP statement in z/OS Communications Server: IP Configuration Reference for more information. Alternatively, you can toggle extended tracing on or off during an FTP session with the DUMP subcommand.

The DEBUG and DUMP subcommands activate the general and the extended levels of tracing. The general tracing shows key events in the processing of a subcommand (for example, the opening of a file) and the extended trace shows data areas that are used during processing. The extended trace produces large amounts of output and should be used at the direction of IBM service team. The format of DEBUG allows multiple parameters to be specified on one subcommand. See z/OS Communications Server: IP User’s Guide and Commands for the syntax and parameters for the DEBUG and DUMP subcommands.

For example, the following sequence of subcommands would set traces:

<table>
<thead>
<tr>
<th>DEBUG</th>
<th>ACC</th>
<th>SQL</th>
<th>*Activates the ACC and SQL traces</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEBUG</td>
<td>BAS</td>
<td></td>
<td>*Activates the default traces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CMD,</td>
<td>*CMD, INT, FSC, and SOC in addition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INT,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FSC,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SOC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*to the two already set</td>
</tr>
<tr>
<td>DEBUG</td>
<td></td>
<td></td>
<td>*Resets all tracing</td>
</tr>
</tbody>
</table>

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When running FTP interactively or from a REXX exec, all tracing goes to the terminal unless output is redirected. When running FTP from a TSO batch job, all tracing goes to SYSOUT.

Use the following checklist to diagnosis FTP client problems with tracing:

- Ensure that the user has properly allocated the DDNAME being referred to. The TSO LISTALC STAT HIST command can be helpful in debugging allocations. Also, ensure that the allocations are correct. For example, if a file already exists, the disposition should not be new.

- Ensure that DDNAMEs are only used to refer to local files. For example, GET //DD:FTP01 FILEONE is not valid because it attempts to use a DDNAME to refer to a host file. If you try to use a DDNAME for a remote file name, the name is sent to the remote host for processing as it is. If the remote host actually has a file named //DD:FTP01, then that file would be referred to, but most likely the remote host would reject it as a file name that is not valid.

- To find attempts to access files by DDNAME, look for DD: in FTP trace output as shown below:

```plaintext
MF0573 seq_open_file: OSTN -> w, recfm=*, NOSEEK for dd: FTP02
MF0663 seq_open_file: ddname FTP02 has filename USER1.COPYXLMT
MF0669 seq_open_file: set DDNAME characteristics- recfm=9, lrecl=128, blksize=614
```

**Tip:** By using DDNAME support, the user is assuming responsibility for correctly allocating and deallocating the DDNAMEs being used.

**Where to find the FTP client trace**

The destination of the z/OS FTP client trace depends on the environment in which the client executes as described as follows:

- When the FTP client is invoked interactively from TSO or a REXX exec with an allocated OUTPUT DD, the trace is written to the destination associated with the OUTPUT DD.

- When the FTP client is invoked interactively from a TSO session with no allocated OUTPUT DD, the trace is written to the user's console.

- When the FTP client is invoked interactively from OMVS, the trace is written to the user’s console, or it can be written to a file by using the OMVS redirect operand (>).

- When the FTP client is invoked interactively from a REXX exec with no allocated OUTPUT DD, the trace is written to the destination for STDOUT (which might be the user's console).

- When the FTP client is invoked from any application using the FTP Callable Application Programming Interface (API), the trace output is stored in the interface buffer until the application issues a request to retrieve the output. See z/OS Communications Server: IP Programmer's Guide and Reference for a complete description of the FTP Callable API.

**Rules:** When the FTP client is invoked from a batch job, the following rules apply:

- If the client is invoked directly (EXEC PGM=FTP), the trace is written to the destination associated with the OUTPUT DD.

- If the client is invoked from TSO in batch (EXEC PGM=IKJEFT01), the trace is written to the destination associated with the OUTPUT DD if one exists. Otherwise, the trace is written to the destination associated with the SYSTSPRT DD.

- If the client is invoked from a REXX exec in batch, whether under batch TSO, the trace is written to the destination for the OUTPUT DD (if one exists). Otherwise, the trace is written to the destination for STDOUT (under batch TSO, this might be the SYSTSPRT DD).

**Documenting FTP client problems**

If the problem is not caused by any of the common errors described in this section, collect the following documentation before calling the IBM Software Support Center. Documentation is divided into the following categories: essential and helpful (but not essential).

- **Essential**
  
  - Precise problem description, including client console, expected results, and actual results
Include trace in the output by one of these methods:

- Coding DEBUG statements in the client's FTP.DATA. See z/OS Communications Server: IP Configuration Reference for information about the DEBUG statement.
- Invoking the FTP client with the -d or TRACE invocation option. See z/OS Communications Server: IP User's Guide and Commands for information about entering the FTP environment.
- Specifying a DEBUG subcommand in the client command input stream before the affected transfer. Use this option only if the problem does not involve the initial establishment of the FTP control session.

 FTP.DATA file used by the client.

- You can use DEBUG ALL to capture all details possible.
- When activating the trace, use the DEBUG option TIMESTAMPS to time stamp the client trace output. See z/OS Communications Server: IP User's Guide and Commands for information about the DEBUG subcommand and z/OS Communications Server: IP Configuration Reference for information about the DEBUG statement.
- If executing the client in batch, collect all the JES output.

Helpful:

- Output from the client locstat subcommand
- Output from the client stat subcommand
- FTP.DATA data set
- TCPIP.DATA data set
- If appropriate, sample data to re-create the problem
- If the FTP.DATA parameter LOGCLIENTERR is TRUE, report the contents of message EZZ9830I. The message is written to the system log and the job log when the client is running in batch and to the user's terminal during an interactive client session.
Chapter 15. Diagnosing z/OS UNIX Telnet daemon (otelnethd) problems

This topic provides diagnostic information for z/OS UNIX Telnet daemon (otelnethd) and contains the following subtopics:

- “Common problems” on page 463
- “Debug traces” on page 464

Common problems

The following list describes common problems that you might encounter during execution of the Telnet daemon (otelnethd):

- Diagnostic messages are not being printed to the appropriate file.
  - The diagnostic messages are printed out with the use of syslogd. Ensure that the syslogd is currently active by checking for /etc/syslog.pid.
  - If syslogd is active, ensure that the file where the output is sent is currently allocated. Syslogd creates the file if it is started with the -c runtime option. z/OS UNIX Telnet uses local1.debug for logging messages. Ensure that the syslog.conf file contains an entry for local1.debug or the *.* default file. See the z/OS Communications Server: IP Configuration Guide for more detailed information about syslogd.
  - Ensure also that the specified file exists. Ensure that the permissions on the file are at a minimum 666.
  - Make sure you specify -t or -D all, or -t and -D all, as the z/OS UNIX Telnet options in /etc/inetd.conf.

- Use of the arrow keys.
  The arrow keys are not functional in raw mode. This is AIX-like behavior, except that, in AIX, the arrow key produces peculiar characters such as ¬-B on the screen to let the user know not to use arrows. Under rlogin, the cursor moves to where you would want it and correction is allowed, but the shell also treats these characters as part of the original command.

- The keyboard appears to be locked and the user cannot issue commands.
  When executing UNIX-type clients (for example, AIX), if the -k option is specified for Telnet in inetd.conf, Telnet does not allow kludge linemode (see “Setting up the inetd configuration file” on page 535). UNIX clients require character-at-a-time mode to process correctly. If you remove the -k option from the parameters, then the software processes correctly.

  If this does not work, run tracing -t D all. Look for Ept to determine what the exception conditions are for the pty. The number of bytes should equal four. Verify that the exception conditions identified are processed by the TN3270E Telnet server. (Check EZYTE67I messages for more information; see Figure 60 on page 465.)

  - EDC5157I An internal error has occurred, rsn=0b8802AF.
    The 2AF of the reason code signifies that the user did not have the proper authority to execute the command. This might result in either the user system having BPX.DAEMON authority set up in its environment, and the proper authorities have not been issued to the user. Another result might be that the user does not have super user authority, which might be required to issue some of these commands.
Table 31 on page 464 describes options that relate to user-controlled trace information.

### Table 31. Debug trace options

<table>
<thead>
<tr>
<th>Option</th>
<th>Sub-Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-t</td>
<td></td>
<td>Internal tracing, intended to replace the DIAGNOSTICS compile option currently in place within the BSD code.</td>
</tr>
<tr>
<td>-D</td>
<td>authentication</td>
<td>Turns on authentication debugging code.</td>
</tr>
<tr>
<td>-D</td>
<td>encryption</td>
<td>Turns on encryption debugging code.</td>
</tr>
<tr>
<td>-D</td>
<td>options</td>
<td>Prints information about the negotiation of TELNET options.</td>
</tr>
<tr>
<td>-D</td>
<td>report</td>
<td>Prints the options information, plus some additional information about what processing is going on.</td>
</tr>
<tr>
<td>-D</td>
<td>netdata</td>
<td>Displays the data stream received by telnetd.</td>
</tr>
<tr>
<td>-D</td>
<td>ptydata</td>
<td>Displays the data stream written to the pty.</td>
</tr>
<tr>
<td>-D</td>
<td>all</td>
<td>Supports all options/report/ptydata/netdata/authentication/encryption options.</td>
</tr>
</tbody>
</table>

### Debug trace flows (netdata and ptydata)

When issuing any of the following three trace commands within /etc/inetd.conf (-D ptydata, -D netdata, or -D all), you have the contents in both hexadecimal and ASCII, and the data being sent over the sockets or between the ttys in your syslogd file. If the user is having problems between the parent and the client, try the -D netdata option. If it is between the parent and the child, try the -D ptydata option. If both or either might apply, try the -D all option.

Each set of hexadecimal data is preceded by a three-letter tag. This tag represents the direction the data is flowing from. Figure 59 on page 464 is a pictorial representation of this flow.

- Int—client to parent
- Ont—parent to client
- Ipt—child to parent
- Opt—parent to child

The user types a command on the command line. It flows Int -> Opt. The child responds and the flow is Ipt -> Ont.

**Figure 59. Trace between the Telnet client, parent, and child**

### Debug trace examples (-t -D all)

Figure 60 on page 465 gives an example of the trace generated from `-t -D all`, generated from an AIX Telnet client. A trace explanation follows the figure.
Figure 60. z/OS UNIX Telnet trace using -t -D all

Diagnosing z/OS UNIX Telnet daemon (otelnetd) problems 465
AUTHENTICATION
NAME
u
s
r
5
2
>>TELNETD: Got NAME [user52]
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=465)

21 EZYTU17I UTILITY: receive suboption
AUTHENTICATION
IS
KERBEROS_V5
CLIENT/MUTUAL/ENCRYPT
AUTH 110 130 1 198 48 130 1 194 160 3 2 1 5 161 3 2 1 14 162 7 3 5 0 32 0 0 0
163 130 1 18 97 130 1 14 48 130 1 18 160 3 2 1 5 161 16 27 14 75 82 66 51 57 48
46 73 66 77 46 77 69 172 16 43 48 41 16 3 2 1 5 161 34 38 27 2 14 104 111 115
116 27 24 109 118 115 106 46 116 99 112 46 114 97 108 101 105 103 104 106 105 98
199 46 99 111 199 129 148 48 129 49 129 2 1 1 161 3 2 1 1 162 129 129 179 4
129 176 28 188 181 169 95 219 176 114 41 127 174 19 209 43 213 123 8 209 49 51
164 133 200 164 73 11 00 08 87 51 222

>>REPLY:2: [3] (91)
6f 59 30 57 a0 03 02 01 05 a1 03 02 01 0f a2 4b
>>REPLY:2: [2] (21)
75 73 65 72 30 32 46 4b 52 33 39 30 2e 49 42

23 EZYTU17I UTILITY: receive suboption
ENCRYPT
REQUEST-START

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TELNETD: He is supporting DES_OFB64 (2)
Creating new feed
utility: printsub(length=14)

Using ENCRYPT

DES_OFB64

OBF64_IV 123 117 204 223 5 21 98 2

TELNETD: (*ep->start)() returned 6

EZYTU17I UTILITY: send suboption

EZYTU14I UTILITY: netwrite 16 chars.
EZYTU21I Ont: fffa260002017b75ccdf05156292fff0 ......#........0
utility: printsub(length=7)

EZYTU17I UTILITY: receive suboption

NAWS

0 120 (120)
0 50 (50)

auth_wait: auth_context a080a30, validuser 3
auth_wait: auth_level 0
telnetd: authteln client name: user52 auth name: user52

state: send_do(option=38, init=0)
EZYTU17I UTILITY: send suboption

EZYTU14I UTILITY: send DO 0 ENCRYPT
state: send_do(option=24, init=1)
state: send_do(option=32, init=1)
state: send_do(option=35, init=1)

EZYTU14I UTILITY: send DO 0 XDISPLOC
state: send_do(option=39, init=1)
state: send_do(option=36, init=1)

EZYTU17I UTILITY: receive suboption

EZYTU04I STATE:send_do: send DO OLD-ENVIRON
EZYTU01I STATE:send_will: send WILL ECHO
EZYTU14I UTILITY: netwrite 12 chars.

EZYTU21I Ont: fffa260002017b75ccdf05156292fff0 .....#........0
utility: printsub(length=7)

EZYTU17I UTILITY: receive suboption

EZYTU09I STATE:send_will: send WILL ECHO

EZYTU14I UTILITY: netwrite 0 chars.

EZYTU17I UTILITY: printsub(length=52)

EZYTU17I UTILITY: receive suboption

LINEMODE

SLC

SYNCH

DEFAULT

0;

IP

VARIABLE

|FLUSHIN|FLUSHOUT

3;

AO

VARIABLE

IS;

AYT

DEFAULT

0;

ABORT

VARIABLE

|FLUSHIN|FLUSHOUT

28;

EOF

VARIABLE

4;

SUSP

VARIABLE

|FLUSHIN

26;

EC

VARIABLE

8;

EL

VARIABLE

21;

EW

VARIABLE

23;

RP
VARIABLE 18;
LNEXT VARIABLE 22;
XON

VARIABLE 17;
XOFF VARIABLE 19;
FORM1 VARIABLE 0;
FORM2 VARIABLE 0;

EZYTS10I STATE: dooption: receive DO SUPPRESS GO AHEAD
EZYTU10I UTILITY: ttloop read 16 chars.
EZYTU20I Int: fffa26000201094321d752693162fff0 ...........P....0
telrcv() encrypt_output =0
telrcv() decrypt_input =0
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=14)

20 EZYTU17I UTILITY: receive suboption
ENCYP
IS
DES_OFB64
OFB64_IV 9 67 33 215 82 105 49 98
CFB64: initial vector received
Initializing Decrypt stream
utility: printsub(length=6)

21 EZYTU17I UTILITY: send suboption
ENCYP
REPLY
DES_OFB64
OFB64_IV_OK
(*ep->is)(a09abc3, 9) returned MORE_TO_DO (7)
EZYTU14I UTILITY: netwrite 8 chars.
EZYTU20I Int: fffa26020202fff0 ...........0
telrcv() encrypt_output =0
telrcv() decrypt_input =0
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=6)

22 EZYTU17I UTILITY: receive suboption
ENCYP
REPLY
DES_OFB64
OFB64_IV_OK
utility: printsub(length=5)

23 EZYTU17I UTILITY: send suboption
ENCYP
ENC_KEYID 0
(*ep->reply)(a09abc3, 1) returned MORE_TO_DO (4)

>>>TELNETD: encrypt_reply returned 4

30 EZYTS08I STATE: won'toption: receive WON'T XDISPLOC
EZYTS08I STATE: won'toption: receive WON'T OLD-ENVIRON
EZYTS18I STATE: dooption: receive DO ECHO

>>>TELNETD: in encrypt_wait
EZYTU14I UTILITY: netwrite 7 chars.
EZYTU20I Int: fffa260700fff0 ...........0
telrcv() encrypt_output =0
telrcv() decrypt_input =0
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=5)

31 EZYTU17I UTILITY: receive suboption
ENCYP
ENC_KEYID 0
utility: printsub(length=5)

29 EZYTU17I UTILITY: send suboption
ENCYP
Diagnosing z/OS UNIX Telnet daemon (otelnetd) problems
5
2
EZYTU14I UTILITY: netwrite 0  chars.
utility: printsub(length=9)
EZYTU17I UTILITY: receive suboption
TERMINAL-TYPE IS XTERM
EZYTE10I terminaltypeok: call tgetent (buf, XTERM)
EZYTU15I terminaltypeok: Tgetent failure EDC5129I No such file or directory. rsn = 053B006C
35 EZYTE10I terminaltypeok: call tgetent (buf, xterm)
telnetd: getterminaltype() return 3
EZYTE22I herald() entered for /etc/otelnetd.banner
EDC5129I No such file or directory. rsn = 053B006C
36 EZYTE88E herald: stat error on /etc/otelnetd.banner
EZYTE16I uid = 52, gid = 5
telnsave: mallocTelnetSave() rc=0
telnetd: doit() subcount=96
telnetd: doit() execvp()
EZYTU34I id 30002 pri 3 call catopen(tnmsgs.cat,0) code 81 reason 053B006C
h_errno N/A
telnetd: doit(Second_pass=1)
39 EZYTU02I GETPTY: open of /dev/ptyp EDC5114I Resource busy. rsn = 020A0155
EZYTU02I GETPTY: open of /dev/ptyp EDC5114I Resource busy. rsn = 020A0155
EZYTU05I GETPTY: slave fd = 9 , masterfd = 8
telnetd: doit() deferred_processing=1
EZYTS15I STATE:dooption:deferred receive DO   ECHO
EZYTS15I STATE:dooption:deferred receive DO   SUPPRESS GO AHEAD
EZYTS15I STATE:dooption:deferred receive DO   STATUS
EZYTS15I STATE:dooption:deferred receive WILL   TERMINAL TYPE
39 EZYTS16I STATE:willoption:deferred receive WILL NAWS
EZYTS16I STATE:willoption:deferred receive WILL TSPEED
EZYTS16I STATE:willoption:deferred receive WILL LFLOW
EZYTS16I STATE:willoption:deferred receive WILL LINEMODE
EZYTU14I UTILITY: netwrite 13  chars.
EZYTU21I Ont: b7c2d637e5d127b4aeced4cbad .BO.VJ....M.
EZYTU09I options(1) = 3.
EZYTU09I options(2) = 12.
EZYTU09I options(3) = 3.
EZYTU09I options(4) = 12.
EZYTU09I options(5) = 3.
EZYTU09I options(6) = 12.
EZYTU09I options(7) = 12.
EZYTU09I options(8) = 12.
EZYTU09I options(9) = 12.
EZYTU09I options(10) = 12.
EZYTU09I options(11) = 12.
EZYTU09I options(12) = 12.
EZYTU09I options(13) = 12.
EZYTU09I options(14) = 12.
EZYTU09I options(15) = 12.
EZYTU09I options(16) = 12.
EZYTU09I options(17) = 12.
EZYTU09I options(18) = 12.
EZYTU09I options(19) = 12.
EZYTU09I options(20) = 12.
EZYTU09I options(21) = 12.
EZYTU09I options(22) = 12.
EZYTU09I options(23) = 12.
EZYTU09I options(24) = 12.
EZYTU09I options(25) = 12.
EZYTU09I options(26) = 12.
EZYTU09I options(27) = 12.
EZYTU09I options(28) = 12.
EZYTU09I options(29) = 12.
EZYTU09I options(30) = 12.
EZYTU09I options(31) = 12.
EZYTU09I options(32) = 12.
EZYTU09I options(33) = 12.
EZYTU09I options(34) = 12.
EZYTU09I options(35) = 12.
EZYTU09I options(36) = 12.
EZYTU09I options(37) = 12.
EZYTU09I options(38) = 12.
EZYTU09I options(39) = 12.
telrcv() encrypt_output=0xA00C848
telrcv() decrypt_input =0xA00C6C0

EZYT518I Process deferred suboption negotiation
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=7)

EZYTU17I UTILITY: receive suboption
NAWS
  0 120 (120)
  0 50 (50)

EZYT518I Process deferred suboption negotiation
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=52)

EZYTU17I UTILITY: receive suboption
LINEMODE
  SLC
  SYNCH
  DEFAULT
  0;
  IP
  VARIABLE
  |FLUSHIN|FLUSHOUT
  3;
  AO
  VARIABLE
  15;
  AYT
  DEFAULT
  0;
  ABORT
  VARIABLE
  |FLUSHIN|FLUSHOUT
  28;
  EOF
  VARIABLE
  4;
  SUSP
  VARIABLE
  |FLUSHIN
  26;
  EC
  VARIABLE
  0;
  EL
  VARIABLE
  21;
  EW
  VARIABLE
  23;
  RP
  VARIABLE
  18;
  LNEXT
  VARIABLE
  22;
  XON
  VARIABLE
  17;
  XOFF
  VARIABLE
  19;
  FORM1
  VARIABLE
  0;
  FORM2
  VARIABLE
  0;

EZYT518I Process deferred suboption negotiation
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=13)

EZYTU17I UTILITY: receive suboption
TERMINAL-SPEED
  IS 9600,9600

EZYT518I Process deferred suboption negotiation
EZYTU14I UTILITY: netwrite 0 chars.
utility: printsub(length=16)

EZYTU17I UTILITY: receive suboption
NEW-ENVIRON

Diagnosing z/OS UNIX Telnet daemon (otelnetd) problems 471
IS
VAR
USR
ERE
VALUE
us
r
5
2
telnetd: doit() deferred_processing=0
state: send_do(option=31, init=1)
state: send_do(option=33, init=1)
telrcv() encrypt_output=0xA00C848
telrcv() decrypt_input =0xA00C6C0
state: send_do(option=0, init=1)
EZYT04I STATE:send_do: send DO   BINARY
EZYT07I STATE:send_dont: send DON'T   LINEMODE
EZYT14I UTILITY: netwrite 66 chars.
EZYTU21I Ont: 28925cf2dbf210c689e053fabad994f522421dbb7 .k*..2.Fi\...[r|.....
EZYTU21I Ont: 862e63d290bf59f7e4060ebc4c43f4eef139b405 ..6K...7U...<.4.1...
EZYTU21I Ont: a59b84b3fc185a609644499e56c69fe7790b6e7e v.d...!-o....F.X`.>=
EZYTU21I Ont: 8cd2de808d42 ......
utility: printsub(length=52)
EZYTU71I UTILITY: send suboption
LINEMODE
SLC
SYNCH
NOSUPPORT
0;
IP
VARIABLE
ACK|FLUSHIN|FLUSHOUT
3;
AO
VARIABLE
ACK
15;
AYT
NOSUPPORT
0;
ABORT
VARIABLE
ACK|FLUSHIN|FLUSHOUT
28;
EOF
VARIABLE
ACK
4;
SUSP
VARIABLE
ACK|FLUSHIN
26;
EC
VARIABLE
ACK
8;
EL
VARIABLE
ACK
21;
EW
VARIABLE
ACK
23;
RP
VARIABLE
ACK
18;
LNEXT
VARIABLE
ACK
22;
XON
VARIABLE
ACK

Following are short descriptions of the numbered items in the trace:

1. EZYTE29I indicates the start of a new z/OS UNIX Telnet client session.
2. EZYTE05I indicates what options were specified in /etc/inetd.conf for z/OS UNIX Telnet.
3. EZYTE11I indicates the resolved host name (from the client).
4. EZYTE11I shows the IP address of the z/OS UNIX Telnet client.
5. EZYTS04I indicates oTelned agrees to send and receive authentication information.
6. EZYTU14I traces netwrites (writes to the client terminal).
7. EZYTU21I traces data from parent to client; that is, z/OS UNIX Telnet to the client terminal.
8. EZYTU03I indicates the number of bytes read from the client by z/OS UNIX Telnet.
9. EZYTU20I traces data from the client to the parent (z/OS UNIX Telnet server).
10. EZYTS05I indicates the client agrees to send and receive authentication information.
11. EZYTU17I shows oTelned requesting that the client send authentication information for Kerberos Version 5.
12. EZYTS10I indicates the client agrees to receive encrypted data.
EZYTS09I indicates otelnetd agrees to send encrypted data.

EZYTS05I indicates the client agrees to send encrypted data.

EZYTS04I indicates otelnetd agrees to receive encrypted data.

EZYTU17I shows which types of encryption otelnetd supports when receiving data.

EZYTS10I shows the terminal option negotiation the client has sent/received.

EZYTS05I shows the terminal option negotiation the client has sent/received.

EZYTS04I indicates the terminal negotiation options sent to the client by the z/OS UNIX Telnet server.

EZYTU17I shows the account name on otelnetd that the client wishes to be authorized to use.

EZYTU17I shows the client authentication information for Kerberos Version 5.

Shows the Kerberos Version 5 principal of the user logging in.

EZYTU17I shows the client requesting that otelnetd enable encryption as soon as the initialization is completed.

EZYTU17I shows which types of encryption the client supports when receiving data.

EZYTU17I shows otelnetd sending to the client the type of encryption to use for the data stream (otelnetd to client) and the initial encryption data.

EZYTU17I shows otelnetd receiving from the client the type of encryption to use for the data stream (client to otelnetd) and the initial encryption data.

EZYTU17I shows otelnetd acknowledging receipt of the initial encryption data from the client.

EZYTU17I shows the client acknowledging receipt of the initial encryption data from otelnetd.

EZYTU17I shows otelnetd verifying its keyids.

EZYTS08I shows the terminal option negotiation the client has sent/received.

EZYTU17I shows the client verifying its keyids.

EZYTU17I shows all data following this command in the data stream (otelnetd to client) are encrypted using the previously negotiated method of data encryption.

EZYTU17I shows all data following this command in the data stream (client to otelnetd) are encrypted via the previously negotiated method of data encryption.

EZYTU17I traces z/OS UNIX Telnet sending terminal negotiation suboptions to the client.
EZYTE10I traces the call to tgetent(), which determines client terminal type.

EZYTE88E indicates no /etc/otelnetd.banner file was found.

EZYTO04I shows the user name with which the telnet client logged in.

EZYTE88E indicates no /etc/banner file was found.

EZYTS15I and EZYTS16I show that a state change was processed due to options/responses received from the client.

EZYTY08I traces the parameters passed to the spawned/forked child address space where the OMVS shell runs.

EZYTE67I traces the socket sets to show whether input/ibits, output/obits, or exception/ebits data has been received.

EZYTE68I shows exception data received on the parent/child connection.

**Cleaning up the utmp entries left from dead processes**

Assuming that you have the suggested /etc/rc script, the utmpx file is cleaned up each time the S OMVS command is issued. The utmpx file should not normally need cleaning up, as each terminal slot should be reused the next time someone logs on with that terminal.

Although during normal processing the utmp entries are cleaned up, there are the occasional incidents where zombies are created, or the user might have terminated the session abnormally. When this occurs, the utmp entry for that user remains in the /etc/utmpx file until it is cleared out. There is an associated tty reserved for every entry in the /etc/utmpx file including the zombie entries. For dead entries, these ttys are not available for reuse until someone under superuser erases the /etc/utmpx file.

**Tip:** If you erase the file while someone is logged on, the next logoff reports not finding the utmpx entry for the user. This can be seen with a waitpid failure during that user cleanup.
Chapter 16. Diagnosing Telnet problems

This topic describes how to diagnosis Telnet problems, and contains the following subtopics:

• “General TN3270E Telnet server information” on page 477
• “TN3270E Telnet server definitions” on page 477
• “Diagnosing TN3270E Telnet server problems” on page 477
• “General Telnet client information” on page 485
• “Telnet client definitions” on page 485
• “Diagnosing Telnet client problems” on page 485
• “Telnet client traces” on page 488

General TN3270E Telnet server information

The Telnet protocol provides a standardized interface, through which a program on one host (the Telnet client) can access the resources of another host (the TN3270E Telnet server) as though the client were a local terminal connected to the server host.

Telnet protocol is based on the concept of a Network Virtual Terminal (NVT) and the principle of negotiated options.

An NVT is an imaginary device, providing the necessary basic structures for a standard terminal. Each host client represents an imaginary device with certain terminal characteristics that the host server can support.

The principle of negotiated options is used by the Telnet protocol because many clients and hosts require additional services beyond the base services. Various options can be negotiated. Server and client use a set of conventions to establish operational characteristics for their Telnet connection by means of the DO, DON'T, WILL, WON'T mechanism that is discussed in “Telnet commands and options” on page 492.

Component event tracing is done under the SYSTCPIP component. A subset of trace options and a subset of IPCS commands are available to Telnet. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 and Chapter 6, “IPCS subcommands for TCP/IP,” on page 165 for details.

TN3270E Telnet server definitions

Telnet LUs must be defined correctly to both VTAM and Telnet. A VTAM APPL definition statement is needed for each Telnet LU that is used. Model application definitions can also be used. See the z/OS Communications Server: SNA Resource Definition Reference for detailed information about these definitions. A corresponding LU must be specified in the BEGINVTAM section of the PROFILE data set. See the z/OS Communications Server: IP Configuration Reference for detailed information about these definitions.

Note: All default 3270 LOGMODE entries from the table of Telnet device name parameters in the z/OS Communications Server: IP Configuration Reference are for non-SNA sessions. You must code device types and the needed LOGMODE entries for SNA sessions. All default 3270E LOGMODES are for SNA sessions.

Diagnosing TN3270E Telnet server problems

Problems with Telnet are generally reported under one of the following categories:

• Abends
• Logon problems
• Session hangs
• Incorrect output
• Session outages

Use the information provided in the following sections for problem determination and diagnosis of errors reported against Telnet.

**Abends (server)**

An abend during Telnet processing should result in messages and error-related information sent to the MVS system console. A dump of the error is needed unless the symptoms already match a known problem.

**Documentation**

Code a SYSMDUMP DD or SYSABEND DD statement in the PROC used to start Telnet to ensure that a useful dump is obtained in the event of an abend.

**Analysis**

See z/OS Problem Management or see Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21, for debugging dumps produced during TCP/IP processing.

**Logon problems (server)**

Telnet logon problems are reported when clients are unable to connect to the host application. Generally, this type of problem is caused by an error in the configuration or definitions (either in VTAM or Telnet).

If the problem can be re-created, use the DEBUG DETAIL parameter to gather diagnostic messages or trace information. See z/OS Communications Server: IP Configuration Guide for details.

**Documentation**

The following documentation should be available for initial diagnosis of Telnet login problems:

- Console Log of error messages issued by both Telnet and VTAM
- PROFILE data set
- VTAM APPL definitions for Telnet LUs

More documentation that might be needed is discussed in the following analysis section.

**Steps for analyzing logon problems (server)**

Determine why clients are unable to connect to a host application.

**About this task**

Table 32 on page 478 shows symptoms of login problems and refers to the steps needed for initial diagnosis of the error. The information following the chart and associated information can be used for extended diagnosis, if the problem persists.

<table>
<thead>
<tr>
<th>Login problem</th>
<th>Analysis steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>No LUs available</td>
<td>1, 2, 6, 10, 13</td>
</tr>
<tr>
<td>OPEN failure</td>
<td>1, 2, 3, 4, 5, 6, 7, 8, 9, 10</td>
</tr>
<tr>
<td>x-clock (Telnet solicitor panel)</td>
<td>1, 2, 3, 4, 5, 6, 7, 10</td>
</tr>
</tbody>
</table>
Table 32. Telnet login problems (continued)

<table>
<thead>
<tr>
<th>Login problem</th>
<th>Analysis steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>x-clock (blank screen)</td>
<td>1, 2, 3, 6, 7, 8, 10, 12</td>
</tr>
<tr>
<td>x-clock (application panel)</td>
<td>7, 8, 10</td>
</tr>
<tr>
<td>Incorrect USSMSG or DEFAULTAPPL</td>
<td>3, 4, 5, 6, 1, 13, 14</td>
</tr>
</tbody>
</table>

Procedure

Perform the following steps:

1. Have VTAM APPL definition statements been coded correctly?
   - **Note:** There must be a VTAM definition statement or model application name for each LU coded in the PROFILE data set.
2. Is the VTAM node containing the Telnet LU definitions active?
3. Is there a DEFAULTAPPL coded in the PROFILE data set?
4. Is the host application (or DEFAULTAPPL) active?
5. Is there an ALLOWAPPL statement coded that includes the requested application?
6. Have comment delimiters been added or removed as needed in the BEGINVTAM section of the PROFILE data set?
7. Have correct LOGMODEs (or required overrides for SNA) been coded in the PROFILE data set?
8. Does the host application have BIND (session parameter) requirements that are not met by the specified LOGMODE?
9. Is the MSG07 parameter coded in the PROFILE.TCP data set?
   - **Note:** MSG07 returns information to the end user indicating the reason for the failure.
10. Are any abends (in VTAM, host application, or TCP/IP) indicated on the MVS system console?
    - **Note:** If an abend occurred, see the section on abends to continue investigation of the problem.
11. Check the PROFILE data set for the IP to LU mapping.
12. Is an SSL client attempting to connect to a basic port or is a basic client trying to connect to an SSL port?
13. Use the D TCPIP,,T,PROFILE,DETAIL command to view the active profile definitions.
14. Determine whether USSTCP within the TCPIP PROFILE points at the correct USSTAB, because this could also cause an incorrect USSMSG to be displayed.

Results

If the problem still occurs after following the preceding procedure and making any needed changes, obtain the following documentation:

- TELNET display of the LUNAME or CONN ID of affected client, for example, D TCPIP,,T,CONN,LUN=luname.
- VTAM DISPLAY of Telnet LU.
- VTAM DISPLAY of the target host application.
- Activate DEBUG DETAIL and review additional diagnostic information this function provides.

For information about the Telnet Display command options, see the z/OS Communications Server: IP System Administrator’s Commands.

The following documentation might also be needed in some cases, but it is suggested that your IBM Software Support Center be contacted before this documentation is obtained:

- TCP/IP packet trace and CTRACE with TELNET option filtered on the IP address of the failing client.
- VTAM buffer trace of the Telnet LU.
• VTAM INTERNAL TRACE (VIT) with options (API, PIU, MSG, PSS, NRM, SSCP).
• Dump of the Telnet address space. To capture the necessary areas of storage in the DUMP command, include:

\[SDATA=(CSA, LSQA, PSA, RGN, SQA, SUM, SWA, TRT, LPA)\]

For information about obtaining VTAM traces, see z/OS Communications Server: SNA Operation or to z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps and the VIT for your release. Instructions on obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids for your release of MVS.

Session hangs (server)

This topic discusses diagnosis of a hang after a session has been successfully connected. A hang would be indicated by the keyboard remaining locked on the client side of the session, with no data being sent to or received from the server host.

If a problem is recreatable, you can use the DEBUG TRACE parameter. See the z/OS Communications Server: IP Configuration Guide for details.

Documentation

To determine the cause of a Telnet session hang, the following documentation is required:

• CTRACE specifying the TELNET option filtered on the IP address of the failing client.
• In some cases a VTAM buffer trace of the Telnet LU might be needed.
• Information about what was seen at the client screen.

Steps for analyzing session hangs (server)

Determine why a session hangs after it was successfully connected.

About this task

The preceding traces are essential to finding the reason for the session hang. Data entered at the client terminal is sent to Telnet on the TCP/IP connection. The TCP/IP packet trace shows the data arriving at or leaving the stack. CTRACE with the option Telnet specified shows the data coming into and out of Telnet (from both the stack and VTAM). Some processing steps during this time are also included in the trace. The CTRACE with Telnet option shows what Telnet does with this data.

The VTAM buffer trace shows the data as received by VTAM to be forwarded to the host application. Following the data flow through the traces between VTAM, TCP/IP, and Telnet provides an indication of where the problem is occurring.

The following list suggests information to check in the traces. See z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps and the VIT or SNA Formats for more information about VTAM buffer trace output.

Procedure

Perform the following steps:

1. Does the packet trace show data passed to TCP/IP? If not, the problem is in client or emulator code. If data is in the trace, continue with Step “2” on page 480.
2. Does CTRACE with TELNET option show data passed to Telnet? The TELNET option shows data coming into Telnet from the stack and also going out to VTAM (the reverse for outbound data). If not, the error is in the TCP/IP platform code. Otherwise, continue with Step “3” on page 480.
3. Does VTAM buffer trace show data passed from Telnet? If not, problem is in the Telnet code. Otherwise, continue with Step “4” on page 480.
4. Does VTAM buffer trace show data passed to host application? If not, problem is in VTAM code. If buffer trace shows correct data, continue with Step “5” on page 481.
5. Does the buffer trace show data coming from the host application? If not, the problem is in the host application. Contact your host application support center for these products. Otherwise, continue with Step “6” on page 481.

6. Does the buffer trace show data sent back to the Telnet LU? If not, the problem is in VTAM. Otherwise, continue with Step “7” on page 481.

7. Is the last data from the application seen in the CTRACE with TELNET option output? If not, the problem is in Telnet. Otherwise, continue with Step “8” on page 481.

8. Does the packet trace show the data sent to the client? If not, the error is in TCP/IP platform. Otherwise, continue with Step “9” on page 481.

9. Check the data in the packet trace output to see whether unlock keyboard is set on in the data stream. If unlock is set in the output data, the problem is in the emulator or client code. Otherwise, continue with Step “10” on page 481.

10. Check the last data received by the Telnet LU in the VTAM buffer trace. If unlock is set in that data stream, or end bracket or change direction is set in the RH, the problem is in the Telnet code. If none is set, the host application did not allow for unlocking of the keyboard. Contact your host application software support.

Results

If the preceding problem determination shows the error to be in the TCP/IP platform or Telnet code, a dump is needed to allow a more detailed investigation of the problem.

Incorrect output (server)

Problems with incorrect output are reported when the data sent to the client is not seen in its expected form. This could be garbled data that is unreadable on the screen, a blank screen when output is expected, or screen formatting problems. These problems are generally traced back to logmode issues. Ensure the primary and alternate screen sizes in the logmode used are correct for the TN3270 or TN3270E emulator that you are using. The logmode coded in the TCPIP profile is suggested to VTAM as the correct logmode for this device type. The VTAM PLU application determines the actual logmode that is used. Therefore this application must be configured correctly to use the appropriate logmode.

If a problem is recreatable, you can use the Telnet DEBUG features. See z/OS Communications Server: IP Configuration Guide for details.

Documentation

Documentation needed to find the source of the error in an incorrect output problem would be:

- CTRACE with TELNET option and the FULLDATATRACE parm active in the profile
- VTAM buffer trace of the Telnet LU, with AMOUNT=FULL specified
- Client screen output information

Steps for analyzing incorrect output (server)

The main goal of diagnosing this type of problem is to determine whether the data was sent incorrectly by the host application or corrupted by VTAM, TCP/IP, Telnet, or Telnet client code.

About this task

Table 33 on page 481 lists the types of incorrect output that might be seen and the steps needed to identify the code in error.

<table>
<thead>
<tr>
<th>Incorrect Output</th>
<th>Analysis Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank screen</td>
<td>1, 6, 7</td>
</tr>
</tbody>
</table>
Table 33. Incorrect output types for Telnet (continued)

<table>
<thead>
<tr>
<th>Incorrect Output</th>
<th>Analysis Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garbled or unreadable characters on the screen</td>
<td>2, 3, 4, 5, 6, 7</td>
</tr>
<tr>
<td>Incorrectly formatted screen</td>
<td>6, 7</td>
</tr>
</tbody>
</table>

Procedure

See Table 33 on page 481 to identify which of the following steps to use in determining the cause of the error.

1. Was the last output data seen in a SEND DATA to CLIENT CTRACE entry displayed at the terminal emulator? If not, the problem is in the client or emulator. Contact your emulator provider for this product. If the last output was seen at the terminal, go to step “9” on page 481 of the analysis procedure in “Session hangs (server)” on page 480, and continue your diagnosis.

2. Was the TELNET command entered with TRANSLATE specified? If so, make sure the translate table is compatible with the capabilities of the client device. If compatible or no TRANSLATE was used, continue with Step “4” on page 482.

3. The CTRACE with TELNET option entries show the data as it arrived from VTAM and again as it goes to the stack. FULLDATATRACE parameter should be specified in the profile when looking for a problem in the data stream. Examine the CTRACE and compare the DATA from VTAM entries to the DATA to CLIENT entries. If they are different, then Telnet altered the data stream. If not, the problem is with the TCP/IP platform code. Otherwise, continue with Step “4” on page 480.

4. In the data trace output, is the data stream sent by the server the same as received from VTAM? If not, the problem is with the Telnet code. Otherwise, continue with Step “5” on page 481.

   **Tip:** If the client is an ASCII device, these might be different due to EBCDIC-to-ASCII translation. Check the appropriate translate table for compatibility with the client device.

5. In the VTAM Buffer trace with the FULL option specified, is the data in the VTAM USER entry (data received by VTAM) the same as the data in the VTAM BUFF entry (data sent by VTAM)? If not, VTAM has corrupted the data. Otherwise, incorrect data was sent by the application. Contact the IBM Software Support Center for the host application.

6. Is the LOGMODE specified for the negotiated terminal type valid for the actual client device?

   **Tip:** A VTAM session display specifying the SID for the session shows the actual logmode selected by the SNA application.

7. Does the device characteristics information in the BIND sent by the host application match the device characteristics information in the specified LOGMODE entry, and are these characteristics appropriate for the emulator in use?

   This can be checked by comparing the specified LOGMODE entry (see z/OS Communications Server: SNA Customization) with the BIND in the buffer trace at logon to the selected application. For information about the BIND RU, see z/OS Communications Server: SNA Programming and SNA Formats.

Results

If the problem is not found after using the analysis steps, contact your IBM Software Support Center for additional diagnostic suggestions.

Session outages (server)

Session outages are reported as an unexpected termination of the TCP/IP connection or the Telnet-to-host application session. A session that has been disconnected or terminated results in the client being returned to the panel where the initial TELNET command was entered and message EZZ6034I is issued. See z/OS Communications Server: IP Messages Volume 4 (EZZ, SNM).
Telnet sessions can be terminated due to TELNETPARMS specified in the PROFILE data set. Telnet ends a session if there is no activity on the SNA side of the connection for the amount of time specified in the INACTIVE parameter. Telnet checks for dormant sessions on the IP side of the connection using the SCANINTERVAL/TIMEMARK parameters specified. When appropriate, the connection is terminated due to this processing. See the SCANINTERVAL/TIMEMARK parameters in z/OS Communications Server: IP Configuration Reference for additional information.

Documentation

The following documentation is needed for initial investigation of problems reported as session outages.

Abnormal connection terminations are reported by using the EZZ6034i message with the appropriate reason code (RCODE). If DEBUG SUMMARY is coded in the Telnet profile, then normal connection terminations are also reported. If DEBUG DETAIL is coded, then additional diagnostic information is reported by using EZZ6035I messages. These messages can be spooled to either the console or job log. Examination of the RCODE carried in these messages is the first step to diagnosing this type of problem.

Steps for analyzing session outages (server)

The preceding output is needed to begin diagnosis of a session outage reported against Telnet. It is also helpful to know what processing the Telnet user was doing at the time of the interrupted session.

Procedure

Perform the following steps:

1. If a timeout due to inactivity or termination due to TIMEMARK processing is suspected, check the values set in the PROFILE data set.

2. Additional messages are issued for session outages when the Telnet DEBUG features are active. See z/OS Communications Server: IP Configuration Guide for details of the Telnet DEBUG features.

3. Check the documentation listed in “Documentation” on page 483 for indications of an error.
   - If the MVS system console indicates a VTAM error, continue diagnosis with your VTAM programmer.
   - If the console shows a Telnet or TCP/IP error, check z/OS Communications Server: IP Messages Volume 1 (EZA) or z/OS Communications Server: IP Messages Volume 4 (EZZ, SNM) and follow the directions for system programmer response for the message.

   If messages are found that do not lead to an accurate diagnosis and resolution of the error, search the APAR data base, available at for more information. If this does not provide a solution, contact the IBM Software Support Center.

4. If only one Telnet user session was affected, continue with step “5” on page 483. Otherwise, go to step “7” on page 483.

5. If the problem can be re-created by performing the same operation or processing, run the following traces:
   - TCP/IP packet trace filtered using the IP address of the failing client
   - Component Trace output (CTRACE) specifying the Telnet option
   - VTAM Internal Trace (VIT)
   - VTAM buffer trace output with AMOUNT=FULL specified.

   Note: Contact your IBM Software Support Center for information about options needed before running these traces.

6. If all Telnet user sessions were interrupted, do one of the following:
   - Check the MVS system console and LOGREC for abends.
   - Check for loss of network connectivity. Verify whether all the TELNET users come in through the same channel interface or through a common router.

7. If there are no messages or abends and all Telnet user sessions have been disconnected, the traces listed in Step “5” on page 483 are needed during a recurrence of the failure.
A dump of the TCP/IP address space or a dump of the Telnet address space should be taken at this time. To capture the necessary areas of storage in the DUMP command, include:

```
SDATA=(CSA,LSQA,PSA,RGB,SQA,SUM,SWA,TRT,LPA)
```

Instructions on obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids for your release of MVS.

**Special considerations when using SSL encryption support**

Because data flowing across the connection between the client and the server is encrypted, the data field in the packet trace is also encrypted after SSL handshaking is completed. If problem determination requires seeing Telnet handshake or user data, you also need to run Component Trace to see the decrypted data field. When starting Component Trace, specify `options=(TELNET)` and use IPCS to format the Component Trace. For more information about Component Trace, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

The Telnet Component Trace records contain the connection ID in the CID field. The connection ID in the trace corresponds to the connection ID output of the connection display command. Use this field to locate records related to the client in question. After an LUname has been assigned, the Component Trace User field shows the LUname, providing additional data for locating your client.

The following Component Trace records might be of interest:

**SKSCINIT Succeeded**

SSL handshaking completed and subsequent data on this connection is encrypted.

**Receive Data from Client**

The Data from Client field of this record contains the decrypted data coming from the client.

**Send Data to Client**

The Data to Client field of this record contains the decrypted data going to the client.

Following is a sample Send Data to Client Component Trace record:

```
MVS181    TELNET    70010004  12:49:06.354966   Send Data to Client
HASID...002A    PASID...002A    SASID...002A    MODID..EZBTTSND
TCB....00000000    REG14...89D37F40    USER...TCPM1011    DUCB...0000000D
CID....092552C4    SEQ.....000024BE
...                  
ADD...00000000   8167AB0    LEN....00000004   Number of Bytes Sent
+0000   080000002C
ADD...00000000   7F687950    LEN....0000002C   Data to Client
+0000   5FCC115D    7F1D4011    400401DC8    C9D21D1F5    5A.)"...HIK35
+0810   F6F7F0F0    C140C5D5    E3550D940    E4E2C5D9    6700A ENTER USER
+0020   C9C44F66    1040111C1    5913FFEF
```

**Telnet Component Trace data**

To help associate a Component Trace entry with a particular client, the following two Component Trace fields contain data unique to Telnet:

**CID**

The connection ID for the connection. This is equivalent to the connection ID output from the connection display command.

**USER**

The LUname associated with the client, after it has been assigned. Prior to LUname assignment, this field might be null or contain the TCP procedure name. The LUname is not set until after the completion of the Telnet handshake.
Use these fields in Component Trace formatting to limit the records to be displayed. For example, if you want Telnet records for a client connection ID X'021F' with the LUName TCPM1011, code the following IPCS command:

```
CTRACE COMP(SYSTCPIP) SUB((proc_name)) FULL JOBLIST (TCPM1011)
OPTIONS((TELNET,CID(X'0000021F')))```

Tip: Some of the records pertinent to the connection are not shown when the output is restricted by the CID and USER options. However, it is often helpful to use the output produced by these filters as a starting point.

### General Telnet client information

The Telnet client code runs under TSO in the TSO user’s address space. The Telnet client uses the VTAM interface, like other TSO applications, to send data out to the user’s terminal.

The Telnet client can run in line mode, when accessing an ASCII host, or run in full-screen mode, if the remote host provides 3270 full-screen support.

### Telnet client definitions

The Telnet command must be authorized to be issued by TSO users. See the z/OS MVS Initialization and Tuning Guide for information about making Telnet an authorized command. There are no other special definitions or setup requirements to run the Telnet client.

### Diagnosing Telnet client problems

Problems that might involve the Telnet client are reported as one of the following types:

- Abends
- Session hangs
- Incorrect output

Use the information in the following topics for problem determination and diagnosis of errors reported in the Telnet client.

#### Abends (client)

An abend in the TELNET client should result in messages and error-related information being sent to the MVS system console. These abends should affect only the TSO user that was running Telnet. A dump of the error is needed unless the symptoms match a known problem.

**Documentation**

Code a SYSMDUMP DD or SYSABEND DD statement in the TSO PROC to ensure that a useful dump is obtained in the event of an abend. See Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21, for more information.

**Analysis**

See z/OS Problem Management or see Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21 for more information about debugging dumps produced during TCP/IP processing.

#### Session hangs (client)

This topic discusses diagnosis of a hang after a session has been successfully connected. A hang is indicated by the keyboard remaining locked after sending or receiving data from the remote host.
There are many components involved in the transfer of data from a locally attached device through a Telnet session. Any one of these might be the cause or a contributing factor to the hang. Each must be investigated to define the area responsible for the failure.

**Documentation**

To determine the cause of a Telnet client session hang, the following is needed:

- Information about what was seen at the client screen
- VTAM buffer trace of the local device LU
- VTAM internal trace (if the error appears to be in VTAM)
- VTAM TSO trace of the user ID issuing Telnet
- GTF trace of SVC93 and SVC94 (TGET/TPUT)
- Telnet client trace
- Dump of the TSO user’s address space
- TCP/IP packet trace and CTRACE with TELNET option on remote host (if possible)

The preceding list of documentation is a complete list that includes documentation needed to resolve most types of hangs. All of the indicated data might not be needed for each occurrence of a hang. The following analysis section provides information about what types of data might be needed through each diagnostic step.

**Steps for analyzing session hangs (client)**

**Diagnosing a Telnet client hang.**

**Before you begin**

To assist with diagnosis of a Telnet client hang, it is helpful to be familiar with the components involved and understand which ones interface directly with each other. In the case of a Telnet from an MVS client to a remote host, the following occurs:

- Data is entered by the user and then passed by VTAM to TSO.
- Data is passed from TSO to Telnet client code.
- Data is transferred across the TCP/IP connection to the remote host.
- The remote server sends data to the target application.

**Note:** It is suggested that a VTAM buffer trace and a Telnet client trace be run while recreating the problem for initial debugging purposes. A sample of the client trace output can be found in Figure 61 on page 489. See z/OS Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures or SNA Formats for more information about VTAM buffer trace output.

**Procedure**

Perform the following steps:

1. Does the hang affect other Telnet clients? If so, go to “Diagnosing TN3270E Telnet server problems” on page 477. Otherwise, continue with Step “2” on page 486.
2. Was the last activity at the terminal input or output? If input, go to step “5” on page 487. If output, continue with Step “3” on page 486.
3. Check the data in the VTAM buffer trace to see whether unlock keyboard is set on in the data stream. If unlock is set on in the data stream, the problem is in the emulator, control unit, or terminal device. If not, check the Telnet client trace to ensure the output data stream matches what is seen in the buffer trace. If the data streams match, the remote host application has not unlocked the keyboard. Contact your IBM Software Support Center for the host application for more help with the problem. If the data streams do not match, continue with Step “4” on page 486.
4. The problem appears to be in the VTAM TSO area. Re-create the error while running the Telnet client trace, a GTF trace of SVC93 and SVC94, a VTAM TSO trace, and a VTAM buffer trace. Contact your IBM Software Support Center for assistance in interpreting the traces.
5. Check the VTAM buffer trace to ensure input data was received by VTAM and passed to TSO. If the last
data entered at the terminal is not in the VTAM buffer trace, the problem is in the PC emulation code or
in the control unit. If input data is correct, continue with Step “6” on page 487.
6. Is the entered data seen in client trace output? If not, the problem is in VTAM TSO. Follow the
instructions in Step “4” on page 486. If data is in the client trace, the error needs to be diagnosed from
the server host. See “Session hangs (server)” on page 480 and follow the path for “last activity at the
terminal was input.”

Results
Documentation listed earlier, but not referenced in the previous debugging steps, can be useful in the
following situations:
• VTAM internal trace
  Note: Data is seen in “BUFF VTAM” VTAM buffer trace entry (entering VTAM from the terminal), but not
in the “BUFF USER” VTAM buffer trace entry (passed from VTAM to TSO).
• Dump of TSO user’s address space
  Note: Data is seen in the “BUFF USER” VTAM buffer trace entry, but not in the VTAM TSO trace or Telnet
client trace.
Contact the IBM Software Support Center for assistance with further diagnosis when data is obtained in
these situations.
Tip: Information about starting and examining traces is discussed in “Step for starting Telnet client
traces” on page 488.

Incorrect output (client)

Problems with incorrect output are reported when the data seen at the terminal is not in its expected
form. This might be garbled data that is unreadable, a blank screen when output is expected, or screen
formatting problems.

Documentation
Documentation needed to find the source of the error in an incorrect output problem is:
• VTAM buffer trace of the local device LU
• VTAM TSO trace of the user ID issuing Telnet
• GTF trace of SVC93 and SVC94
• Telnet client trace
• Client screen output information

Steps for analyzing incorrect output (client)
The main goal of diagnosing this type of problem is to determine whether the data was sent incorrectly by
the host application or corrupted by the Telnet server, Telnet client, TSO, or VTAM code. The following
analysis steps hopefully allow quick determination of whether the problem is a Telnet client problem or
must be addressed from the server host.

Procedure
1. If new data sent to the screen cannot be read (garbled or formatted incorrectly), go to step “4” on
page 488. Otherwise, continue with Step “2” on page 487.
2. Was the last output data seen in the VTAM buffer trace displayed at the terminal? If not, the problem is
in the emulator or device. Contact the appropriate IBM Software Support Center. Otherwise, continue
with Step “3” on page 487.
3. Does the last output data in the Telnet client trace match the data in the VTAM buffer trace? If not,
contact your IBM Software Support Center with the client trace, a VTAM TSO trace, and a VTAM buffer
trace of the error. Otherwise, this problem must be investigated from the Telnet server side. Continue with the investigation as a Telnet server session hang.

4. Was the TELNET command entered with TRANSLATE specified? If so, make sure the translate table is compatible with the capabilities of the output device. If the table is compatible or no TRANSLATE was used, continue with Step “5” on page 488.

5. Check the Telnet client trace and VTAM buffer trace. If the data is different, contact your IBM Software Support Center with the client trace, a VTAM TSO trace, and a VTAM buffer trace. Otherwise, continue investigating as a Telnet server incorrect output problem.

6. If the data is formatted incorrectly for the screen size, check the defined session parameters for the negotiated device type for the Telnet server.

**Results**

If the problem is not found after using the analysis steps, contact your IBM Software Support Center for more diagnostic suggestions.

---

### Telnet client traces

The Telnet client trace shows data received from the remote server to be sent to the local device, and data from the device to be forwarded to the remote host. This includes attention interrupts and some negotiation data seen at the beginning of the session. Data from the initial Telnet negotiation is not seen, only an indication that it is negotiation data and the number of bytes received.

#### Step for starting Telnet client traces

Before issuing the Telnet command, the following command should be issued from the TSO ready prompt or command line to allocate the trace data set:

```
ALLOC F(DEBUGFIL) DA(data.set.name) NEW
```

Trace data is written to the data set indicated in the command.

The trace is invoked by issuing the Telnet command with the DEBUG option:

```
TELNET hostname (DEBUG
```

#### Trace example (client)

Figure 61 on page 489 is sample output from a Telnet client trace showing part of a Telnet login to a remote host.
In Transparent mode, found IAC at IacOffset 0, CurrentChar is 0

EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:

In Transparent mode, found IAC at IacOffset 0, CurrentChar is 3

EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:

In Transparent mode, found IAC at IacOffset 214, CurrentChar is 6

EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:

EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:

Figure 61. Telnet client trace

In Transparent mode, found IAC at IacOffset 0, CurrentChar is 0

EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:

In Transparent mode, found IAC at IacOffset 0, CurrentChar is 3

EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:
EZAS345I in TelnetRead
EZAS305I in IacNoteArrives
EZAS306I Option neg. stuff arrives
EZAS338I ord: 255 asis:

In Transparent mode, found IAC at IacOffset 214, CurrentChar is 6

EZAS345I in TelnetRead
EZAS313I got USRdeliversLINE
EZAS371I in SendData
User data is...

LEN is 22

DataDelivered; # bytes: 48

Data received from TCP:

In Transparent mode, found IAC at IacOffset 42, CurrentChar is 0

In TelnetRead

got USERdeliversLINE

in SendData

User data is...

LEN is 11

DataDelivered; # bytes: 1106

Data received from TCP:
Following are short descriptions of the numbered items in the trace:

1. This entry shows the data received from the Telnet server and indicates the number of bytes. The example here is during initial negotiation and does not include the actual data received.

2. This indicates the type of data received.

3. This entry indicates the data received from TCP (from the Telnet server).

4. The actual hexadecimal data received. This trace example is of a transparent mode session, so the data is in EBCDIC. In a line mode session, the data would be in ASCII, and there would be one character per line (like the input data later in the trace).
This is the translation of the previous hexadecimal data. All hexadecimal characters that translate into readable data are displayed.

This entry indicates data received from the terminal or PC.

Following this line is the actual input data. There is a single hexadecimal byte per line that is translated into its readable form.

This entry follows the input data and indicates the number of bytes received from the terminal.

This entry indicates the data from the host application (using the Telnet server) that is being sent to the terminal.

## Telnet commands and options

For information about Telnet connection negotiations, see RFC 2355. Table 34 on page 492 describes the Telnet commands from RFC 854, when the codes and code sequences are preceded by an IAC. For more information about Telnet commands, see RFC 854.

### Table 34. Telnet commands from RFC 854

<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE</td>
<td>X'F0'</td>
<td>End of subnegotiation parameters.</td>
</tr>
<tr>
<td>NOP</td>
<td>X'F1'</td>
<td>No operation.</td>
</tr>
<tr>
<td>Data Mark</td>
<td>X'F2'</td>
<td>The data stream portion of a Synch. This should always be accompanied by a TCP Urgent notification.</td>
</tr>
<tr>
<td>Break</td>
<td>X'F3'</td>
<td>NVT character BRK.</td>
</tr>
<tr>
<td>Interrupt Process</td>
<td>X'F4'</td>
<td>The function IP.</td>
</tr>
<tr>
<td>Abort output</td>
<td>X'F5'</td>
<td>The function AO.</td>
</tr>
<tr>
<td>Are You There</td>
<td>X'F6'</td>
<td>The function AYT.</td>
</tr>
<tr>
<td>Erase character</td>
<td>X'F7'</td>
<td>The function EC.</td>
</tr>
<tr>
<td>Erase Line</td>
<td>X'F8'</td>
<td>The function EL.</td>
</tr>
<tr>
<td>Go ahead</td>
<td>X'F9'</td>
<td>The GA signal.</td>
</tr>
<tr>
<td>SB</td>
<td>X'FA'</td>
<td>Indicates that what follows is subnegotiation of the indicated option.</td>
</tr>
<tr>
<td>WILL (option code)</td>
<td>X'FB'</td>
<td>Indicates the want to begin performing, or confirmation that you are now performing, the indicated option.</td>
</tr>
<tr>
<td>WON'T (option code)</td>
<td>X'FC'</td>
<td>Indicates the refusal to perform, or continue performing, the indicated option.</td>
</tr>
<tr>
<td>DO (option code)</td>
<td>X'FD'</td>
<td>Indicates the request that the other party perform, or confirmation that you are expecting the other party to perform, the indicated option.</td>
</tr>
<tr>
<td>DON'T (option code)</td>
<td>X'FE'</td>
<td>Indicates the demand that the other party stop performing, or confirmation that you are no longer expecting the other party to perform, the indicated option.</td>
</tr>
</tbody>
</table>
Table 34. Telnet commands from RFC 854 (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAC</td>
<td>X'FF'</td>
<td>Data byte 255.</td>
</tr>
</tbody>
</table>

Table 35 on page 493 lists the options available for Telnet commands from RFC 1060. For more information about Telnet protocols, see RFC 1060 and RFC 1011.

Table 35. Telnet command options from RFC 1060

<table>
<thead>
<tr>
<th>Option</th>
<th>Option (Hex)</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Binary Transmission</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Echo</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Reconnection</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Suppress Go Ahead</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Approx Message Size Negotiation</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Status</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Timing Mark</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Remote Controlled Trans and Echo</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>Output Line Width</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Output Page Size</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>Output Carriage-Return Disposition</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>Output Horizontal Tab Stops</td>
</tr>
<tr>
<td>12</td>
<td>C</td>
<td>Output Horizontal Tab Disposition</td>
</tr>
<tr>
<td>13</td>
<td>D</td>
<td>Output Formfeed Disposition</td>
</tr>
<tr>
<td>14</td>
<td>E</td>
<td>Output Vertical Tabstops</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>Output Vertical Tab Disposition</td>
</tr>
<tr>
<td>16</td>
<td>10</td>
<td>Output Linefeed Disposition</td>
</tr>
<tr>
<td>17</td>
<td>11</td>
<td>Extended ASCII</td>
</tr>
<tr>
<td>18</td>
<td>12</td>
<td>Logout</td>
</tr>
<tr>
<td>19</td>
<td>13</td>
<td>Byte Macro</td>
</tr>
<tr>
<td>20</td>
<td>14</td>
<td>Data Entry Terminal</td>
</tr>
<tr>
<td>21</td>
<td>15</td>
<td>SUPDUP</td>
</tr>
<tr>
<td>22</td>
<td>16</td>
<td>SUPDUP Output</td>
</tr>
<tr>
<td>23</td>
<td>17</td>
<td>Send Location</td>
</tr>
<tr>
<td>24</td>
<td>18</td>
<td>Terminal Type</td>
</tr>
<tr>
<td>25</td>
<td>19</td>
<td>End of Record</td>
</tr>
<tr>
<td>26</td>
<td>1A</td>
<td>TACACS User Identification</td>
</tr>
<tr>
<td>27</td>
<td>1B</td>
<td>Output Marking</td>
</tr>
<tr>
<td>Option</td>
<td>Option (Hex)</td>
<td>Name</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>28</td>
<td>1C</td>
<td>Terminal Location Number</td>
</tr>
<tr>
<td>29</td>
<td>1D</td>
<td>Telnet 3270 Regime</td>
</tr>
<tr>
<td>30</td>
<td>1E</td>
<td>X.3 PAD</td>
</tr>
<tr>
<td>31</td>
<td>1F</td>
<td>Negotiate About Window Size</td>
</tr>
<tr>
<td>32</td>
<td>20</td>
<td>Terminal Speed</td>
</tr>
<tr>
<td>33</td>
<td>21</td>
<td>Remote Flow Control</td>
</tr>
<tr>
<td>34</td>
<td>22</td>
<td>Linemode</td>
</tr>
<tr>
<td>35</td>
<td>23</td>
<td>X Display Location</td>
</tr>
<tr>
<td>255</td>
<td>FF</td>
<td>Extended-Options-List</td>
</tr>
</tbody>
</table>
Chapter 17. Diagnosing z/OS UNIX popper problems

This topic describes how to diagnose problems with z/OS UNIX popper, a mail-delivery agent.

The following subtopic is in this topic:

• “Diagnostic aids for popper” on page 495

Diagnostic aids for popper

Diagnostic aids for popper are found in the SYSLOGD log information. Following is a sample z/OS UNIX popper log message:

```
Apr 20 14:19:36 MVSW popper[16777240]: Received: "quit"
```

Use the -t trace option to direct all popper message logging to the specified file. The POP server copies the user’s entire maildrop to /tmp and then operates on that copy. If the maildrop is particularly large, or inadequate space is available in /tmp, then the server refuses to continue and terminate the connection.

To test popper, you can mimic a popper client by TELNETing into a popper port (110) and issuing the `popper` commands that are documented in RFC 1725. The following are a few of the commands that are used to verify that popper is listening on port 110:

`user name`  
Specifies the mailbox.

`pass string`  
Specifies a server/mailbox-specific password.

`list [msg]`  
Lists all message numbers and size or information about a specific message.

`retr msg`  
Retrieves the specific message to the screen.

`quit`  
Closes the connection to popper.

Following is an example of a TELNET exchange:

```
> telnet <host name/ip addr> 110
OK POP (version 2.53) at MVSW.tcp.raleigh.ibm.com starting.

> user user163
OK Password required for USER163

> pass tcpxyz
OK USER163 has 6 messages (4273 octets)

> list
OK 6 messages (4273 octets)
1 346
2 371
3 333
4 347
5 2541
6 335

> retr 3
OK 333 octets
Received: 9BPXROOT@local host by mvsw.tcp.raleigh.ibm.com (8.8.7/8.8.1) id PAA83
886099 for user163; Tue, 10 Mar 1998 15:36:57 -0500
Date: Tue, 10 Mar 1998 15:36:57 -0500
from USER163 <USER163>USER163
Message-ID: <199803102036.PAA83886099@mvsw.tcp.raleigh.ibm.com>
X-UIDL: 4569e8e12631e857eedd8d8b0ca493
```
Chapter 18. Diagnosing SNALINK LU0 problems

The TCP/IP host is implemented with the SNALINK LU0 function. This function allows the use of an SNA backbone to transfer TCP/IP protocols. A TCP/IP host with SNALINK LU0 can be an originator, destination, or router for TCP/IP data. To use the SNALINK LU0 function of TCP/IP, each connected host must have VTAM and TCP/IP installed. The SNALINK LU0 application runs in its own address space and is defined as a VTAM application. There are two types of SNALINK implementations:

- SNALINK LU0, which uses VTAM LU0 protocol
- SNALINK LU6.2, which uses VTAM LU6.2 protocol

This topic describes how to diagnose problems with the SNALINK LU0 function and contains the following sections:

- “Definitions” on page 497
- “Problem diagnosis” on page 497
- “Traces” on page 15

SNALINK LU6.2 diagnosis is discussed in Chapter 19, “Diagnosing SNALINK LU6.2 problems,” on page 503.

SNALINK LU0 is a very convenient way to connect to TCP/IP hosts using an existing SNA backbone. An IP datagram destined for a remote host that is connected using SNALINK LU0 is passed to the SNALINK LU0 address space by TCP/IP. The data is packaged into an SDLC frame and transmitted to the remote host using SNA LU0 protocol. Two SNALINK LU0 applications can be configured to connect using a single, bidirectional session or with two separate sessions (one dedicated to send data in each direction).

Definitions

The following are required to define a SNALINK LU0:

- Device and link definitions in the TCPIP profile
- Home address and routing information
- VTAM application definitions
- Parameters on the PROC used to start SNALINK LU0

For more information about these required definitions, see z/OS Communications Server: IP Configuration Reference.

Problem diagnosis

SNALINK LU0 problems are normally reported as one of the following:

- Abends
- Session hung terminals
- Session outages

Use the information in the following sections for problem determination and diagnosis of errors reported against SNALINK LU0.

When contacting the IBM Software Support Center for any type of SNALINK LU0 problem, have the VTAM application definitions for SNALINK LU0 and the DEVICE and LINK information from the hlq.PROFILE.TCPIP data set for SNALINK LU0.
Abends

An abend for the SNALINK LU0 application should result in messages or error-related information about the MVS system console. Since SNALINK LU0 is a VTAM application, some abends might be generated or first detected by VTAM. These messages indicate that VTAM is abending or a dump is being taken for the SNALINK LU0 application.

If a VTAM error caused by SNALINK LU0, see z/OS Communications Server: SNA Messages and z/OS Communications Server: IP and SNA Codes for initial problem determination.

If SNALINK LU0 fails to initialize with an 0C4 abend, there is probably an installation problem. Check the program properties table (PPT) entries for errors. Some levels of MVS do not flag PPT syntax errors properly. For more information about PPT configuration, see z/OS MVS Initialization and Tuning Reference.

Documentation

Code a SYSMDUMP DD or SYSABEND DD statement in the SNALINK cataloged procedure.

There are two MVS abends commonly seen during the initialization and startup of the SNALINK LU0 application: X'0C2' and X'0F8'. Both can be caused by the SNALINK LU0 application processing in TCB mode. The VTAM application definition statement for SNALINK LU0 must have the SRBEXIT=YES parameter coded. This should ensure that VTAM passes control to SNALINK LU0 in SRB mode. SNALINK LU0 code has processing that is not allowed in TCB mode. If the SRBEXIT parameter is coded incorrectly or allowed to default, either abend X'0C2' or X'0F8' will occur.

Guideline: Some networking optimizing packages change the defined mode for VTAM applications for performance purposes. It is suggested that this type of program not be used for the SNALINK LU0 application.

Analysis

For more information about debugging abends, see Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21.

An abend or unexpected termination of the SNALINK LU0 application does not terminate the TCP/IP address space. If there is no alternate route to the remote host, IP datagrams for TCP/IP Services components (such as TELNET and FTP) are not transmitted until the application is restarted, either manually or using TCP/IP autolog.

Session hangs

This section discusses diagnosis of a hung terminal after a session has been successfully connected. A hang might be detected by TCP/IP users who are connected to the remote system with SNALINK LU0 (this could be FTP, TELNET, or other applications).

The SNALINK LU0 application detects a hung terminal if there is no response to data sent. After waiting 30 seconds for a response, SNALINK LU0 ends the session and tries to reestablish the LU-to-LU session with its partner SNALINK LU0 application. This processing is shown on the SNALINK LU0 log or MVS console log.

Documentation

To determine the cause of an SNALINK LU0 session hung terminal, the following might be needed:

- SNALINK LU0 log or MVS console log
- NETSTAT DEVLINKS display output
- VTAM display application status output
- SNALINK LU0 DEBUG trace output
- VTAM buffer trace of the SNALINK LU0 applications
- VTAM internal trace
Steps for analyzing session hangs
Determine the cause of a reported SNALINK LU0 hung terminal.

Before you begin
The first step in analysis is to determine whether the SNALINK LU0 is actually hung or if one of the sessions using SNALINK LU0 to transfer data is hung. When the SNALINK LU0 is the only connection between two hosts, an actual hang in the SNALINK LU0 application impacts all data flowing for TCP/IP. This can include TELNET, FTP, and any other application.

Procedure
Perform the following steps:
1. Does all traffic across the SNALINK LU0 stop? A VTAM buffer trace of the SNALINK LU0 application can be used to see whether any data is being passed. If data is still flowing on the session, the SNALINK LU0 is not hung. You need to determine which TCP/IP application or component is failing. If there is no data traffic, continue with Step 2.
   You can also check SNALINK LU0 traffic by doing multiple VTAM displays of the SNALINK LU0 application. The SEND and RECEIVE data count should increase for an active session. Often, using the VTAM display to obtain the status of the TRLE might provide useful information.
2. Issue NETSTAT DEVLINKS to determine the status of the SNALINK LU0 TCP/IP device. If the NETSTAT output shows that the application is trying to connect, check the VTAM and SNALINK LU0 consoles for information about a previous error or abend. If NETSTAT indicates "negotiating," verify the session type. You might require a session_type of SINGLE; see the z/OS Communications Server: IP Configuration Reference for information about configuring session types. If NETSTAT indicates "connected" or "sending," continue with Step 3.
3. At this point, you should determine the last SNALINK LU0 activity or processing. This is best accomplished with the debug trace. Contact your IBM Software Support Center with information about the last activity from the SNALINK LU0 console and debug trace.

Session outages
A session outage is an unexpected abend or termination of the task. Session outages are seen only when an unrecoverable error is detected. The error might be a SNALINK LU0 abend or an error return code from a VTAM request. A session outage should not occur without an indication of its cause, either on the SNALINK LU0 or the VTAM console. Since SNALINK LU0 abends were already described separately, this topic describes other types of session outages.

For an example of a successful session setup between two SNALINK LU0 applications, see the z/OS Communications Server: IP Configuration Reference.

Documentation
The following documentation might be needed to determine the source of the error for a session outage problem:
- SNALINK LU0 log
- MVS console log
- VTAM log
- NETSTAT DEVLINKS display output
- VTAM display application status output
• SNALINK LU0 DEBUG trace output
• VTAM buffer trace of the SNALINK
• LU0 applications
• VTAM Internal Trace (VIT)

Note: For information about VTAM traces, see z/OS Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures and z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps and the VIT.

Analysis

When a SNALINK LU0 outage occurs, there should be messages and indicators of the reason for the outage. These appear in the SNALINK LU0 log, or on the VTAM console, or both. If an abend has been recorded, continue diagnosis using the section on abends.

The following is an example of a session outage problem. The message EZA5797E Rejecting bind from xxxxx-no DLC found, along with VTAM error message IST663I Bind fail request received, SENSE=080A0000, was displayed on the MVS system console.

Cause: Large packet size sent in a PIU is rejected by the NCP with sense 800A0000 (PIU too long).

Resolution: Reduce the MTU size on this route by using the BEGINROUTES statement.

Traces

The following traces are useful:

• Use VTAM buffer trace to trace the data sent and received from the VTAM.
• Use the TCPIP PKTTRACE LINKNAME=link_name to trace the data sent and received from TCP/IP.

Using IP packet trace

The IP packet trace facility is used to trace the flow of IP packets. It is useful when tracking the cause of packet loss or corruption. If the LINKNAME parameter of the IP packet trace facility is specified, only packets that are transferred along the specific link are traced. Specifying this parameter is recommended to avoid tracing many unrelated packets. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details about how to use the IP packet trace facility.

SNALINK LU0 DEBUG trace

The SNALINK LU0 DEBUG trace output is written to an internal buffer. The trace can be seen only if a dump of the SNALINK LU0 address space is taken. The trace wraps when the buffer is full (a pointer in the trace header points to the most current entry).

The trace contains information about SNALINK LU0 processing. This information includes communication with VTAM and TCP/IP, showing VTAM macro requests and DLC requests.

Starting SNALINK LU0 DEBUG trace

To run the SNALINK LU0 DEBUG trace, SNALINK LU0 must be started with DEBUG listed as the first parameter of the PARM parameter on the EXEC statement of the SNALINK cataloged procedure. For information about this parameter, see z/OS Communications Server: IP Configuration Reference.

DEBUG trace example

Figure 62 on page 501 shows part of an internal SNALINK LU0 trace obtained from a dump. As shown in the example, the trace can be located by searching for the characters TRCTBL in the dump of the SNALINK LU0 address space. Following the eyecatcher is the address of the next entry to be written, the starting address of the trace table, and the ending address of the trace table.

Use the information following the trace to interpret the entry types and their meaning.
Figure 62. Example of a SNALINK LU0 DEBUG trace

The layout of a SNALINK trace table entry is shown in Table 36 on page 501.

<table>
<thead>
<tr>
<th>Bytes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>00–07</td>
<td>TOD time stamp</td>
</tr>
<tr>
<td>08–0F</td>
<td>LU name, if any</td>
</tr>
<tr>
<td>Bytes</td>
<td>Definition</td>
</tr>
<tr>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>10</td>
<td>Entry Type</td>
</tr>
<tr>
<td></td>
<td>Value</td>
</tr>
<tr>
<td></td>
<td>01 DLC Accept</td>
</tr>
<tr>
<td></td>
<td>02 DLC Send</td>
</tr>
<tr>
<td></td>
<td>03 DLC Receive</td>
</tr>
<tr>
<td></td>
<td>04 DLC Sever</td>
</tr>
<tr>
<td></td>
<td>05 DLC Msg Pend Queue Request</td>
</tr>
<tr>
<td></td>
<td>06 DLC Msg Pend D-Queue Request</td>
</tr>
<tr>
<td></td>
<td>0E MVS DLC emulation</td>
</tr>
<tr>
<td></td>
<td>0F DLC Interrupt</td>
</tr>
<tr>
<td></td>
<td>10 VTAM Request</td>
</tr>
<tr>
<td></td>
<td>17 VTAM OPNDST Exit</td>
</tr>
<tr>
<td></td>
<td>1F VTAM CLSDST Exit</td>
</tr>
<tr>
<td></td>
<td>22 VTAM SEND Exit</td>
</tr>
<tr>
<td></td>
<td>23 VTAM Receive Exit</td>
</tr>
<tr>
<td></td>
<td>25 VTAM SESSIONC Exit</td>
</tr>
<tr>
<td></td>
<td>2A VTAM OPNSEC Exit</td>
</tr>
<tr>
<td></td>
<td>2C VTAM TERMSESS Exit</td>
</tr>
<tr>
<td></td>
<td>31 VTAM SCIP Exit</td>
</tr>
<tr>
<td></td>
<td>32 VTAM LOSTERM Exit</td>
</tr>
<tr>
<td></td>
<td>33 VTAM NSEXIT Exit</td>
</tr>
<tr>
<td></td>
<td>34 VTAM TPEND Exit</td>
</tr>
<tr>
<td></td>
<td>35 VTAM LOGON Exit</td>
</tr>
<tr>
<td></td>
<td>40 SNALINK Internal Message Routine Call</td>
</tr>
<tr>
<td>11</td>
<td>DLC Interrupt Code/VTAM RPL REQ Code/ VTAM Receive Exit Chain field</td>
</tr>
<tr>
<td>12</td>
<td>VTAM CMD: R15/VTAM Exit: RTNCD</td>
</tr>
<tr>
<td>13</td>
<td>VTAM CMD: R0 /VTAM Exit: FDB2/DLC IPRCODE</td>
</tr>
<tr>
<td>14-17</td>
<td>RPL Address/DLC MSG ID/TPEND reason code/Internal Message ID</td>
</tr>
<tr>
<td>18-1B</td>
<td>VTAM Send/Receive/DLC buffer address/Number of Arguments Passed to Internal Message routine</td>
</tr>
<tr>
<td>1C-1F</td>
<td>VTAM Send/Receive/DLC buffer length/Internal Message Routine caller's return address</td>
</tr>
</tbody>
</table>
Chapter 19. Diagnosing SNALINK LU6.2 problems

This topic describes how to diagnose problems with the SNALINK LU6.2 function and contains the following subtopics:

- “Steps for setting up a SNALINK LU6.2 network” on page 504
- “Common configuration mistakes” on page 505
- “Diagnosing problems” on page 505
- “Documentation references for problem diagnosis” on page 517
- “Traces” on page 520
- “Finding abend and sense code documentation” on page 525
- “Finding error message documentation” on page 525

The SNALINK LU6.2 interface uses the LU type 6.2 protocol to establish a point-to-point connection across a SNA network. SNALINK LU6.2 is capable of establishing a connection with any system that runs TCP/IP and uses the LU type 6.2 protocol.

The SNALINK LU6.2 interface is similar to the SNALINK LU0 and X.25 NPSI interfaces with the connection involving several subsystems. The components of the SNALINK LU6.2 network are shown in Figure 63 on page 503.

![Diagram of SNALINK LU6.2 components on MVS](image)

**Figure 63. Components of a SNALINK LU6.2 connection on MVS**

Following is a brief description of the component interaction and data flow that occurs when data is transferred over a SNALINK LU6.2 network. Each component is cross-referenced to the figure.

1. Data is generated and encapsulated on the TCP/IP address space and is passed to the SNALINK LU6.2 address space through a DLC connection.

2. The SNALINK LU6.2 address space handles all establishment, aging, and termination of SNA network connections in a manner transparent to the TCP/IP address space. The data is then sent to the local system SNA subsystem. For MVS hosts, this subsystem is VTAM.

3. VTAM APPC routines are used to pass the data to the SNA network.
VTAM routines on the destination system receive the data and pass it through to the SNALINK LU6.2 address space.

The SNALINK LU6.2 address space sends the data to the TCP/IP address space using a DLC connection.

The data is unencapsulated and processed by the TCP/IP address space.

### Steps for setting up a SNALINK LU6.2 network

This list of steps can be used to diagnose problems in starting components by identifying the prerequisites. For details about how to complete the steps, see the appropriate documentation.

**Procedure**

Complete the following steps to establish the system that is described in Figure 63 on page 503.

1. Configure the SNALINK LU6.2 network on both the local and remote network hosts. This is fully described in *z/OS Communications Server: IP Configuration Reference* in the section about configuring and operating the SNALINK LU6.2 interface. The process can be condensed into the following steps:
   a. Specify SNALINK LU6.2 DEVICE and LINK statements in the hlq.PROFILE.TCPIP data set.
   b. Copy the sample SNALINK LU6.2 cataloged procedure to an authorized data set and update according to your system.
   c. Define a SNALINK LU6.2 application LU to VTAM.
   d. Customize a SNALINK LU6.2 configuration data set.

2. Vary the SNALINK LU6.2 VTAM application LUs active on both the local and remote network hosts.

3. Start both the local and remote network TCP/IP address spaces.

4. Start both the local and remote network SNALINK LU6.2 address spaces, if they have not been autologged by the TCP/IP address space.

5. Verify that the network connection has been established between the local host and the remote host. See “Using the SNALINK LU6.2 subcommand” on page 517 for details about how to verify SNALINK LU6.2 connections.

**Results**

The example in Figure 64 on page 504 shows the messages that are expected when the SNALINK LU6.2 address space is started and a network connection is established.

```
S SNAL621A
$HASPI00 SNAL621A ON STCINRDR
$HASP373 SNAL621A STARTED
1 IEF403I SNAL621A - STARTED - TIME=15.26.03
2 EZA5927I LU62CFG : NO ERRORS DETECTED - INITIALIZATION WILL CONTINUE
3 EZA5932I INITIALIZATION COMPLETE - APPLID: SNAL621A  TCP/IP: TCPCS
4 EZA5935I SEND CONVERSATION ALLOCATED FOR 9.67.22.2
5 EZA5933I LINK SNALU62L OPENED
EZZ4313I INITIALIZATION COMPLETE FOR DEVICE SNALU621
4 EZA5936I RECEIVE CONVERSATION ALLOCATED FOR 9.67.22.2
```

*Figure 64. Sample MVS System Console Messages on SNALINK LU6.2 Address Space Startup*

The following list explains the MVS system console messages on SNALINK LU6.2 address space startup as shown in Figure 64 on page 504.
The SNAL621A address space has been started.

The SNALINK LU6.2 configuration data set for the SNAL621A address space has been successfully parsed.

The SNAL621A address space displays its local VTAM application LU and the TCP/IP address space name to which it connects.

The SNAL621A address space establishes a network connection through the VTAM API.

The SNAL621A address space establishes a DLC connection with its TCP/IP address space.

Common configuration mistakes

Following is a list of common configuration mistakes:

- The SNALINK LU6.2 configuration data set contains a syntax error.
- The SYSTCPD or LU62CFG ddnames in the SNALINK LU6.2 cataloged procedure have been assigned to a data set that is not valid.
- The SNALINK LU6.2 VTAM application LU has not been activated.
- The SNALINK LU6.2 VTAM application LU definition has the option SRBEXIT=YES.
- The SNALINK LU6.2 VTAM application LU definition does not have the option APPC=YES.
- The SNALINK LU6.2 VTAM application LU definition specifies a logon mode table in the MODETAB parameter that does not contain the log mode entry specified in the LOGMODE parameter on the LINK statement in the SNALINK LU6.2 configuration data set. The logon mode entry options used for the local host must be the same as for the remote host.
- The hlq.PROFILE.TCPIP data set contains syntax errors in the SNALINK LU6.2 BEGINROUTES, DEVICE, LINK, HOME, or START statements.
- The maximum buffer size in the SNALINK LU6.2 configuration data set does not match the MTU size on the BEGINROUTES statement of the hlq.PROFILE.TCPIP data set.
- The link name in the SNALINK LU6.2 configuration data set does not match the link name on the LINK statement in the hlq.PROFILE.TCPIP data set.
- The SNALINK LU6.2 device has not been started by a START statement in the hlq.PROFILE.TCPIP data set.
- The user ID assigned to the SNALINK LU6.2 start procedure has not had an OMVS Segment assigned to it using RACF or similar security manager.

Diagnosing problems

SNALINK LU6.2 problems are normally reported under one of the following categories:

- Problems starting the SNALINK LU6.2 address space
- DLC connection
- Network connection establishment
- Network connection loss
- Data loss
- Data corruption

Use the information in the following topics to help you diagnose SNALINK LU6.2 problems.
Quick checklist for common problems

The following list summarizes some initial checks that can be made quickly.

Use the following checklist to identify problem areas:

1. **Is the TCP/IP SNALINK LU6.2 network active?**
   
   PING the remote TCP/IP host from the local TCP/IP host to verify that the SNALINK LU6.2 network is active. If the SNALINK LU6.2 network is not active, continue through this list to identify the problem.

   If the PING still fails after working through this list, see “Network connection establishment problems” on page 512 for a detailed list of network connection problems and their solutions.

2. **Have you completed all the required definitions?**
   
   See “Steps for setting up a SNALINK LU6.2 network” on page 504 for the list of definitions and configurations required. Continue through this list if connection problems persist.

3. **Have the VTAM major node and application LU used by the SNALINK LU6.2 address space been varied active?**
   
   See “Useful VTAM operations” on page 518 for details on how to use the VTAM DISPLAY command to identify the status of the VTAM major node and application LU.

   If the VTAM application LU is not in a CONCT state, see “Useful VTAM operations” on page 518 for details about how to vary the VTAM application LU active.

4. **Are the TCP/IP and SNALINK LU6.2 devices started and active on the local and remote host?**
   
   Check to see whether the TCP/IP and SNALINK LU6.2 devices are active and running. The MVS SDSF facility can be used to view the active address space list for MVS hosts.

   If the SNALINK LU6.2 address space does not start, see “Problems starting the SNALINK LU6.2 address space” on page 506 for a detailed list of startup problems and their solutions.

5. **Did the SNALINK LU6.2 address space list any configuration errors to the SYSPRINT data set?**
   
   Use the JCL DD statement in the SNALINK LU6.2 cataloged procedure to identify the destination of the SYSPRINT output and check for errors. If errors occur, see “Finding error message documentation” on page 525 to determine the reason for the configuration errors. Text in the message documentation specifies the action required to fix the problem.

6. **Have the TCP/IP-to-SNALINK LU6.2 DLC connections been established?**
   
   See “Using NETSTAT” on page 517 for details about how to use the NETSTAT command to identify the status of the DLC connection.

   If the status of the DLC connection is not “Connected,” see “DLC connection problems” on page 509 for a detailed list of SNALINK LU6.2 DLC connection problems and their solutions.

7. **Does the MVS system console contain VTAM error messages?**
   
   See z/OS Communications Server: SNA Messages and z/OS Communications Server: IP and SNA Codes for detailed descriptions of the VTAM error messages and sense codes. These messages might indicate a network configuration or hardware error.

Problems starting the SNALINK LU6.2 address space

Generally, if there is a startup problem, error messages are displayed on the MVS system console during the starting of the SNALINK LU6.2 address space. The address space then terminates.

**Documentation**

To isolate a SNALINK LU6.2 address space starting problem, note any error messages or abend codes that are displayed on the MVS system console.
Table 37. Common SNALINK LU6.2 address space startup problems

<table>
<thead>
<tr>
<th>If this is displayed...</th>
<th>Then this might have occurred...</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The message <strong>Errors Detected</strong> - <strong>Address Space will Terminate</strong> has been displayed on the MVS system console with no other error messages.</td>
<td>This error message indicates that an error has occurred with the SNALINK LU6.2 configuration data set.</td>
<td>Check the SNALINK LU6.2 SYSPRINT output for messages that tell what kind of syntax error might have occurred. If a syntax error has occurred in the configuration data set, correct it and restart the SNALINK LU6.2 address space. See the z/OS Communications Server: IP Configuration Reference for details about the SNALINK LU6.2 configuration data set statement syntax.</td>
</tr>
<tr>
<td>The message <strong>Error in open of LU62CFG - no data will be read</strong> has been displayed on the MVS system console.</td>
<td>The SNALINK LU6.2 address space cannot access a SNALINK LU6.2 configuration data set. The LU62CFG ddname might have been omitted from the SNALINK LU6.2 cataloged procedure.</td>
<td>Check the SNALINK LU6.2 cataloged procedure. Ensure that the LU62CFG ddname is assigned a valid SNALINK LU6.2 configuration data set. See the z/OS Communications Server: IP Configuration Reference for an example of a SNALINK LU6.2 cataloged procedure.</td>
</tr>
<tr>
<td>The message <strong>Address Space Already Active - this Address Space will Terminate</strong> has been displayed on the MVS system console.</td>
<td>An address space with the same name as the SNALINK LU6.2 address space is already active.</td>
<td>Check to see whether the address space with the same name is no longer required before stopping it, or rename the SNALINK LU6.2 address space. Restart the SNALINK LU6.2 address space.</td>
</tr>
</tbody>
</table>
Table 37. Common SNALINK LU6.2 address space startup problems (continued)

<table>
<thead>
<tr>
<th>If this is displayed...</th>
<th>Then this might have occurred...</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| **The messages Error 0000005A in VTAM OPEN and Errors detected in VTAM Initialization - Address Space will terminate have been displayed on the MVS system console.** | The SNALINK LU6.2 address space has not been able to find the VTAM application LU that has been defined in the VTAM statement of the SNALINK LU6.2 configuration data set. | This problem might be resolved by one or both of the following solutions:  
- Check the status of the SNALINK LU6.2 VTAM application LU and its VTAM major node. If it is not in a CONCT state, the VTAM major node and then the VTAM application LU must be activated.  
  
See “Useful VTAM operations” on page 518 for a detailed description of the VTAM operations that display the status of VTAM application LUs and activate them.  
- Check the VTAM application LU specified in the VTAM statement of the SNALINK LU6.2 configuration data set. Ensure that it exists and is not duplicated within the domain in which the SNALINK LU6.2 application program resides.  
  
See z/OS Communications Server: IP Configuration Reference for details about the SNALINK LU6.2 VTAM statement syntax and the SNALINK LU6.2 VTAM application LU definition. |

| The messages Error 00000024 in VTAM OPEN and Errors detected in VTAM Initialization - Address Space will terminate have been displayed on the MVS system console. | VTAM security is not allowing the SNALINK LU6.2 address space to access the VTAM application LU. | Check to see whether the SNALINK LU6.2 configuration data set VTAM statement password matches the password set in the VTAM application LU definition and correct it, if necessary.  
  
See z/OS Communications Server: IP Configuration Reference for details about the SNALINK LU6.2 VTAM statement syntax and the SNALINK LU6.2 VTAM application LU definition. |
<table>
<thead>
<tr>
<th>If this is displayed...</th>
<th>Then this might have occurred...</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SNALINK LU6.2 address space abends with a system abend code of 300 after the SNALINK LU6.2 address space STARTED message.</td>
<td>The abend code of 300 indicates that there is insufficient storage for the SNALINK LU6.2 address space.</td>
<td>Either increase the value of the REGION parameter for the address space or reduce the number of buffers specified in the SNALINK LU6.2 configuration data set. See z/OS Communications Server: SNA Messages and z/OS Communications Server: IP and SNA Codes for detailed SNALU6.2 abend code descriptions.</td>
</tr>
<tr>
<td>The SNALINK LU6.2 address space abends with an abend code of S0F8 after the Initialization Complete... message.</td>
<td>The MVS S0F8 abend code indicates that an SVC was issued in SRB mode. SNALINK LU6.2 is not designed to run with VTAM in SRB mode.</td>
<td>The SRBEXIT option in the VTAM application LU definition has been set to “Yes.” Correct the VTAM application LU definition. See z/OS Communications Server: IP Configuration Reference for details about the SNALINK LU6.2 VTAM application LU definition.</td>
</tr>
</tbody>
</table>

If, after investigation, you do not find the SNALINK LU6.2 startup problem, obtain a description of all abend codes and errors written to the SYSPRINT data set and MVS system console. Most solutions to SNALINK LU6.2 address space starting problems can be solved by reading the error message or abend code descriptions.

See “Finding abend and sense code documentation” on page 525 and “Finding error message documentation” on page 525 for a list of references that contain SNALINK LU6.2 error message and abend code documentation.

**DLC connection problems**

These problems are related to the TCP/IP DLC connection between the TCP/IP address space and the SNALINK LU6.2 address space.

The DLC connection between the TCP/IP and SNALINK LU6.2 address spaces is established during the SNALINK LU6.2 address space startup after the SNALINK LU6.2 configuration data set has been parsed. This DLC connection can be established independently of the SNA LU type 6.2 connection between two or more SNALINK LU6.2 address spaces. The fundamental requirements of the DLC connection are an active, configured SNALINK LU6.2 address space and an active, configured TCP/IP address space. The DLC connection is initiated by a START statement in hlq.PROFILE.TCPIP.

**Steps for checking DLC connection status**

Check the status of the DLC connection.

**Procedure**

Perform the following steps:

1. Note the SNALINK LU6.2 address space startup messages displayed on the MVS system console.
2. Issue a NETSTAT DEVLINKS command to obtain the status of the DLC connection.
   
   See “Using NETSTAT” on page 517 for details about how to use the NETSTAT command to identify the status of the DLC connection.
Results
If the DLC connection status is not Connected, check the list of common DLC connection problems in the next section.

Analysis
Table 38 on page 510 lists some of the common DLC connection problems between the SNALINK LU6.2 address space and the TCP/IP address space.

<table>
<thead>
<tr>
<th>If this is displayed. . .</th>
<th>Then this might have occurred . . .</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The message Error in DLC connect... has been displayed on the MVS system console and the NETSTAT DEVLINKS output shows that the DLC connection status is either Issued Connect or Will retry connect.</td>
<td>The TCP/IP address space is attempting to attach to the SNALINK LU6.2 address space, but the SNALINK LU6.2 address space is not responding.</td>
<td>Check whether the SNALINK LU6.2 address space is active and start it, if necessary.</td>
</tr>
</tbody>
</table>
Table 38. Common DLC connection problems (continued)

<table>
<thead>
<tr>
<th>If this is displayed. . .</th>
<th>Then this might have occurred . . .</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| The SNALINK LU6.2 address space has started, but the Link open message has not been displayed on the MVS system console, no other error messages have been displayed on the console, and the NETSTAT DEVLINKS output shows that the DLC connection status is either Issued Connect or Will retry connect. | This problem can be due to one of the following situations:  
1. The SNALINK LU6.2 address space might be rejecting the connect attempt from the TCP/IP address space because it has the wrong TCP/IP ID.  
2. The SNALINK LU6.2 address space might be rejecting the connect attempt from the TCP/IP address space because of a SNALINK LU6.2 link name that is incorrectly defined. | • Check the SNALINK LU6.2 SYSPRINT output for the “Rejecting DLC path for the link_name, wrong TCP/IP id tcpip_addr_space” error message. If this error message is displayed, check whether a valid TCPIP.DATA data set was specified as the SYSTCPD ddbname in the SNALINK LU6.2 cataloged procedure and correct it, if necessary.  
Note: SYSTCPD can be overridden by the global TCPIP.DATA file.  
See z/OS Communications Server: IP Configuration Reference for an example of a SNALINK LU6.2 cataloged procedure and for the search order for the TCPIP.DATA data set.  
If a valid TCPIP.DATA data set has been used, check the TCP/IP address space specified in the TCPIPJOBNAME statement within it.  
See z/OS Communications Server: IP Configuration Reference for a detailed description of the TCPIPJOBNAME statement in the TCPIP.DATA.  
• Check the SNALINK LU6.2 SYSPRINT output for the “Rejecting DLC path for link_name, not configured” error message.  
If this error message is displayed, check to see whether the link name specified in the LINK statement of the SNALINK LU6.2 configuration data set matches the link name specified in the LINK statement associated with the SNALINK LU6.2 device defined in hlq.PROFILE.TCPIP.  
See z/OS Communications Server: IP Configuration Reference for details about the SNALINK LU6.2 LINK statement syntax and the TCPIP LINK statement syntax. |
Table 38. Common DLC connection problems (continued)

<table>
<thead>
<tr>
<th>If this is displayed . . .</th>
<th>Then this might have occurred . . .</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SNALINK LU6.2 address space has been started but the Link opened message has not been displayed and the NETSTAT DEVLINKS output shows that the DLC connection is Inactive.</td>
<td>The DLC connection to the SNALINK LU6.2 device associated with the SNALINK LU6.2 address space might not have been started by the TCP/IP address space.</td>
<td>Check the START statements in hlq.PROFILE.TCPIP. If the SNALINK LU6.2 device has not been started, use the VARY TCPIP,procname,START,device_name for the SNALINK LU6.2 device or include the START statement in the hlq.PROFILE.TCPIP and restart the TCP/IP address space. See z/OS Communications Server: IP Configuration Reference for a detailed description of the START statement in the hlq.PROFILE.TCPIP.</td>
</tr>
</tbody>
</table>

Network connection establishment problems

These problems are related to the establishment of the SNA LU type 6.2 connection between two or more SNALINK LU6.2 devices.

The SNA LU type 6.2 connection can be established independently of the TCP/IP address space and the DLC link. The fundamental requirements for establishing the LU type 6.2 connection are two active, configured SNALINK LU6.2 devices that have an active SNA network connection between them.

Initiate the establishment of a network connection in one of the following ways:

- Connections with the INIT parameter specified on the DEST statement in the SNALINK LU6.2 configuration data set are established when the SNALINK LU6.2 address space is started.
- Connections with the DATA parameter specified on the DEST statement in the SNALINK LU6.2 configuration data set or connections that have timed out or been terminated are established when a request is made to the SNALINK LU6.2 address space to transfer data across the link.
- Connections can be established using the SNALINK LU6.2 RESTART MODIFY subcommand.

Steps for checking network connection problems

Issue MODIFY subcommands to the MVS SNALINK LU6.2 address space to check the status of the LU type 6.2 connection

Procedure

Perform the following steps:

1. MODIFY addr_sp_name,LIST,LU=dest_lu_name
   where addr_sp_name is the MVS SNALINK LU6.2 address space name and dest_lu_name is the SNA destination LU name of the remote SNALINK LU6.2 device.
   See “Using the SNALINK LU6.2 subcommand” on page 517 for more information about issuing this command and reading the output.
   If the connection status is not “Allocated,” continue with the following commands.
2. MODIFY addr_sp_name,RESTART,LU=dest_lu_name
   This command attempts to establish the LU type 6.2 connection between the SNALINK LU6.2 devices. During connection establishment, any problems causes error messages to be output to the MVS system console.
3. MODIFY addr_sp_name,LIST,LU=dest_lu_name
**Results**

If the connection status is still not “Allocated,” note the messages in the SYSPRINT data set and on the MVS system console and continue with the following analysis.

**Analysis**

Table 39 on page 513 lists some of the common SNALINK LU6.2 address space network establishment problems.

---

<table>
<thead>
<tr>
<th>If this is displayed . . .</th>
<th>Then this might have occurred . . .</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| The SNALINK LU6.2 address space issued error message: Unable to allocate send conversation. | This problem can be due to one of the following situations:  
1. The local VTAM application LU might not be enabled for LU type 6.2 conversations. The name of this LU is specified on the VTAM statement in the SNALINK LU6.2 configuration data set.  
2. The remote VTAM application LU names might not identify an LU that is reachable or that can establish an LU type 6.2 conversation over the SNA network. The remote VTAM application LU name is specified in the DEST statement of the SNALINK LU6.2 configuration data set. For dependent LUs, both the SEND and RECV LU names must be able to establish LU type 6.2 conversations. | 1. The APPC option in the VTAM application LU definition must be set to YES to enable LU type 6.2 conversations.  
2. The first step is to check to see whether the remote SNALINK LU6.2 device is active. If the remote SNALINK LU6.2 is using VTAM to access the SNA network, see “Useful VTAM operations” on page 518 to check the active status of the remote LU. If the remote SNALINK LU6.2 device is active, use the VTAM error messages to determine why the LU type 6.2 conversation cannot be established with the destination LU. The VTAM error messages are written to the MVS system console immediately before the Unable to allocate send conversation message. VTAM sense code documentation can be found in z/OS Communications Server: SNA Messages and z/OS Communications Server: IP and SNA Codes. These messages might indicate a network configuration or hardware error. |

VTAM error message output to the MVS system console: REQUIRED LOGMODE NAME UNDEFINED.  
To allocate LU type 6.2 conversations over an SNA network, both sides must specify matching log modes. The VTAM log modes are defined in log mode tables. The log mode configured for use with this connection cannot be found in the log mode table specified on the VTAM application LU definition.  
The log mode entry name specified as the LOGMODE parameter on the LINK statement in the SNALINK LU6.2 configuration file must exist in the log mode table specified on the MODETAB statement in the VTAM application LU definition.

---

The following list contains some of the common SNALINK LU6.2 address space network establishment problems. Each error symptom is listed with possible causes and resolutions.
Network connection loss problems

SNA network connection loss can be either expected or unexpected. This section deals with unexpected connection problems. The definitions of expected and unexpected losses are described before continuing with the analysis for unexpected loss.

Connections for the SNALINK LU6.2 address space can be configured to be normally active or normally inactive. The normally inactive configuration is used when there is a cost involved with the network connection time. Normally inactive connections are expected to experience connection establishment and loss regularly with use. Because of this, the SNALINK LU6.2 address space does not write messages to the MVS system console for connection loss. Connection loss for a normally active connection is unexpected. In this case, the SNALINK LU6.2 address space writes connection loss messages to the MVS system log.

When a connection is configured with the INIT parameter on the DEST statement and a timeout value of zero on the LINK statement in the SNALINK LU6.2 configuration data set, the connection is a normally active connection.

When a connection is configured with the DATA parameter on the DEST statement and a nonzero timeout value on the LINK statement in the SNALINK LU6.2 configuration data set, the connection is a normally inactive connection.

Check the connection that is experiencing the loss to ensure that the loss is unexpected. If the connection loss experienced is caused by errors, the loss is unexpected regardless of the connection configuration.

Documentation

Unexpected connection loss occurs if the SNALINK LU6.2 address space encounters errors that compromise the connection. In this case, error messages are written to the data set specified on the SYSPRINT DD statement in the SNALINK LU6.2 cataloged procedure.

To check the status of the SNA LU type 6.2 connection, issue the LIST MODIFY subcommand to the MVS SNALINK LU6.2 address space. See “Using the SNALINK LU6.2 subcommand” on page 517 for more information about issuing this command and reading the output.

Analysis

Use the error messages in the SNALINK LU6.2 SYSPRINT data set to identify the cause of the loss. See “Finding error message documentation” on page 525 for details on finding the documentation for these messages. Text in the message documentation specifies the action required to fix the problem.

Data loss problems

These problems are related to data transfer over the SNALINK LU6.2 network. The first step is to determine the point in the network where the data is being lost. The following information is mainly concerned with determining the actual place of loss.

Steps for documenting data loss problems

Determine the source of the data loss.

Before you begin

To determine where the data packets are being lost, use the LIST MODIFY command for the SNALINK LU6.2 address space. See “Using the SNALINK LU6.2 subcommand” on page 517 for details. When listing the connection status, the number of packets sent and received over the connection since establishment is displayed in the report.

Procedure

Perform the following steps:

1. Record the current packet count for the SNALINK LU6.2 devices in the network that support the LIST MODIFY command.
2. Issue the PING command on one end of the connection. In a correctly functioning network, PING sends a data packet to the other end of the connection, which then sends a response data packet back to the PING command.
3. Use the updated packet counts to determine how far the packet went.
4. Issue the PING command from the other end of the connection.
5. Use the updated packet counts to determine how far the packet got.

**Results**

**Tip:** IP packet trace, as described in “Using IP packet trace” on page 523, can also be used to trace and validate the IP data packets as they enter and leave the SNALINK LU6.2 address space.

**Analysis**

Table 40 on page 515 lists some of the common SNALINK LU6.2 data loss problems.

<table>
<thead>
<tr>
<th>Table 40. Common SNALINK LU6.2 data loss problems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>If this is displayed. . .</strong></td>
</tr>
</tbody>
</table>
| Data packets are lost between the TCP/IP and the SNALINK LU6.2 address space (either end). | This problem can be due to one of the following situations:  
   1. The DLC link between the TCP/IP address space and the SNALINK LU6.2 address space might not be active.  
   2. The SNALINK LU6.2 address space might be discarding packets. | 1. See “DLC connection problems” on page 509 to diagnose the DLC link problem.  
   2. When a condition occurs in the SNALINK LU6.2 address space that causes data to be lost, “discarding datagram” messages are written to the data set specified by the SYSPRINT DD statement in the SNALINK LU6.2 cataloged procedure. See “Finding error message documentation” on page 525 for details on finding the documentation for these messages. Text in the message documentation specifies the action required to fix the problem. |
### Table 40. Common SNALINK LU6.2 data loss problems (continued)

<table>
<thead>
<tr>
<th>If this is displayed. . .</th>
<th>Then this might have occurred . . .</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| Data packets are actually not lost but the protocol (PING) times out. | The SNALINK LU6.2 device might be establishing the LU type 6.2 connection to transfer the data packets. The delay in establishing the connection might be causing the protocol to time out. | If the DATA parameter is specified on the DEST statement for the connection in the SNALINK LU6.2 configuration data set, the connection is not established until data is to be transferred over the connection. In this case, after the first data transfer, further data packets are transferred successfully.  
If the TIMEOUT parameter is specified on the LINK statement for the connection in the SNALINK LU6.2 configuration data set, the connection can be timing out too often, causing the connection to be reestablished for each data transfer. In this case, the protocol timeout value or the connection timeout value should be increased. |
| Data packets are lost between the SNALINK LU6.2 devices. | The network is failing. | Check for VTAM error messages on the MVS system console. See “VTAM buffer traces” on page 524 for more details about using VTAM traces to diagnose the SNA network. |

### Data corruption problems

To determine the source of corruption for the data packets, use the IP packet tracing facility. This facility traces and validates the IP data packets as they enter and leave the SNALINK LU6.2 address space. Using this facility, the source of corruption can be identified as either the SNA network or the TCP/IP system.

#### Documentation

Set up the network conditions that are experiencing the data corruption. Start component trace in the SNALINK LU6.2 address space. Use the appropriate amount of data and time to ensure the corruption occurs.

**Guideline:** Allocate the MVS GTF trace data set (usually SYS1.TRACE) large enough to hold the expected trace output. This trace data set wraps back to the start of the data set when full, overwriting trace information. When tracing, this option does not collect all the data, which means the corruption could be missed. When formatting, this option turns off some of the IP packet validation processing.

#### Analysis

The IP packet trace facility analyzes the data corruption problem automatically. After the trace is collected, the trace data is passed through a formatter, which presents the data packets in an easy-to-read report and validates the contents of the packets against the RFC requirements. Every byte of the data packet is validated including reserved fields. The checksums are also recalculated and verified. If any of the data packets traced are corrupted, the formatter writes messages in the formatted report.

You can use this method, possibly together with TCP/IP internal traces, network level traces, or both, to identify the source and type of corruption.

For details on how to use the IP packet trace facility, see “Using IP packet trace” on page 523.
Documentation references for problem diagnosis

This section contains the information and documentation references required to gather and decode diagnostic information about the SNALINK LU6.2 network connection.

The main tools used for problem diagnosis are the NETSTAT utility, the SNALINK LU6.2 LIST subcommand, VTAM status display operations, the SNALINK LU6.2 internal trace facility, and the IP packet trace facility. The use of these tools is explained in the following sections. An explanation of how to interpret the output from each of these tools is also provided and referenced against the sample output.

For TCP/IP internal tracing or VTAM buffer tracing, you are referred to the appropriate diagnosis documentation.

Two cross-reference sections are provided at the end of this section that list all of the types of abend codes, sense codes, and error messages that can be issued from the SNALINK LU6.2 network connection. For each type of abend code, sense code, or error message, you are referred to the documentation that provides a complete description.

Using NETSTAT

This section describes how to use NETSTAT to query the state of TCP/IP devices. This command can be used to quickly verify the status of the SNALINK LU6.2 device and link with relation to the TCP/IP address space.

The NETSTAT DEVLINKS command output displays only information that is known to TCP/IP.

Restriction: The TCP/IP address space must be started before the NETSTAT command can query the connection status.

The NETSTAT DEVLINKS command displays the devices and links that have been defined to the main TCP/IP address space and the status of these devices (whether active or inactive).

Figure 65 on page 517 shows a sample of output from the NETSTAT DEVLINKS command.

```
DevName: SNALU621          DevType: SNALU62
    DevStatus: Ready
LnkName: SNALU62L          LnkType: SNALU62     LnkStatus: Ready
    NetNum: 1   QueSize: 0
    BytesIn: 0                     BytesOut: 0
    ActMTU: 32764
    BSD Routing Parameters:
        MTU Size: 00000             Metric: 00
        DestAddr: 0.0.0.0           SubnetMask: 255.0.0.0
        Multicast Specific:
            Multicast Capability: No
```

Figure 65. NETSTAT DEVLINKS output example

The example shows four SNALINK LU6.2 devices and associated links known to TCP/IP.

The most significant field for diagnosing DLC connection problems is the DevStatus field. See z/OS Communications Server: IP Configuration Reference for detailed interpretation of the device status and its importance in the SNALINK LU6.2 DLC connection.

Using the SNALINK LU6.2 subcommand

This section details how to use the LIST MODIFY subcommand for the MVS SNALINK LU6.2 address space. The SNALINK LU6.2 address space has interactive commands to control the operation and list the status of the active address space. The LIST MODIFY subcommand writes a report to the MVS system console giving the status of the specified connections.

The connection status listed by the LIST subcommand can be requested for a particular remote VTAM application LU name or destination IP address. The following is an example using the LU parameter:

```
MODIFY proclename,LIST LU=lu_name
```
In this example, `procname` is the member name of the cataloged procedure used to start the local SNALINK LU6.2 address space and `lu_name` is the remote VTAM application LU name of the connection for which you are requesting the status.

Figure 66 on page 518 shows a sample output from the subcommand.

```plaintext
f snal621a,list lu=snal622a
EZA5971I LIST ACCEPTED; RANGE = SINGLE CONNECTION
EZA5996I  9.67.22.2 (Connected on 01.051 at 15:44:32)
EZA5969I Connected via: DATA Trace Level: ON
EZA5969I SEND:- Status: Allocated Packets Out: 1
EZA5970I RECV:- Status: Allocated Packets In: 1
EZA5974I LIST COMPLETED
```

**Figure 66. LIST MODIFY subcommand output example**

An active connection displays the EZA5968I Connected message with the Allocated status for both the send and receive conversations.

The SNALINK LU6.2 connection allocates two LU type 6.2 conversations: one for sending data to the remote device and one for receiving data. For independent LUs, the remote LU name is the same for both conversations. For dependent LUs, a remote LU name is specified for both the send and receive conversations.

The Packets In and Packets Out fields are decimal counters that record the number of data packets received from the remote SNALINK LU6.2 and the number of data packets sent to the remote SNALINK LU6.2, respectively. These fields can be used to identify configuration errors that cause data packets to be lost or discarded. For example, the packet counters can be used to track how far a PING packet travels around the network circuit before it gets lost. Each counter incremented means the packet made it past that point.

For more information about the contents of the messages from the LIST MODIFY subcommand, see the message documentation referenced in “Finding error message documentation” on page 525. See the z/OS Communications Server: IP System Administrator’s Commands for more explanation of the LIST MODIFY subcommand.

**Useful VTAM operations**

This section describes how to use the VTAM DISPLAY and VARY commands to activate an LU, change an LU definition, and to check the status of an application LU.

VTAM application LUs are defined with VTAM macros in a member of the SYS1.VTAMLST data set. The data set member, called the major node, can contain many application LU definitions, called minor nodes. The application LU names (minor node names) are specified on the VTAM and DEST statements in the SNALINK LU6.2 configuration data set.

**Activating an LU**

To activate an LU, the major node containing the LU definition must be activated first. If there are no definition errors, all the minor nodes defined in the major node are activated when the major node is activated. If a minor node becomes inactive, it can be activated individually. The following is an example of a VTAM VARY subcommand to activate a major or minor node:

```plaintext
VARY NET,ACT,ID=node_name
```

In this example, `node_name` is the major or minor node name to activate.

See “Displaying the status of an LU” on page 519 for an explanation of the active states for a minor node.

See z/OS Communications Server: SNA Operation for a complete description of the VARY ACT subcommand.
Changing an LU definition

To change an LU (minor node) definition, the major node containing the LU definition must be deactivated and then reactivated to force VTAM to read the new definition. The following is an example of a VTAM VARY subcommand to deactivate a major node:

```
VARY NET,INACT,ID=majnode_name
```

In this example, *majnode_name* is the major node name to deactivate.

See “Activating an LU” on page 518 for the major node activation subcommand.

See z/OS Communications Server: SNA Operation for a complete description of the VARY INACT subcommand.

Displaying the status of an LU

To display the status of an LU definition, use the following command:

```
DISPLAY NET,ID=node_name,E
```

In this example, *node_name* is the major or minor node name for which you want to display the status.

Displaying the status of a major node lists all of the minor nodes defined to the major node and their STATUS field. For complete information about status of a minor node, specify the actual minor node name in the command.

The STATUS field for a successfully activated LU definition is set to “CONCT,” which means connectable. An LU in this state is waiting for the SNALINK LU6.2 address space to be started. An LU in the CONCT state cannot establish an LU type 6.2 conversation.

Figure 67 on page 519 shows a sample of the output from an LU in connectable state.

```
D NET,ID=SNAL621A,E
IST075I DISPLAY ACCEPTED
IST486I STATUS= CONCT, DESIRED STATE= CONCT
IST1447I REGISTRATION TYPE = CDSERVR
IST934I DLOGMOD=LU62MODE USS LANGTAB=***NA***
IST1632I VPACING = 0
IST597I CAPABILITY-PLU INHIBITED,SLU INHIBITED,SESSION LIMIT NONE
IST231I APPL MAJOR NODE = SNALNK1A
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST1501I JOBNAME = ***NA***, STEPNAME = ***NA***, DSPNAME = ***NA***
IST281I ENCRYPTION = OPTIONAL , TYPE = DES
IST1563I CKEYNAME = SNAL621A CKEY = PRIMARY CERTIFY = NO
IST1552I MAC = NONE MACTYPE = NONE
IST1050I MAXIMUM COMPRESSION LEVEL - INPUT = 0, OUTPUT = 0
IST1633I ASRCVLM = 1000000
IST1634I DATA SPACE USAGE: CURRENT = ***NA*** MAXIMUM = ***NA***
IST171I ACTIVE SESSIONS = 0000000000, SESSION REQUESTS = 0000000000
IST172I NO SESSIONS EXIST
IST314I END
```

Figure 67. DISPLAY subcommand output example for connectable LU

After the SNALINK LU6.2 address space has successfully started, the STATUS field is set to ACTIV, which means in use by an address space.

Figure 68 on page 520 shows a sample of the output from a DISPLAY command for an LU in active state.
This example shows that the SNALINK LU6.2 address space (SNAL621A) has been started successfully and has its local LU (SNAL621A) in use with three sessions active to a remote LU (SNAL622A).

For each SNALINK LU6.2 connection, VTAM establishes three sessions between the application LUs. The first is the control session, which is the middle session in the example. The other two sessions are established for the LU type 6.2 conversations allocated for the connection, one for sending data and one for receiving data.

See z/OS Communications Server: SNA Operation for more information about the DISPLAY command.

Traces

Use the following traces to obtain information about the data flows and actions of the SNALINK LU6.2 network connection:

- SNALINK LU6.2 internal trace
- IP packet trace
- TCP/IP internal trace
- VTAM buffer trace

The SNALINK LU6.2 internal trace is the most useful for determining the state of the SNALINK LU6.2 address space. The IP packet trace facility is the most helpful trace facility for monitoring IP packets transferred across the SNALINK LU6.2 network. The TCP/IP internal traces can be used to diagnose problems with the DLC link between TCP/IP and SNALINK LU6.2. The VTAM buffer trace is used to monitor data transactions through the VTAM API interface.

Using SNALINK LU6.2 internal traces

The SNALINK LU6.2 internal traces are written to the location specified by the SYSPRINT statement in the SNALINK LU6.2 cataloged procedure. These traces provide information about the internals of the SNALINK LU6.2 address space.
SNALINK LU6.2 internal tracing is enabled by specifying the following statement in the SNALINK LU6.2 configuration data set:

```
TRACE DETAIL ALL
```

The SNALINK LU6.2 internal trace can also be started by passing a MODIFY console command to the SNALINK LU6.2 interface. The following MODIFY command starts internal tracing:

```
MODIFY procname,TRACE DETAIL ALL
```

In this example, `procname` is the member name of the cataloged procedure used to start the local SNALINK LU6.2 address space.

See the z/OS Communications Server: IP Configuration Reference for detailed descriptions of the TRACE statement parameters and the TRACE subcommand parameters.
EZA5926I LU62CFG : STARTING PASS 1 OF 2
EZA5926I LU62CFG : STARTING PASS 2 OF 2
1 EZA5927I LU62CFG : NO ERRORS DETECTED - INITIALIZATION WILL CONTINUE
EZA5932I INITIALIZATION COMPLETE - APPLID: SNAL621A  TCP/IP: TCPCS
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
2 EZA5994I CNOS FOR INDEPENDENT PARTNER; SESSLIM=0002, WINNER=0001, LOSER=0001
EZA5984I OLU= SNAL621A, DLU= SNAL622A, IP ADDRESS= 9.67.22.2
EZA6029E OPRCNOS ERR. R15 00000000 R0 0000000B RTNCD 00000000 FDBK2 0000000B
EZA6030E OPRCNOS ERR. RCPRI= 0008, RCSEC= 0001
EZA6031E OPRCNOS SENSE CODE RECEIVED: 08570003
EZA6032E SENSE CODE SPECIFIED: 00000000
EZA6023E UNABLE TO COMPLETE CNOS ON LU SNAL622A FOR 9.67.22.2
2 EZA6009W CONVERSATIONS FOR 9.67.22.2 TERMINATED
EZA5933I LINK SNALU62L OPENED
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
EZA5936I RECEIVE CONVERSATION ALLOCATED FOR 9.67.22.2
EZA5986I VTAM CONVERSATION ALLOCATED; CONVID= 01000011, SID= F6ABEEC3DCB90B89
EZA5984I OLU= SNAL622A, DLU= SNAL621A, IP ADDRESS= 9.67.22.2
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
2 EZA5935I SEND CONVERSATION ALLOCATED FOR 9.67.22.2
EZA5986I VTAM CONVERSATION ALLOCATED; CONVID= 01000012, SID= EAABEEC3D9B90C3F
EZA5984I OLU= SNAL621A, DLU= SNAL622A, IP ADDRESS= 9.67.22.2
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
4 EZA5992I IP DATAGRAM ADDED TO THE VTAM SEND QUEUE, LENGTH= 276, QUEUE COUNT = 1
EZA5989I VTAM SENT LOGICAL RECORD; CONVID= 01000012, SID= EAABEEC3D9B90C3F
EZA5984I OLU= SNAL621A, DLU= SNAL622A, IP ADDRESS= 9.67.22.2
EZA5996I NUMBER OF IP PACKETS RECEIVED ON 9.67.22.2 = 1
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EZA5999I 450001140315000040014D4C09431601094301020800D58BEFBF74
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
EZA5999I 6831DE802206A580625B768062C0CD805FF38E806F107580219260021D9D080664F3
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
EZA5999I 6831DE802206A580625B768062C0CD805FF38E806F107580219260021D9D080664F3
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
EZA5999I 6831DE802206A580625B768062C0CD805FF38E806F107580219260021D9D080664F3
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
EZA5999I 6831DE802206A580625B768062C0CD805FF38E806F107580219260021D9D080664F3
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
EZA5999I 6831DE802206A580625B768062C0CD805FF38E806F107580219260021D9D080664F3
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
EZA5999I 6831DE802206A580625B768062C0CD805FF38E806F107580219260021D9D080664F3
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
5 EZA5990I IP DATAGRAM PACKED INTO MESSAGE, LENGTH= 276
EZA5985I LU= SNAL622A, LINKNAME= SNALU62L, IP ADDRESS = 9.67.22.2
EZA5996I NUMBER OF IP PACKETS PACKED INTO MESSAGE = 1
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
2 EZA5998I LINK SNALU62L CLOSED
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
EZA5997I CONNECTION 9.67.22.2 WILL TIMEOUT IN 600 SECONDS
Figure 69. SNALINK LU6.2 internal trace output
EZA5999I 03C2D6806C906D807E04EE8075C615081FA0868039593D0801D49E801DFE1E5807412
368000000000
EZA5999I IP DATAGRAM PACKED INTO MESSAGE, LENGTH= 276
EZA5999I OLU= SNAL622A, LINKNAME= SNALU62L, IP ADDRESS = 9.67.22.2
EZA5985I LU= SNAL622A, LINKNAME= SNALU62L, IP ADDRESS = 9.67.22.2
EZA5993I RECOVRCY REASON REQUEST
EZA5993I LINK SNALU62L CLOSED
EZA5993I IP NUMBER OF PACKETS RECEIVED ON 9.67.22.2 = 1
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Following are brief explanations of the numbered items in the output:

1 Messages written to the MVS system console.

2 VTAM send and receive conversation status.

3 Information about the VTAM API interface data flow.

   The VTAM interface information contains the LU type 6.2 conversation ID (Convid), the VTAM session ID (SID), length of the VTAM logical record, the origin and destination VTAM application LUs, and the home IP address.

   The VTAM logical record length should be four greater than the length of the TCP/IP datagram packet to account for the VTAM logical record header.

4 Information about data received from the TCP/IP DLC connection.

   Datagrams received from the SNALINK LU6.2 DLC connection are unpacked from the DLC message and added to the appropriate VTAM send queue for transmission.

5 Information about data received from the VTAM API interface.

   Datagrams received from the VTAM API are packed into a DLC message buffer.

6 Hexadecimal display of data passed through the SNALINK LU6.2 address space.

   There should be a hexadecimal display for every 4th and 5th event.

7 Change number of sessions (CNOS) data.

   See the z/OS Communications Server: SNA Programmer's LU 6.2 Guide for more information about CNOS processing.

Using IP packet trace

Trace on the SNALU62 LINKNAME using the TCPIP PKTTRACE command, or on the SNA LU name using the VTAM buffer trace command.

If the LINKNAME parameter of the IP packet trace facility is specified, only packets transferred along the given link are traced. Specifying this parameter is recommended to avoid tracing many unrelated packets.

See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details about how to use the IP packet trace facility.

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Figure 70 on page 524 shows an example of a CTRACE formatted packet trace record.

### TCP/IP internal traces

The TCP/IP internal traces are written to the data set that is specified on the TCP/IP address space SYSDEBUG ddname statement. These traces provide information about the internals of the TCP/IP address space that can be used to diagnose problems in establishing the DLC link between the TCP/IP address space and the SNALINK LU6.2 address space.

### VTAM buffer traces

The VTAM buffer traces provide information about the contents of the VTAM API buffers. This information can be used to follow the data through the VTAM API interface. For details about VTAM buffer tracing and reading the trace reports, see z/OS Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures.
Finding abend and sense code documentation

The following list refers to the appropriate abend and sense code documentation for all abend and sense codes expected in the SNALINK LU6.2 network connection:

- See z/OS Communications Server: IP Messages Volume 1 (EZA) and z/OS Communications Server: IP and SNA Codes for detailed SNALINK LU6.2 abend code descriptions.
- Sense codes in SNALINK LU6.2 error messages are generated by VTAM. See z/OS Communications Server: SNA Messages and z/OS Communications Server: IP and SNA Codes for detailed sense code descriptions.

Finding error message documentation

The following list refers to the appropriate error message documentation for all error messages expected when using SNALINK LU6.2:

- Error messages from SNALINK LU6.2 are written to the SNALINK LU6.2 SYSPRINT data set and the MVS system console. See z/OS Communications Server: IP Messages Volume 1 (EZA) and z/OS Communications Server: IP and SNA Codes for descriptions of the SNALINK LU6.2 error messages.
- Error messages from TCP/IP are written to the TCPIP SYSERROR data set. See z/OS Communications Server: IP Messages Volume 1 (EZA) and z/OS Communications Server: IP and SNA Codes for descriptions of the error messages in these data sets.
- Error messages from VTAM are written to the MVS system console. See z/OS Communications Server: SNA Messages and z/OS Communications Server: IP and SNA Codes for descriptions of the VTAM error messages written to the MVS system console.
Chapter 20. Diagnosing REXEC, REXECD, and RSH problems

This topic contains diagnosis information about the classic (non-z/OS UNIX) Remote Execution Protocol (REXEC), the Remote Execution Protocol Daemon (REXECD), and the remote shell client (RSH). See “General information about REXEC and RSH” on page 527 for information about REXEC and RSH and “General information about REXECD” on page 528 for information about REXECD.

The following subtopics are included:

- “General information about REXEC and RSH” on page 527
- “General information about REXECD” on page 528

General information about REXEC and RSH

REXEC and RSH are remote execution clients that allow you to execute a command on a remote host and receive the results on the local host. REXEC and RSH commands can be executed from the TSO command line or as a batch program.

See z/OS Communications Server: IP Configuration Reference for information about defining the remote execution server.

Figure 71 on page 527 shows the principle behind REXECD.

![Figure 71. Remote execution protocol principle](image)

Documentation for REXEC problem diagnosis

The following kinds of information might be required to diagnose a REXEC problem:

- REXEC console log
- REXEC debug trace
**TSO console log**

The TSO console log should be saved and made available, particularly if there are any error messages that are displayed at the console.

**Activating the REXEC debug trace**

To activate the REXEC debug trace, use the REXEC -d command.

See z/OS Communications Server: IP User's Guide and Commands for more information about REXEC commands.

**REXEC trace example and explanation**

Figure 72 on page 528 shows an example of an REXEC trace. Short descriptions of the numbered items in the trace follow the figure.

REXEC trace output is sent to the TSO console from which the command was submitted.

```
rexec -d -l debfox -p mypwd norway time
Established affinity with TCPCS
EZA4801I MVS TCP/IP REXEC CS V1R5
EZA4775I Calling function rexec_af with the following:
  Host: norway  user: debfox  cmd: time  port: 512
  EZA4774I  rexec invoked;
  Data socket = 1  Control socket = 3
  IKJ566560I TIME-01:22:00 PM. CPU-00:00:00 SERVICE-5982 SESSION-00:00:01 March 24, 2003
EZA4789I  rexec complete
```

*Figure 72. Example of an REXEC trace*

**RSH trace example and explanation**

Figure 73 on page 528 shows an example of an RSH trace. Short descriptions of numbered items in the trace follow the figure.

RSH trace output is sent to the RSH console.

```
rsh -d -l user1/tcpsup norway time
Established affinity with TCPCS
EZA5025I Calling function rcmd_af with the following:
  Host: norway  user: user1  cmd: time  port: 514
  EZA5046I  rsh invoked;
  Data socket = 1  Control socket = 3
  IKJ566560I TIME-02:30:30 PM. CPU-00:00:00 SERVICE-6454 SESSION-00:00:00 March 24, 2003
EZA5048I  rsh complete
```

*Figure 73. Example of an RSH trace*

**General information about REXECD**

The remote execution server allows execution of a TSO batch command that is received from a remote host. REXECD supports both the remote execution command (REXEC) and remote shell (RSH) client protocols.

**Note:** When the REXECD server is active, it has outstanding listens on Ports 512 and 514. If you want to have a concurrent server for the z/OS UNIX REXECD or RSHD daemons, then configure them to use different ports.

**Documentation for REXECD problem diagnosis**

The following kinds of information might be required to diagnose a REXECD problem:
MVS system console log

Save the MVS system console log and make it available, particularly if there are any error messages displayed at the console.

Starting REXECD server traces

To run the REXECD trace, REXECD must be started with one or more of the following options on the TRACE parameter in the PROC statement:

- **LOG**
  - Specifies to write trace records to the SYSPRINT data set.
- **SEND**
  - Specifies to send trace records to the REXEC or RSH client.
- **CLIENT**
  - Specifies a specific client host for which trace records are to be produced.
- **ALLCLIENTS**
  - Specifies that host records are to be produced for all clients.

See the z/OS Communications Server: IP Configuration Reference for more information about the options. See the z/OS MVS JCL Reference for information about the length limit of the PARM= parameter on the exec statement in the start procedure. REXECD trace output is included in the job output log.

**Restriction:** If more than one trace option is selected, the options must be enclosed within parentheses.

Example of an REXECD trace of a client using the SEND command

Figure 74 on page 529 shows a portion of an example of an REXECD trace of a client using a SEND command. Short descriptions of numbered items in the trace follow the figure.

Following are short descriptions of the numbered items in the trace:

1. **JOB00043** is the JES job number. The number 40 indicates that the job is waiting for execution. This means that the remote execution server has processed the REXEC client request, created a JES job, and has submitted the JOB to JES. The server continues to check the status.

   **Guidelines:** If the status does not change from 40, this could indicate one of the following problems:
   - A JES initiator has not started to process the submitted job class.
   - Other jobs might be running in this class that are inhibiting this job from starting.
Make a note of the job number and check JES activity, or check any other jobs that might be running at the same time.

2

The number 80 indicates that the job is currently active. This means that the remote execution server has checked with JES on the job status and was informed that the job is running.

Guideline: If the status does not change from 80, this could indicate that the job is taking too long to run. REXEC was not intended to be used for long running jobs. Long running jobs should be submitted using FTP JES processing.

Tip: The FTP JES interface provides an alternate method of submitting a batch job remotely and retrieving the results.

3

The number 20 indicates that the job is on the output queue. This means that when the server checked with JES on the job status it discovered that the JES job has completed, and it has been placed on the output queue. The command output should be sent back to the client soon. See z/OS Communications Server: IP Messages Volume 1 (EZA) for more information about the individual messages in the trace.

4

This line shows the return code from the dynamic allocation of the JES data sent back to the client.

5

Actual command output sent to the client.

6

This line displays the return code that is expected when the process has completed.

Example trace of an RSH client using the SEND command

Figure 75 on page 530 shows a portion of an example of a trace of an RSH client using a SEND command. Short descriptions of numbered items in the trace follow the figure.

```
1. EZA4438I SSSCARAY[0] JOB00043 20 COMPLETED
   EZA4385I SSSORT(CTRL): 00000000
   EZA4389I SSSORT(init): 00000004

2. EZA4437I SSSCARAY[1] JOB00044 40 WAITING
   EZA4438I SSSCARAY[0] JOB00043 20 COMPLETED
   EZA4385I SSSORT(CTRL): 00000000
   EZA4389I SSSORT(init): 00000004

3. EZA4436I SSSCARAY[1] JOB00044 80 ACTIVE
   EZA4438I SSSCARAY[0] JOB00043 20 COMPLETED
   EZA4385I SSSORT(CTRL): 00000000
   EZA4389I SSSORT(init): 00000004

4. EZA4438I SSSCARAY[1] JOB00044 20 COMPLETED
   EZA4385I SSSORT(CTRL): 00000000

5. EZA4392I 999ret: 00000000, A RSHD NEWALTON.RSHD5.JO000044.D0000105.

6. TIME-12:07:02 PM. CPU-00:00:00 SERVICE-1134 SESSION-00:00:00 APRIL 1,2008
   EZA4393I 999ret: 00000000

7. EZA4442I SSSORT(next): 00000004 NO MORE OUTPUT ON JES SPOOL
```

Figure 75. Example of a trace of an RSH client using a SEND command

Following are short descriptions of numbered items in the trace:

1. JOB00043 is a previous job that has completed.
The 40 indicates that job JOB00044 is waiting for execution. This means that the remote execution server has processed the RSH client request, created a JES job, and has submitted the JOB to JES. The server continues to check the status.

**Guidelines:** If the status does not change from 40, this could indicate one of the following problems:

- No JES initiator started to process the submitted job class.
- Other jobs might be running in this class that are inhibiting this job from starting.

Make a note of the job number and check JES activity, or check any other jobs that might be running at the same time.

The 80 indicates that job JOB00044 is currently active. This means that the remote execution server has checked with JES on the job status and was informed that the job is executing.

**Note:** If the status does not change from 80 this could indicate that the job is taking too long to run. RSH was not intended to be used for long running jobs. Long running jobs should be submitted using FTP JES processing.

The 20 indicates that job JOB00044 is on the output queue. This means that when the server checked with JES on the job status it discovered that the JES job has completed, and it has been placed on the output queue. The command output should be sent back to the client soon.

**Note:** See z/OS Communications Server: IP Messages Volume 1 (EZA) for more information about the individual messages in the trace.

This line shows the return code from the dynamic allocation of the JES data sent back to the client.

Actual command output sent to the client

This is the return code expected when there is no more work to do.
### Example trace to the JES spool file of the server

Figure 76 on page 532 shows a trace log as it appears on the server. Short descriptions of numbered items in the trace follow the figure.

<table>
<thead>
<tr>
<th>Socket</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EZA4381I Accept 2 from 9.37.217.142 on 512</td>
</tr>
<tr>
<td>2</td>
<td>EZA4382I Connecting on 3 to 9.37.217.142:1255</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4381I Accept 4 from 9.37.217.133 on 514</td>
</tr>
<tr>
<td></td>
<td>EZA4382I Connecting on 5 to 9.37.217.133:1584</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
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<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4436I SSCSARAY[0] 30B00048 80 ACTIVE</td>
</tr>
<tr>
<td></td>
<td>EZA4382I SSSORT(CTRL): 00000000</td>
</tr>
<tr>
<td></td>
<td>S99ret: 00000000, T RSHD USER35.RSHD2.JOB00048.D0000102.?</td>
</tr>
<tr>
<td></td>
<td>S99ret: 00000000</td>
</tr>
<tr>
<td></td>
<td>SSSORT(next): 00000004 NO MORE OUTPUT ON JES SPOOL</td>
</tr>
<tr>
<td></td>
<td>EZA4381I Closing socket 2 from 9.37.217.142 on 512</td>
</tr>
<tr>
<td></td>
<td>EZA4421 SSSORTCTRL: 00000000</td>
</tr>
<tr>
<td></td>
<td>S99ret: 00000000</td>
</tr>
<tr>
<td></td>
<td>SSSORT(next): 00000004 NO MORE OUTPUT ON JES SPOOL</td>
</tr>
<tr>
<td></td>
<td>EZA4382I Closing socket 3 to 9.37.217.142:1255</td>
</tr>
<tr>
<td></td>
<td>EZA4381I Closing socket 4 from 9.37.217.133 on 514</td>
</tr>
<tr>
<td></td>
<td>EZA4421 Closing socket 5 to 9.37.217.133:1584</td>
</tr>
</tbody>
</table>

**Figure 76. Example trace to the JES spool file of the server**

Following are short descriptions of numbered items in the trace:

**Note:** Trace messages are preceded by the identification of which socket that trace entry applies too.

The listening socket is socket 0. The EZA4381I message for this socket identifies the socket the request is processed on and the IP address and port that the request was received on. Port 512 is for REXEC requests and port 514 is for RSH requests.

1. Indicates an REXEC request was received on socket 2 for the specified IP address. Subsequent entries beginning with socket 2 indicates activity occurring during the processing of this request. Message EZA4441I is issued when this socket is closed.

2. EZA4382I identifies the socket 3 and the IP address and port the server is connecting back to the client on. This port (1255) is in the packet that the client sent to the server. Message EZA4442I is issued when this socket is closed. Common messages are EZA4382I and EZA4442I for this socket.
This line shows the return code from the dynamic allocation of the JES data sent back to the client.

Indicates the request is completed and the socket is closed.

Indicates the error socket is closed
Chapter 21. Diagnosing z/OS UNIX REXEC, RSH, REXECD, and RSHD problems

This topic contains diagnosis information about the z/OS UNIX remote execution protocol (REXEC), remote shell protocol client (RSH), remote execution protocol daemon client (REXECD), and remote shell daemon (RSHD).

Setting up the inetd configuration file

The inetd program is a generic listener program used by such servers as z/OS UNIX TELNETD and z/OS UNIX REXECD. Other servers such as z/OS UNIX FTPD have their own listener program and do not use inetd.

The inetd.conf file is an example of the user's configuration file. It is stored in the /etc directory. Upon startup, the servers for z/OS UNIX TELNETD, rshell, rlogin, and rexec are initiated if they have been defined in /etc/inetd.conf. If it does not include z/OS UNIX TCP/IP applications, add the information shown in Figure 77 on page 535:

```
#===============================================
# service  |  socket  |  protocol  |  wait/ |  user  |  server program
# name     |  type    |           |       |       |                   
#===============================================
# shell    |  stream  |  tcp       |  nowait| OMVSKERN /usr/sbin/orshd rshd -l 
exec      |  stream  |  tcp       |  nowait| OMVSKERN /usr/sbin/rexecd rexecd -LV 
otelnet   |  stream  |  tcp       |  nowait| OMVSKERN /usr/sbin/otelnetd otelnetd -LV 
login     |  stream  |  tcp       |  nowait| bpxroot /bin/rlogind rlogind -d 
# Add the following line to enable Kerberos for orshd 
shell     |  stream  |  tcp       |  nowait| OMVSKERN /usr/sbin/orshd orshd -l -k KRB5 
```

Figure 77. Adding applications to /etc/inetd.conf

Guideline: For IPv6 support, specify tcp6 for the protocol.

When nowait is specified, the inet daemon issues an accept when a connect request is received on a stream socket. You can specify nowait.max, where max is the maximum number of users allowed to request service in a 60-second interval. The default is 40. If maximum is exceeded, the service's port is shut down. If you expect more than 40 users per minute requesting service, specify the maximum that you expect.

To establish a relationship between the servers defined in the /etc/inetd.conf file and specific port numbers in the z/OS UNIX environment, ensure that statements have been added to ETC.SERVICES for each of these servers. See the sample ETC.SERVICES installed in the /usr/lpp/tcpip/samples/services directory for how to specify ETC.SERVICES statements for these servers.

Guideline: It is important that the service name in /etc/inetd.conf (login in 1) matches the service name in /etc/services:

```
login 513/tcp
```

The traces for both the z/OS UNIX REXECD server and the z/OS UNIX RSHD server are enabled by options in the inetd configuration file (/etc/inetd.conf). See Figure 78 on page 536.
The traces are turned on for both servers by passing a -d argument to the server programs. 2 is the RSHD server and 3 is the REXECD server. All commands executed after the debug flags have been turned on in the inetd configuration file and after the inetd server has reread the file produces trace output.

The trace is written in formatted form to the syslogd facility name daemon with a priority of debug. The trace data can be routed to a file in your Hierarchical File System by specifying the following definition in your syslogd configuration file (/etc/syslogd.conf):

```
# All ftp, rexecd, rshd
# debug messages (and above
# priority messages) go
# to server.debug.a

daemon.debug /tmp/syslogd/daemon.debug.a
```

In this example, the trace data is written to /tmp/syslogd/daemon.debug.a in your hierarchical file system. See z/OS Communications Server: IP Configuration Reference for more information about syslogd.

For more information about inetd, see z/OS UNIX System Services Planning.

**Diagnosing z/OS UNIX REXEC**

The following kinds of information can help you diagnose a z/OS UNIX REXEC problem:

- A message beginning with EZYRC
- A code
- An z/OS UNIX REXEC debug trace
- A REXECD debug trace from the foreign host

**Activating the z/OS UNIX REXEC debug trace**

To activate the z/OS UNIX REXEC debug trace, specify the -d option.

**z/OS UNIX REXEC trace example and explanation**

The z/OS UNIX REXEC can be invoked using either rexec or orexec. Enter one of the following commands with either an IP address or a host name.

- IPv4
  ```
  orexec -d -l debfox -p mypwd -s 1512 197.22.190.1 ls -al
  ```
- IPv6
  ```
  orexec -d -l debfox -p mypwd -s 1512 fec0:0:0:12BE::1 ls -al
  ```

The following are examples of the trace output:
Diagnosing z/OS UNIX REXEC

The following kinds of information can help you diagnose a z/OS UNIX REXEC problem:

- A code
- A z/OS UNIX RSH debug trace
- An RSHD debug trace from the foreign host

Step for activating the z/OS UNIX RSH debug trace

Activate the z/OS UNIX RSH debug trace.

Procedure

Perform the following step:

- Specify the -d option.

Step for invoking z/OS UNIX RSH trace

The z/OS UNIX RSH trace can be invoked using either rsh or orsh.

Procedure

Enter one of the following commands with either an IP address or a host name:

- IPv4
  
orsh -d -l debfox/mypwd -s 1514 197.22.190.1 date

- IPv6
  
orsh -d -l debfox/mypwd -s 1514 fec0:0:0:12BE::1 date

Results

The following are examples of the trace output:

- IPv4
  
EZRYC31I Calling function rcmd_af with the following:
EZRYC02I Host: 197.22.190.1, user debfox, cmd date, port 1514
EZRYC19I Data socket = 4, Control socket = 6.
Thu Apr  3 15:44:11  2003
Diagnosing z/OS UNIX REXED

The following kinds of information can help you diagnose a z/OS UNIX REXED problem:

- A message beginning with EZYRD
- A code
- A z/OS UNIX REXED debug trace
- A trace from the z/OS UNIX REXED client

Activating the z/OS UNIX REXED debug trace

The z/OS UNIX REXEC can be invoked using either rexecd or orexecd. To activate the z/OS UNIX REXED debug trace, specify the -d option in the /etc/inetd.conf file.

z/OS UNIX REXED trace example and explanation

These examples are in the file that is specified in syslogd.conf.

Note: Ensure syslogd is running before collecting these traces and that the file is properly specified.

For an explanation of the messages, see z/OS Communications Server: IP Messages Volume 1 (EZA).

Diagnosing z/OS UNIX RSHD

The following kinds of information can help you diagnose a z/OS UNIX RSHD problem:

- A message beginning with EZYRS
- A code
- A z/OS UNIX RSHD debug trace
- A trace from the RSH client

IPv6

EZYRC31I Calling function rcmd_af with the following:
EZYRC02I Host: fec0:0:0:12BE::1, user debfox, cmd date, port 1514
EZYRC19I Data socket = 4, Control socket = 6.
Thu Apr  3 15:41:11  2003

EZYRC31I shows that the local rcmd_af() function has been called. EZYRC02I shows the parameters that have been passed to the rcmd_af() function. EZYRC19I shows the socket descriptor being used for the data connection and the control (or standard error) connection.
Step for activating the z/OS UNIX RSHD debug trace

The z/OS UNIX RSHD debug trace can be invoked using either rshd or orshd.

Procedure

Perform the following step to activate the z/OS UNIX RSHD debug trace.

- Specify the -d option in the /etc/inetd.conf file.

z/OS UNIX RSHD trace example and explanation

These examples are from the file specified in syslogd.conf.

Restriction: Ensure syslogd is running before collecting these traces and that the file exists and has been properly specified.

Jun 9 12:10:04  rshd.4653080.: EZYRS01I  MVS OE RSHD BASE

The entry is stamped with the date, time, name of daemon and the order number of the daemon, the message number (EZYRS01I), and related information, as shown in the following example.

Jun 9 12:10:06  rshd.4653080.: EZYRS12I  Clisecport = 1020
Jun 9 12:10:06  rshd.4653080.: EZYRS21I  Remote user is: OS2USER
Jun 9 12:10:06  rshd.4653080.: EZYRS22I  Local user is: user21
Jun 9 12:10:06  rshd.4653080.: EZYRS23I  Command is: ls -l

For an explanation of the messages, see z/OS Communications Server: IP Messages Volume 3 (EZY).

If the -A option is specified in /etc/inetd.conf, the z/OS UNIX RSHD server does not execute a command when the client host IP address cannot be resolved to a host name.

Resolving garbage errors

There are a few situations where the z/OS UNIX RSHD server might encounter an error so early in the processing of a command that the server has not yet established a proper EBCDIC-to-ASCII translation. In such a situation, the client end user might see garbage data returned to his or her terminal. A packet trace reveals that the response is in fact returned in EBCDIC, which is the reason for the garbage look on an ASCII workstation. This can happen if the z/OS UNIX name resolution has not been configured correctly, so the z/OS UNIX RSHD server, for example, was not able to resolve IP addresses and host names correctly. If your RSH clients encounter such a problem, go back and check your name resolution setup. If you are using a local hosts table, make sure that the syntax of the entries in your hosts file is correct.
This topic describes environment variable XWTRACE that might be useful when diagnosing X Window System and Motif problems. The environment variable, XWTRACE, controls the generation of traces of the socket level communication between Xlib and the X Window System Server.

The following subtopics are included:

- “Trace output when XWTRACE=2” on page 541
- “Trace output when XWTRACELC=2” on page 542
- XWTRACE undefined or zero — No trace generated.
- XWTRACE=1 — Error messages.
- XWTRACE>=2 — API function tracing for TRANS functions.

Another environment variable, XWTRACELC, causes a trace of various locale-sensitive routines. If XWTRACELC is defined, a routine flow trace is generated. If XWTRACELC=2, more detailed information is provided.

**Guideline:** There are no special post-install activities for GDDMXD in z/OS Communications Server. GDDM APAR (PN77391) eliminated these activities for TC/IP Version 3 Release 1. However, if you have an old GDDMXD load library (tcpip.v3r1.SEZALNKG) in your LNKSTxx member in SYSx.PARMLIB, you need to remove that library from the MVS link list, because it is no longer needed.

Following are some examples of X Window System traces.

### Trace output when XWTRACE=2

Figure 79 on page 541 shows a typical stream of socket level activity that is generated when an X application running on z/OS UNIX MVS exchanges information with an X Server.

```
TRANS(OpenCOTSClient) (/9.2.104.56:0)
TRANS(Open) (1,/9.2.104.56:0)
TRANS(SocketOpenCOTSClient) (inet,9.2.104.56:0)
TRANS(Connect) (3,/9.2.104.56:0)
TRANS(SocketINETConnect) (3,9.2.104.56:0)
TRANS(GetPeerAddr) (3)
TRANS(ConvertAddress)(2,16,7f9d288)
TRANS(SocketWritev) (3,225bc,1)
TRANS(Connect) (3,1,1)
TRANS(SocketRead) (3,22344,8)
TRANS(SocketWrite) (3,7f9eb88,60)
TRANS(SocketWrite) (3,7f9eb88,80)
TRANS(SocketWrite) (3,7f9eb88,20)
TRANS(SocketDisconnect) (7f9d2c0,3)
TRANS(Close) (3)
TRANS(SocketINETClose) (7f9d2c0,3)
```

**Figure 79. Example of X Application trace output when XWTRACE=2**
Each line of the trace provides:

- The name of the function involved from x11trans
- Values of the parameters passed to the function

**Trace output when XWTRACELC=2**

Figure 80 on page 543 is a partial trace showing typical types of information displayed by locale-sensitive routines.
Figure 80. Example of X Application trace output when XWTRAPELC=2

Each line of trace provides:

- The name of the locale routine.
- The function invoked within that locale routine.
- Where pertinent, charset name or encoding information, or charset name and encoding information.
- If exiting the invoked function, the trace statement indicates that the function is returning.
Chapter 23. Diagnosing Simple Network Management Protocol (SNMP) problems

This topic explains SNMP-related concepts and terms, including information about how to diagnose SNMP problems, and contains the following subtopics:

- “Overview” on page 545
- “Definitions” on page 547
- “Diagnosing SNMP problems” on page 548
- “SNMP traces” on page 566

Overview

The SNMP protocol provides a standardized interface, through which a program on one host (running an SNMP manager) can monitor the resources of another host (running an SNMP agent).

Management information base (MIB)

The information maintained at each agent is defined by a set of variables known as the management information base, or MIB. In addition to the architected list of variables that must be supported by each SNMP agent, an SNMP agent can also support user-defined variables. These user-defined variables that are not part of the architected MIB are known as enterprise-specific MIB variables.

On z/OS Communications Server, the majority of the MIB variables are maintained outside the SNMP agent address space by programs known as SNMP subagents. The subagent program for the TCP/IP-related MIB variables executes in the TCP/IP address space. The subagent program for OMPROUTE-related MIB variables run as part of OMPROUTE, not as a separate application. The subagent program for SLA-related MIB variables runs as a separate application. The subagent program for TN3270E Telnet server MIB variables executes as a separate subtask in the TN3270E Telnet server address space. For a list of all the MIB objects supported by the agent and subagents shipped as part of z/OS Communications Server, see z/OS Communications Server: IP System Administrator’s Commands.

In addition, user-written subagent programs can also exist. All subagent programs, whether provided by z/OS Communications Server or user-written, communicate with the SNMP agent over an architected interface known as the Distributed Protocol Interface, or DPI.

When the SNMP agent receives and authenticates a request, it passes the request to the DPI subagent that has registered as the target of the request. You can see this exchange by enabling DPI tracing within the agent.

PDUs

The SNMP protocol is based on the exchange of protocol data units, or PDUs, between the SNMP manager and the SNMP agent.

SNMP has seven types of PDUs:

- **GetRequest-PDU**
  Sent from the manager to request information from the agent.

- **getNextRequest-PDU**
  Requests the next variable in the MIB tree.

- **GetBulkRequest-PDU**
  Requests the next variable in the MIB tree and can also be used to specify multiple successors.
GetResponse-PDU
Sent from the agent to return information to the manager.

SetRequest-PDU
Sent from the manager to alter information at the agent.

Trap-PDU
Sent from the agent to report network events to the manager. A trap is an unconfirmed notification.

Inform-PDU
Sent from an agent to a manager or from a manager to another manager to report a network event. Attempts to confirm delivery are made for Inform-PDUs, not Trap-PDUs.

Functional components
The following topics provide detailed descriptions of the SNMP functional components.

Managers
A manager is a client application that requests management data. z/OS Communications Server provides two management applications, the z/OS UNIX `snmp` command (the `osnmp` command is a synonym for the `snmp` command), and the NetView SNMP command. The `snmp` command is a management application used from the z/OS UNIX shell to monitor and control network elements. The NetView SNMP command provides the same type of functions from the NetView environment.

The `snmp` command runs in a user address space that is created and removed as `snmp` is issued and completed. The NetView SNMP client requires the following started tasks:

- SNMPIUCV subtask of NetView, which runs in the NetView address space and provides the operator interface to SNMP.
- SNMP query stack address space, which provides the protocol support for the SNMP PDUs.

The SNMPIUCV subtask in the NetView address space and the SNMP query stack address space communicate over an IUCV connection.

Agents
An agent is the server that responds to requests from managers. The agent maintains the MIB. z/OS Communications Server supports a trilingual SNMP agent which can understand SNMPv1, SNMPv2c, and SNMPv3 versions of the SNMP protocol. It also communicates with the subagents using DPI1.1 and DPI2.0 protocols.

Subagents
Subagents help the agent by managing a part of the MIB. z/OS Communications Server supports the following subagents:

- TCP/IP subagent that manages TCP/IP-related standard MIB objects and several enterprise-specific MIBs
- OMPROUTE subagent that manages the ospf MIB
- Network SLAPM2 subagent that manages the Network SLAPM2 MIB
- TN3270E Telnet subagent that manages the Enterprise-specific TN3270 Telnet MIB

These subagents communicate with the SNMP agent by using the DPI 2.0 protocol.

Trap forwarder daemon
The trap forwarder daemon on z/OS Communications Server listens for SNMP traps on a specified port and forwards them to other configured ports. This eliminates the port contention problem when multiple managers want to receive notifications at the same well-known port (162) at the same IP address.
Definitions

The SNMP agent, subagents and clients must be configured to TCP/IP before use. If the NetView SNMP client is used, NetView configuration is also required.

Though the SNMP Agent can be started with no configuration files, to implement settings or security other than the defaults, several configuration data sets are required. Most of the configuration data can be configured in several places. Details on the syntax of the statements in the files and the search orders for the files are in z/OS Communications Server: IP Configuration Reference. In the text that follows, uppercase file names (such as OSNMP.CONF) indicate the generic name for the file, which can be any of the places in the search order for the file.

TCP/IP configuration files for SNMP are summarized below. For use of the NetView SNMP command, changes are required for the NetView start procedure and the DSIDMN and DSICMD NCCFLST members of the NetView DSIPARM data set. For additional information, see z/OS Communications Server: IP Configuration Guide.

z/OS UNIX snmp command

To use the `snmp` command, the following files might be needed:

**OSNMP.CONF**
Defines configuration data for sending SNMPv1, SNMPv2, and SNMPv3 requests to SNMP agents. You can name this file as either a z/OS UNIX file system file or an MVS data set (partitioned or sequential).

**MIBS.DATA**
Defines textual names for user variables not included in the compiled MIB shipped with the product. You can name this file as either a z/OS UNIX file system file or an MVS data set (partitioned or sequential).

SNMP agent

The SNMP agent (snmpd) uses the following configuration data sets:

**OSNMPD.DATA**
Defines initial settings for some MIB variables supported by the agent.

**PW.SRC**
Defines community names, if the SNMPD.CONF file is not being used. Community name is a mixed-case, case-sensitive field.

**SNMPD.BOOTS**
Defines SNMPv3 initialization parameters to the SNMP agent if SNMPv3 security is used.

**SNMPD.CONF**
Defines security configurations and trap destinations to the SNMP agent. Required if SNMPv3 security is used. Can also be used for community-based (SNMPv1 and SNMPv2c) security.

**SNMPTRAP.DEST**
Defines trap destinations, if the SNMPD.CONF file is not being used.

With z/OS Communications Server, the SNMP agent allows the use of user-based security (SNMPv3) in addition to, or instead of, community-based security (SNMPv1 and SNMPv2c).

For more detailed information about the configuration data sets, see Deciding on SNMP security needs in z/OS Communications Server: IP Configuration Guide.

TCP/IP subagent

The TCP/IP subagent is controlled by statements in the TCP/IP profile. The following statements are important:

**SACONFIG**
Defines configuration parameters for the TCP/IP subagent.
ITRACE
Specifies the level of tracing used by the TCP/IP subagent.

OMPROUTE subagent
The SNMP OMPROUTE subagent is controlled by statements in the OMPROUTE configuration file. The following statements are important:

**ROUTESA_CONFIG**
Defines configuration parameters for the OMPROUTE subagent. You can also use the MODIFY ROUTESA command.

**OMPROUTE start option -s n**
Specifies the level of tracing used by the OMPROUTE subagent. You can also use the MODIFY SADEBUG command.

**OSPF_INTERFACE**
Defines an OSPF interface. The OMPROUTE subagent supports only OSPF MIB (RFC 1850).

*Note:* At least one OSPF_INTERFACE must be defined.

Network SLAPM2 subagent
The Network SLAPM2 subagent is controlled by start options specified when the subagent is started. The following options are important:

**NSLAPM2 start option -c community**
Defines the community name to be used in connecting to the SNMP agent.

**NSLAPM2 start option -P port**
Defines the port to be used in connecting to the SNMP agent.

**NSLAPM2 start option -d n**
Specifies the level of tracing used by the Network SLAPM2 subagent. You can also use the MODIFY DEBUG,LEVEL command.

TN3270E Telnet subagent
The TN3270E Telnet subagent is controlled by the TNSACONFIG Profile statement. See z/OS Communications Server: IP Configuration Reference for a detailed description of this statement.

SNMP socket call settings
Finally, SNMP makes socket calls that require correct settings in the TCPIP.DATA file. Statements used by SNMP include:

**DATASETPREFIX**
Can be used in determining the high-level qualifier for agent configuration data sets.

**TCPIPJOBNAME**
Determines the TCP/IP instance in which SNMP attempts to establish its relationship through the SETIBMOPT socket call. For more information about TCPIPJOBNAME, see the z/OS Communications Server: IP Configuration Reference.

Trap forwarder daemon
The trap forwarder daemon is controlled by the TRAPFWD.CONF file. TRAPFWD.CONF defines the configuration data to forward trap datagrams received on a port to other management applications listening on different ports.

**Diagnosing SNMP problems**

Problems with SNMP are generally reported under one of the following categories:
Abends

An abend during SNMP processing should result in messages and error-related information that is sent to the system console. A dump of the error is needed unless the symptoms match a known problem.

Documentation

Code a CEEDUMP DD statement in the PROC used to start the SNMP agent to ensure that a useful dump is obtained in the event of an abend.

Analysis

See z/OS Problem Management or Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21, for information about debugging dumps produced during SNMP processing.

SNMP connection problems

This topic describes how to diagnose and correct SNMP connection problems.

Problems connecting the SNMP agent to the TCP/IP address space

Problems connecting the SNMP agent to the TCP/IP address space are indicated by an error message in the agent traces in the syslog daemon output, indicating a socket error. For more information about reading the syslogd traces, see the z/OS Communications Server: IP Configuration Guide.

Documentation

The following documentation should be available for initial diagnosis of problems connecting the SNMP agent to the TCP/IP address space:
Analysis

Use the following checklist to check for problems connecting the SNMP client or agent address space to the TCP/IP address space:

- Are you connected to the correct TCP/IP address space? This is obviously a concern when running multiple stacks. See "Problems connecting SNMP agents to multiple TCP/IP stacks" on page 550.

If you get a message "unable to connect to TCPIP JOBNAME," you are not connected to the correct address space. If you have defined two or more stacks, make sure your TCPIPjobname in the TCPIP.DATA data set used by the SNMP agent matches the NAME field on the SUBFILESYSTYPE statement for ENTRYPOINT(EZBPFIN) in the BPZPRMxx member you used to start z/OS UNIX MVS.

- Did any socket-related errors occur?

Check the SNMP agent syslogd for socket(), bind(), accept(), or other socket error messages. For example, a bind() failure occurs when one or more of the ports needed by the SNMP agent is already in use. See z/OS Communications Server: IP Configuration Guide for more information about syslogd.

- Is the correct TCPIP.DATA information being used? Is the SYSTCPD DD statement coded in the PROC JCL? Is the RESOLVER_CONFIG environment variable passed on the SNMP agent initialization parameters?

If the problem still occurs after checking the preceding items and making any needed changes, obtain the following documentation for problems connecting the agent.

- Dump of SNMP agent address space.
- Dump of TCP/IP address space.
- The syslogd traces from the agent (using trace level 255). See z/OS Communications Server: IP Configuration Guide for more information about reading the syslogd.

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids for your release of MVS. Obtaining SNMP traces is discussed in "SNMP traces" on page 566.

Problems connecting SNMP agents to multiple TCP/IP stacks

To receive TCP/IP related management data, each TCP/IP stack that is started must run its own SNMP agent. This requires that each agent can find the TCP/IP job name of the TCP/IP stack with which it wants to associate.

Analysis

Use the following checklist to check for problems connecting the SNMP agent to the correct TCP/IP stack:

- Message EZZ6205I indicates that when __iptcpn() was called, it did not return the correct TCPIPjobname for that agent.
  - Check __iptcpn()'s search path.
  - Check to see whether the _BPXK_SETIBMOPT_TRANSPORT environment variable has been set in the cataloged procedure.

See z/OS Communications Server: IP Configuration Reference for additional information.

- Message EZZ6272I indicates that the setibmopt call failed. This means that __iptcpn() returned a name that z/OS UNIX did not recognize as a PFS. Check the BPXPRMxx member (in SYS1.PARMLIB) used to configure z/OS UNIX.
Problems connecting subagents to the SNMP agent

Problems connecting an SNMP subagent to the SNMP agent are generally indicated by one of the following:

• A socket error at the subagent.
• Authentication failures when the subagent attempts to open a connection.
• A "no such name" response from the SNMP agent when an SNMPv1 manager requests a variable owned by the subagent.
• A "no such object" response from the SNMP agent when an SNMPv2 or SNMPv3 manager requests a variable owned by the subagent.

Documentation

The following documentation should be available for initial diagnosis of interface connection problems:

• PROFILE.TCPIP information.
• SNMP agent job output, including syslogd output.
• Documentation for the subagent which is not connecting, as follows:
  – TCP/IP subagent syslogd output obtained by specifying the profile statement ITRACE ON SUBAGENT 2 (if the subagent is the TCP/IP subagent).
  – Output of the Netstat HOME/-h command.
  – TCPIP.DATA information.
  – OMPROUTE subagent syslogd output obtained by starting OMPROUTE with the -s1 option or by issuing the MODIFY SADEBUG command to start OMPROUTE subagent tracing (if the subagent is the OMPROUTE subagent).
  – Network SLAPM2 subagent syslogd output obtained by starting the Network SLAPM2 agent with the -d 131 option or by issuing the MODIFY DEBUG,LEVEL command to start Network SLAPM2 subagent tracing (if the subagent is the Network SLAPM2 subagent). The value 131 for -d turns on the following traces.
    1 Trace Network SLAPM2 Subagent Error and System Console Messages
    2 Trace Network SLAPM2 Subagent Warning Message
    128 Trace DPIdebug()level 2
  – TN3270E Telnet subagent syslogd output obtained by specifying the TNSATRACE keyword on the TNSACONFIG profile statement.

Analysis

Use the following checklist to check for problems connecting an SNMP subagent program to the SNMP agent:

1. Are there multiple TCP/IP stacks active on the same MVS image, are there subagents active for each stack, and are the subagents using UNIX to connect to the agent (as opposed to using TCP)? If so, have you configured a unique UNIX pathname to be used by the subagents connecting to the Agent through UNIX? In a multi-stack environment, each Agent must use a unique UNIX pathname for subagent connections. The default UNIX pathname is /var/dpi_socket. Additional UNIX pathnames can be specified in one of two ways:
   • As the value of the dpiPathNameForUnixStream MIB object in the OSNMPD.DATA configuration file read by the Agent.
   • On the -s start option in the PARM= field of the EXEC JCL statement in the Agent's started procedure.
2. Is the subagent in question the TCP/IP subagent? If so,
• Is the SACONFIG statement configured correctly?
• Is SACONFIG disabled?

3. Is the subagent in question the OMPROUTE subagent?
   • Is the OMPROUTE ROUTESA_CONFIG statement configured correctly?
   • Is the OMPROUTE subagent (ROUTESA) disabled?
   • Does the port number match the SNMP agent and OMPROUTE application for the OMPROUTE ROUTESA_CONFIG parameter AGENT=<agent port number>?
   • Does the community name (or password) match with the SNMP agent and OMPROUTE application for the OMPROUTE ROUTESA_CONFIG parameter COMMUNITY=<community string>?

4. Is the subagent in question the Network SLAPM2 subagent?
   • Does the port number specified on the -P parameter of the Network SLAPM2 subagent match the port number specified by the SNMP agent?
   • Does the community name (or password) specified on the -c parameter of the Network SLAPM2 subagent match the community name (or password) specified by the SNMP agent?

5. Is the subagent in question the TN3270E Telnet subagent? If so:
   • Is the TNSACONFIG statement configured correctly?
   • Is TNSACONFIG DISABLED specified?

6. If you are using an hlq.HOSTS.SITEINFO file (or its z/OS UNIX file system equivalent, /etc/hosts), you must ensure that the IP address in this file for the system on which the agent/subagent are executing matches an interface IP address of the TCP/IP stack to which the agent/subagent are connected. The interface IP addresses for a TCP/IP stack are defined on the HOME profile statement.

7. Is the subagent using the correct IP address to send the connection request to the SNMP agent? The subagent uses the IPv4 primary interface IP address of this stack when sending the connection request to the SNMP agent. The IPv4 primary interface IP address is either the first IP address in the HOME list or the IP address specified on a PRIMARYINTERFACE TCP/IP profile statement. Check the Netstat HOME/-h output to verify the IPv4 primary interface address of the stack. This IP address is the one that is used by the SNMP agent, along with the community name to verify the subagents authority to connect to the SNMP agent.

8. Is the port number correct?
9. Is the community name (or password) correct?

   Guideline: Community name is a mixed-case, case-sensitive field. Many times the client cannot get a response from an agent because the agent has a community string of PUBLIC. Most clients default their community string to public.

10. If the SNMP agent is configured for SNMPv3, is the community name configured in the agent SNMPD.CONF file? The subagent can use the community name only if VACM_GROUP, VACM_VIEW, and VACM_ACCESS are defined. For the subagent to connect, the VACM_VIEW must include the dpiPort objects.

11. Did any socket-related errors occur?
    Check the SNMP agent/subagent syslogd for socket(), bind(), accept(), or other socket error messages, particularly error messages related to the DPI connection.

12. If the subagent is using TCP to connect to the SNMP agent then the connection could have been closed by the agent due to a security authorization failure. If the agent security resource name has been defined in the SERVAUTH class, then the subagent must be running on the same TCP/IP stack as the agent and the user ID of the subagent must be permitted to the resource name in order for the connection to succeed. See the SNMP information of the z/OS Communications Server: IP Configuration Guide for a description of the agent security resource name used with TCP connections between SNMP agent and subagent.

If the problem still occurs after checking the preceding items and making any needed changes, obtain the following documentation:
- SNMP agent 255 (trace all) output.

- If the problem is with the TCP/IP subagent, get the subagent traces (level 2). These are turned on by specifying the ITRACE statement in the PROFILE.TCPIP file. This can be done as part of the initial TCP/IP startup. It can also be done after TCP/IP has been started by using the VARY TCPIP command, which is documented in the z/OS Communications Server: IP System Administrator's Commands.

- If the problem is with the OMPROUTE subagent, get the OMPROUTE subagent traces. Turn these on by starting OMPROUTE with the -s1 option or by issuing the MODIFY SADEBUG command to start OMPROUTE subagent tracing.

- If the problem is with the Network SLAPM2 subagent, get the Network SLAPM2 subagent traces. Turn these on by starting the Network SLAPM2 subagent with the -d 131 option or by issuing the MODIFY DEBUG,LEVEL command to start Network SLAPM2 subagent tracing.

- If the problem is with a user-written subagent program, use the DPIdebug() DPI library routine to collect dpi traces in the user-written subagent program. DPIdebug() sends output to the syslogd.

- If the problem is with the TN3270E Telnet subagent, get the subagent traces. These are turned on by specifying the TNSATRACE keyword on the TNSACONFIG statement in the PROFILE.TCPIP file. This can be done as part of the initial TCP/IP startup. It can also be done after TCP/IP has been started by using the VARY TCPIP,OBEYFILE command, which is documented in the z/OS Communications Server: IP System Administrator's Commands. To enable tracing using the VARY TCPIP,OBEYFILE command, the subagent must first be disabled and then re-enabled with the TNSATRACE keyword.

The following is a list of things to look for in the SNMP agent trace:

- One of the following incoming SNMP GetRequest-PDU:
  - dpiPortForTcp (1.3.6.1.4.1.2.2.1.1) for TCP connect. This is caused by DPIconnect_to_agent_TCP
  - dpiPathNameForUnixStream (1.3.6.1.4.1.2.2.1.3) for UNIX connect. This is caused by DPIconnect_to_agent_UNIXstream.

  Some questions to consider:
  - Was the GetRequest-PDU received? If the GetRequest was not received, was it sent to the right port?
    In the case of the TCP/IP subagent, the value of the AGENT keyword on the SACONFIG statement in the profile must match the value of -p that was specified (or defaulted) when the agent was invoked.
  - Does it have a valid community name in the request?
    - SNMP subagents must use a valid (including correct case) community name as defined in the PW.SRC data set (or SNMPD.CONF data set when using SNMPv3 security) when requesting the dpiPort or dpiPath variable.
    - Note that community name is a mixed-case, case-sensitive field. Specify as follows:
      - For the TCP/IP subagent, specify the community name in the SACONFIG statement.
      - For the OMPROUTE subagent, specify the community name in the ROUTESA_CONFIG statement.
      - For the Network SLAPM2 subagent, specify the community name by way of the -c parameter.
    - If SNMPv3 is being used, the community name must be defined in the VACM_GROUP statement in the SNMPD.CONF file for the SNMP agent. A VACM_ACCESS statement also needs to be defined to give that group read access to a VACM_VIEW that includes dpiPort objects.
    - dpiPathNameForUnixStream defaults to /var/dpi_socket and provides a z/OS UNIX file system pathname used in connecting a DPI subagent with the SNMP agent. The default can be overridden by using the -s parameter when starting the agent or by adding an entry for dpiPathNameForUnixStream in the OSNMPD.DATA file.
A user-written subagent running from a nonprivileged user ID needs write access to the file. Otherwise, a subagent using DPICconnect_to_agent_UNIXstream() would have to be run from an OMVS superuser user ID or other user ID with the appropriate privilege.

- Outgoing GetResponse-PDU for the dpiPort variable:
  - Was the SNMP GetResponse-PDU sent back to the SNMP subagent?
  - Was it sent to the correct IP address?
  - Did it have the correct value for the DPI port?
    - The actual value for the DPI port for TCP can be determined by issuing a Netstat ALL/-A command at the SNMP agent. This displays the port on which the agent is accepting incoming UDP requests.
    - To display the dpiPath name, issue an osnmp get request for dpiPathNameForUnixStream.

- One of the following incoming subagent connections:
  - Message EZZ6244I Accepted new DPI inet subagent connection on fd fd=xx from inet address xxxx port xxxx.
  - EZZ6246I Accepted new DPI inet socket connection on fd=xx

  **Note:** fd=xx is the number associated with this specific subagent connection. Use it to correlate with later DPI trace messages. The name and number of the port xxxx port xxxx.

- DPI packets transferred for this FD number

The following documentation might also be needed in some cases, but it is suggested that the IBM Software Support Center be contacted before this documentation is obtained:

- Dump of SNMP agent address space
- Dump of TCP/IP address space (for TCP/IP and TN3270E Telnet subagent problems)
- Dump of OMPROUTE address space (for OMPROUTE subagent problems)
- Dump of Network SLAPM2 subagent address space (for Network SLAPM2 subagent problems)
- Dump of user SNMP subagent address space
- Trace from subagent in syslogd

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids. Obtaining SNMP agent traces is discussed in “Starting SNMP agent traces” on page 567.

**Problems connecting to the SNMPIUCV subtask**

Problems in connecting the SNMPIUCV subtask of Tivoli NetView for z/OS to the SNMP query stack address space are indicated by an error message at the Tivoli NetView for z/OS operator console in response to an SNMP request or an attempt to start the SNMPIUCV subtask.

**Documentation**

The following documentation should be available for initial diagnosis of problems connecting the SNMPIUCV subtask to the SNMP query stack:

- PROFILE.TCPIP data set
- SNMP query stack job output, including SYSPRINT output
- NetView log
- SNMPARMS member of DSIPARMS data set

**Analysis**

Check for problems connecting the SNMP query stack to the NetView SNMPIUCV subtask:

- Has the SNMP query stack job started successfully?
- Check the SNMP query stack job output for errors. If the SNMP query stack is started successfully, you should see the message:

```
SQEI001 -- SNMP Query Stack running and awaiting queries...
```

Otherwise, check for errors that might have occurred during socket processing (socket, bind, accept, select, and so on).

- Is the SNMPIUCV subtask started?
  - If not, start the subtask by issuing the command:

```
START TASK=SNMPIUCV
```

from a NetView operator console.

- Was the following message received at the NetView operator console?

```
SNM101W SNMP task (SNMPIUCV) found Query Stack (name) not ready
```

- Is the `name` that the SNMPIUCV subtask is trying to connect to the correct name for the SNMP query stack address space?
  - If not, check the SNMPARMS member of the DSIPARMS data set to make sure that the value specified for the SNMPQE keyword is the correct SNMP query stack address space name.

If the problem still occurs after checking the preceding items and making any needed changes, obtain the following documentation:

- SNMP query stack level 2 trace output
- SNMP query stack IUCV communication trace output

The following documentation might also be needed in some cases, but it is suggested that the IBM Software Support Center be contacted before this documentation is obtained:

- Dump of SNMP query stack address space
- Dump of NetView address space

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids for your release of z/OS. Obtaining SNMP traces is discussed in “SNMP traces” on page 566.

**Problems connecting the SNMP query stack to the TCP/IP address space**

Problems connecting the SNMP query stack to the TCP/IP address space are usually indicated by an error message in the SNMP client output, indicating either a socket or IUCV error.

**Documentation**

The following documentation should be available for initial diagnosis of problems connecting the SNMP query stack to the TCP/IP address space:

- PROFILE.TCPIP data set
- SNMP client output, including SYSPRINT output
- TCPIP.DATA data set

**Analysis**

Check the following for problems connecting the SNMP client address space to the TCP/IP address space:

Use the following checklist to check the connection problems:

- Did any socket-related errors occur?
  - Check the SNMP query stack job output for socket(), bind(), accept(), or other socket error messages.
- Does job output indicate RC=1011 received for IUCV_CONNECT to `tcpip_name`?
Is the tcpip_name indicated by the IUCV_CONNECT error the correct name for the TCP/IP address space?

- Is the correct TCPIP DATA data set being used? (The job output should indicate which data set is being used).

- Is the SYSTCPD DD statement coded in the PROC JCL?

  **Tip:** SYSTCPD can be overridden by the global TCPIP.DATA file. See the z/OS Communications Server: IP Configuration Reference for additional information about the search order for the TCPIP.DATA data set.

- Does the TCPIPJOBNAME keyword in the TCPIP.DATA data set being used have the correct TCP/IP address space name?

If the problem still occurs after checking the preceding items and making any needed changes, obtain SNMP query stack IUCV communication trace output for problems connecting the client.

The following documentation might also be needed in some cases, but it is suggested that the TCP/IP IBM Software Support Center be contacted before this documentation is obtained:

- Dump of SNMP client address space
- Dump of TCP/IP address space

Information about obtaining a dump can be found in the z/OS MVS Diagnosis: Tools and Service Aids manual for your release of z/OS. Obtaining SNMP traces is discussed in “SNMP traces” on page 566.

**Incorrect output**

**Unknown variable**

Unknown variable problems are indicated by a noSuchName or noSuchObject response on an SNMP request. The noSuchName response indicates an error returned on an SNMPv1 request. For SNMPv2 and SNMPv3, more specific errors are returned, such as noSuchObject and noSuchInstance.

Unknown variable problems are usually caused by one of the following:

- A typographical error in the name or OID
- An incorrect instance number

  **Guideline:** If the dot-zero (.0) version of this OID contains a non-NULL value, the getnext would return ifNumber.0 and its value. It should be noted that if the dot-zero version of the requested OID is NULL, the getnext returns the first non-NULL value encountered in the MIB tree after ifNumber.0.

- The subagent supporting the MIB object is not started or is not completely connected to the SNMP agent.

- When SNMPv3 is configured, the object is not within the MIB view the user or community can access.

When the NetView SNMP client is used, unknown variable problems are reported when the SNMP client receives either a major error code 2 (internally detected error), minor error code 7 (unknown MIB variable), or a major error code 1 (SNMP agent reported error), minor error code 2 (no such name) in response to an SNMP request.

**Documentation**

The following documentation should be available for initial diagnosis of unknown variable problems:

- SNMP syslogd output with traces for both the agent and subagent. For more information about syslogd, see z/OS Communications Server: IP Configuration Guide.
- MIBS.DATA, when snmp is used.
- SNMP query stack job output, when Tivoli NetView for z/OS SNMP is used.
- Tivoli NetView for z/OS log, when Tivoli NetView for z/OS SNMP is used.
- hlq.MIBDESC.DATA data set, when Tivoli NetView for z/OS SNMP is used.
• If SNMPv3 security is being used, the SNMP agent configuration file (SNMPD.CONF). If the `snmp` command is the client being used, the `snmp` command configuration file (OSNMP.CONF) might also be needed.

• Include all the configuration files described earlier under “Definitions” on page 547.

Analysis

Use the following checklist to check for unknown variables at the SNMP agent:

1. Was the variable requested with the correct instance number?
   Variables that are not in a table have an instance number of 0. Variables that are part of a table might have more than one occurrence of the variable value. To get the value of the variable, you need to request a specific instance of the variable. To find the instance number, issue a GET NEXT request; the first occurrence of the variable should be returned.

2. If the variable is not defined in any compiled MIB, is the variable name included in the MIBS.DATA file (for the `snmp` command) or the `hlq.MIBDESC.DATA` file (for the NetView SNMP command)?

3. Did the DPI connection come up successfully?
   a. Check the SNMP agent job output for messages indicating a problem in create_DPI_port.
   b. If the DPI port was not successful, no SNMP subagents are able to register MIB variables. The SNMP agent has no knowledge of these unregistered variables and reports them as noSuchName for SNMPv1 requests or noSuchObject for SNMPv2 and SNMPv3 requests.

4. Has the subagent successfully connected to the SNMP agent?
   a. For subagents shipped as part of z/OS Communications Server, check the MVS operator console for a message indicating that the subagent has completed its initialization.
   b. Issue an `snmp walk` command on the SNMP agent subagent status table. For example, either of the following commands display the subagents that are connected to the z/OS Communications Server SNMP agent and the status of their connections:
      ```
      • `snmp -v walk saDescription`
      • `snmp -v walk saStatus`
      ```
      A value of 1 for saStatus indicates that the subagent connection to the SNMP agent is valid. Following are other possible status values:

      | Status            | Value |
      |-------------------|-------|
      | invalid           | (2)   |
      | connecting        | (3)   |
      | disconnecting     | (4)   |
      | closedByManager   | (5)   |
      | closedByAgent     | (6)   |
      | closedBySubagent  | (7)   |
      | closedBySubAgentTimeout | (8) |
      | closedBySubAgentError | (9) |

5. If the SNMP agent was configured with SNMPv3 security, is the object within the MIB view of that allowed for that user or community?
   a. Look at the agent SNMPD.CONF file to determine to which VACM_GROUP the user or community name on the failing request belongs. Then examine the VACM_ACCESS statements for that group for the level of security requested on the failing request to determine which MIB views have been permitted to the user or community name.
   b. Alternatively, SNMP agent configuration can be determined from SNMP agent traces if they were set to level 255 at agent initialization.
   c. SNMP agent configuration can also be determined dynamically by issuing `snmp walk` requests against the agent configuration MIB objects, such as the `vacmSecurityToGroupTable` and the `vacmAcessTable`. Reading the values in these tables requires an understanding of how the tables are indexed. See Requests for Comments (RFCs) 2573, 2574, and 2575 for an explanation of the MIB objects containing the SNMP agent configuration.
If the problem still occurs after checking the preceding items and making any needed changes, obtain the following documentation:

For variable not recognized by manager messages:

- If the manager is the z/OS UNIX `snmp` command, use the `-d 4` option to obtain all manager traces.
- If the manager is the NetView SNMP command, obtain the SNMP query stack level two output. The SNMP query stack level two trace shows the information flowing between the SNMP query stack and the SNMPiucv subtask of NetView. Verify in the trace that the variable name being requested is being passed correctly to the SNMP query stack.

For agent unknown variable:

- SNMP agent level 15 trace output
- Traces from SNMP subagent programs (if the variable is supported by a z/OS Communications Server subagent)

The SNMP agent level 15 trace shows PDUs between the manager and agent, as well as between the agent and any existing subagents. Look for the following in the trace:

- Is the ASN.1 number received from the manager in the SNMP GetRequest-PDU correct?
- Has a DPI packet registering the requested variable been received?
  
  1. If not, if you know which subagent program owns the variable, check the subagent program for errors.
  
  2. If the DPI register has been received, make a note of the FD number for further trace information.
- Were any errors reported for this FD number after the DPI register request was received?
- Was there a DPI information exchange over this FD number as a result of the incoming SNMP GetRequest-PDU?

Another approach to this problem is to look at the agent saMIB variables. This information can be useful when traces are not available. The saMIB variables include the following information:

- An entry for each subagent (including a field for subagent status)
- A table of all trees registered, including:
  
  - Subagent to which the tree is registered
  
  - Status of the tree (valid, not valid, and so on)

A description of the saMIB objects can be found in the file `samib.mib` in the `/usr/lpp/tcpip/samples` directory.

The following documentation might also be needed in some cases, but it is suggested that the IBM Software Support Center be contacted before this documentation is obtained:

- Dump of SNMP agent address space
- Dump of the subagent responsible for the MIB object whose value is being returned incorrectly.
  
  - Dump of TCP/IP address space (for TCP/IP and TN3270E Telnet subagent variables)
  
  - Dump of OMPROUTE address space (for OMPROUTE subagent problems)
  
  - Dump of Network SLAPM2 subagent address space (for Network SLAPM2 subagent problems)
  
  - Dump of user subagent address space

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids. Obtaining SNMP traces is discussed later in “SNMP traces” on page 566.

**Variable format incorrect**

Problems with incorrectly formatted variables are generally reported when the variable value from the GetResponse-PDU is displayed at the manager in the incorrect format (for example, as hexadecimal digits instead of a decimal value or a display string).
Documentation

The following documentation should be available for initial diagnosis of incorrectly formatted variables:

- MIBS.DATA, when snmp is used
- NetView log, when the NetView SNMP command is used
- hlq.MIBDESC.DATA data set, when NetView SNMP is used

Analysis

Use the following checklist to check incorrect variable format:

1. Is the variable contained in the hlq.MIBDESC.DATA data set or MIBS.DATA file?
   a. The SNMP query stack uses the hlq.MIBDESC.DATA data set to determine the display syntax of the variable value. NetView SNMP requires that all MIB object names be included in the hlq.MIBDESC.DATA data set.
   b. snmp searches the MIBS.DATA file for a MIB name definition. If it is not found, the value in the compiled MIB is used.

2. Is the value listed in the syntax position of the hlq.MIBDESC.DATA data set or MIBS.DATA file record for this variable the correct syntax?
   The value specified for syntax (for NetView) is case-sensitive and must be specified in lowercase.

3. For NetView SNMP, is the variable value type specified in message SNM043I Variable value type: correct?
   See the z/OS Communications Server: IP System Administrator’s Commands section about "Managing TCP/IP Network Resources Using SNMP" for the meanings of the variable value types.

If the problem still occurs after checking the preceding and making any needed changes, obtain the following documentation:

- For the TCP/IP subagent, subagent ITRACE level four output to show that the subagent returned to the SNMP agent.
- For the OMPROUTE subagent, syslogd output obtained by starting OMPROUTE with the -s1 option or by issuing the MODIFY SADEBUG command to start OMPROUTE subagent tracing.
- For the Network SLAPM2 subagent, syslogd output obtained by the Network SLAPM2 subagent with the -d 131 option or the MODIFY DEBUG,LEVEL command to start Network SLAPM2 subagent tracing.
- For user-written subagents, DPIdebug(2) output, which is sent to the syslogd. For more information about reading the syslogd traces, see the z/OS Communications Server: IP Configuration Guide.
- SNMP query stack level 4 trace output or z/OS UNIX snmp command trace level -d 4.
- SNMP manager command output showing the incorrectly formatted variable.
- SNMP agent level 31 trace output shows the DPI packet exchanges between the agent and subagent, as well as the value returned to the manager.
- For the TN3270E Telnet subagent, syslogd output from TNSATRACE keyword on TNSACONFIG profile statement to show what the subagent returned to the SNMP agent.

In the traces, verify that the variable value and syntax are passed correctly in the SNMP GetResponse-PDU from the agent to the SNMP manager.

The following documentation might also be needed in some cases, but it is suggested that the IBM Software Support Center be contacted before this documentation is obtained:

- Dump of the TCP/IP address space (for TCP/IP and TN3270E Telnet subagent problems)
- Dump of SNMP agent address space
- Dump of SNMP query stack address space
- Dump of OMPROUTE address space (for OMPROUTE subagent problems)
- Dump of Network SLAPM2 subagent address space (for Network SLAPM2 subagent problems)
Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids. Obtaining SNMP traces is discussed in “SNMP traces” on page 566.

Variable value incorrect
Problems with incorrect variable values are generally reported when the variable value from the GetResponse-PDU that is displayed at the manager contains incorrect information.

Documentation
The following documentation should be available for initial diagnosis of variables with incorrect values:

- SNMP agent syslogd trace output.
- If the object is supported by the TCP/IP subagent, the syslogd output. Obtain the syslogd output by using the profile statement ITRACE ON SUBAGENT 4.
- MIBS.DATA, if snmp is being used.
- hlq.MIBDESC.DATA, if Tivoli NetView for z/OS SNMP is being used.
- Tivoli NetView for z/OS log, if Tivoli NetView for z/OS SNMP is used.

Analysis
Use the following checklist to check for incorrect variable value:

1. Is the object identifier in the MIB description file correct?
2. Were any errors reported at the SNMP agent when the variable was requested?
3. Is the variable being cached at the SNMP query stack?
   The SNMP query stack uses the hlq.MIBDESC.DATA data set to determine the length of time to cache the variable value (or a default time length if the variable is not found in the hlq.MIBDESC.DATA data set). If the variable is requested before the caching time is up, the cached value is used instead of obtaining a new value.
4. Is the variable cached at the TCP/IP subagent?
   The TCP/IP subagent caches variable values for the length of time specified by the ibmMvsSubagentCacheTime MIB object, set by default to 30 seconds.
5. Is the variable supported by the Network SLAPM2 subagent? If so, is it being cached? The Network SLAPM2 subagent caches MIB objects for 30 seconds by default, but the cache time can be overridden at subagent initialization time with the -t parameter.
6. Is the variable cached at the TN3270E Telnet subagent? The TN3270E Telnet subagent caches variable values for the length of time specified by the CACHETIME keyword on the TNSACONFIG profile statement, set by default to 30 seconds.

If the problem still occurs after checking the preceding items and making any needed changes, obtain the following documentation:

- SNMP agent level three showing what was returned to the client.
- For the TCP/IP subagent, ITRACE level four trace output showing what the subagent returned to the SNMP agent.
- For the OMPROUTE subagent, syslogd output obtained by starting OMPROUTE with the -s1 option or by issuing the MODIFY SADEBUG command to start OMPROUTE subagent tracing.
- For the Network SLAPM2 subagent, syslogd output obtained by the Network SLAPM2 subagent with the -d 131 option or the MODIFY DEBUG,LEVEL command to start Network SLAPM2 subagent tracing.
- For user-written subagents, DPIdebug(2) output which is sent to the syslogd. For more information about reading the syslogd traces, see the z/OS Communications Server: IP Configuration Guide.
- For the TN3270E Telnet subagent, syslogd output from the TNSATRACE keyword on the TNSACONFIG profile statement showing what the subagent returned to the SNMP agent.
In the traces, verify that the variable value is passed correctly from the SNMP subagent to the SNMP agent and from the SNMP agent to the client.

The following documentation might also be needed in some cases, but it is suggested that the IBM Software Support Center be contacted before this documentation is obtained:

- Dump of TCP/IP address space (for TCP/IP and TN3270E Telnet subagent variables).
- Dump of SNMP query stack address space.
- Dump of OMPROUTE address space (for OMPROUTE subagent problems).
- Dump of Network SLAPM2 subagent address space (for Network SLAPM2 subagent problems).
- Incorrect values from the TCP/IP subagent are probably due to an error in the TCP/IP stack. In this case, a dump of the TCP/IP address space and a CTRACE from the stack might be useful. You can also use the Netstat command to verify that the TCP/IP subagent is reporting what the TCP/IP stack believes the value to be.

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids. Obtaining SNMP traces is discussed in “SNMP traces” on page 566.

No response from the SNMP agent

Problems receiving a response from the SNMP agent are generally reported when an SNMP request is issued from a manager but no response from the agent is received. This is reported as a timeout message.

Documentation

The following documentation should be available for initial diagnosis when no response is received from the agent:

- If the z/OS UNIX `snmp` command is being used, any command responses and traces at trace level -d 4.
- If the NetView SNMP command is being used, NetView console output or command responses.
- SNMP agent syslogd trace output at trace level 35.
- The OSNMP.CONF file (if the z/OS UNIX `snmp` command is the manager).
- PW.SRC or SNMPD.CONF file being used by the SNMP agent.
- If the SNMP Manager API is being used, any command responses and trace output for level 15 (SNMP_LOG_ALL and SNMP_LOG_INTERNAL).

Analysis

Use the following checklist when no response is received from an agent:

1. Is the SNMP agent running?
2. Is a path to the agent available? Try issuing a PING request to the IP address of the agent.
3. What is the timeout value? For example, the timeout value on the `snmp` command defaults to three seconds. Trying the request again with a larger timeout value, such as 15 seconds, might result in an answer.
4. Does the request use the correct port number and IP address?
5. Were any errors reported at the SNMP agent when the variable was requested?
6. If community-based security is being used, is the correct community name (including correct case) being used in the request?
7. Is the community name defined for the IP address from which the request originates? For example, a community name defined only for IPv4 addresses is not usable from an IPv6 address.
8. Is the community name defined for the SNMP version of the request? If the PW.SRC file is being used for community name definitions, community names are usable for both SNMPv1 and SNMPv2c requests. If the SNMPD.CONF file is being used for community name definitions, separate definitions are required to allow the use of the community name for both SNMPv1 and SNMPv2c requests. Note that the `snmp` command defaults to sending SNMPv1 requests. To send an SNMPv2c request using
the `snmp` command, an entry is required in the OSNMP.CONF file and the `snmp` command must be issued with a `-h` value that refers to an entry in the OSNMP.CONF file.

9. Does the agent support the SNMP version of the request? The z/OS Communications Server supports SNMPv1, SNMPv2c and, if configured with SNMPD.CONF, SNMPv3.

10. Are you using SNMPv3 with Advanced Encryption Standard (AES) encryption for the privacy protocol? For AES encryption, the z/OS Integrated Cryptographic Service Facility (ICSF) must be active. For detailed information about configuring ICSF, see z/OS Cryptographic Services ICSF Administrator's Guide.

If the problem still occurs after checking the preceding items and making any needed changes, obtain SNMP agent level seven trace output documentation.

Check the following in the SNMP agent traces:

1. Was the SNMP request PDU received by the agent?
2. Did it have a valid community name? Note that community name is case-sensitive and mixed-case.
3. Was the IP address of the manager the expected IP address?
4. Was an SNMP GetResponse-PDU sent back to the manager?
5. Was an AuthenticationFailure trap generated?

**Guideline:** For these traps to be generated, you must first provide the trap destination information in either the SNMPTRAP.DEST or SNMPD.CONF file. Then, provide OSNMPD.DATA information where the snmpEnableAuthenTraps MIB object is set to 1, to enable the authentication traps. For detailed information about enabling traps, see z/OS Communications Server: IP Configuration Reference.

The following documentation might also be needed in some cases, but contact the IBM Software Support Center before this documentation is obtained:

- Dump of SNMP agent address space
- Dump of the TCP/IP address space (for TCP/IP and TN3270E Telnet subagent problems)
- Dump of OMPROUTE address space (for OMPROUTE subagent problems)
- Dump of Network SLAPM2 subagent address space (for Network SLAPM2 subagent problems)

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids. Obtaining SNMP traces is discussed in “SNMP traces” on page 566.

**SNMPv3 AES encryption or decryption failures**

SNMP problems might be caused by SNMPv3 AES privacy protocol encryption or decryption failures. The support of SNMPv3 AES privacy protocol requires the services of the z/OS Integrated Cryptographic Service Facility (ICSF). Before you configure the AES privacy protocol, ensure that ICSF is active.

**Documentation**

The following documentation should be available for initial diagnosis:

- Any command responses and traces at trace level -d 4 if the z/OS UNIX `snmp` command is being used.
- SNMP agent syslogd trace output at trace level 35.
- The OSNMP.CONF file (if the z/OS UNIX `snmp` command is the manager).
- PW.SRC or SNMPD.CONF file that the SNMP agent is using.
- If the SNMP Manager API is being used, any command responses and trace output for level 15 (SNMP_LOG_ALL and SNMP_LOG_INTERNAL).

**Analysis**

Use the following checklist to determine whether AES encryption or decryption failures are occurring, based on the SNMP function that you use. For failures other than ICSF not being active, contact the IBM Software Support Center with the documentation.
1. Is ICSF active? For the SNMP agent, the z/OS UNIX `snmp` command, and the SNMP manager API, check the syslog trace output or traces for the following entries to see whether ICSF is active. If the return code is 12 and the reason code is 0, ICSF was not active when you attempted to encrypt or decrypt by using the function.

- Encrypting AESCFB128 completed return=12 reason=0
- Decrypting AESCFB128 completed return=12 reason=0

2. SNMP agent. AES encryption or decryption errors in the SNMP agent result in one of the following situations:

- Timeout messages are issued by the manager because the agent did not respond to a request.
- The manager does not receive notifications.

To determine whether AES encryption or decryption errors are the cause of these problems, look for the following entries in the agent's syslog trace output. One or both might be present.

- Encrypting AESCFB128 completed return=nn reason=nn
- Decrypting AESCFB128 completed return=nn reason=nn

3. z/OS `snmp` command.

- AES encryption errors result in the command issuing the following message:

  ```
  EZZ3301I Error return from SnmpSendMsg()
  ```

- AES decryption errors result in a timeout message.

To determine whether AES encryption or decryption errors are the cause of these problems, look for the following entries in the trace output of the command. One or both might be present.

- Encrypting AESCFB128 completed return=nn reason=nn
- Decrypting AESCFB128 completed return=nn reason=nn

4. SNMP manager API.

- AES encryption errors result in the snmpSendRequest failing with a return code of SNMP_MGR_RC_ENCODE_ERROR (-13).
- AES decryption errors result in the snmpSendRequest failing with a return code of SNMP_MGR_RC_USM_DECRYPTION_ERROR (-68).

To determine whether AES encryption or decryption errors are the cause of these problems, look for the following entries in the syslog trace output of the manager API. One or both might be present.

- Encrypting AESCFB128 completed return=nn reason=nn
- Decrypting AESCFB128 completed return=nn reason=nn

**Report received from SNMP agent**

With SNMPv3, certain error conditions detected on a request are sent back from the SNMP agent to the SNMP manager as a report. Some reports are expected as part of normal processing, but most often they indicate an error condition.

For the `snmp` command, some reports occur during normal processing, such as the usmStatsUnknownEngineIDs condition, which occurs as the `snmp` command performs discovery processing to learn the SNMP stackID of the agent with which it is communicating. Normal processing reports are not displayed by `snmp` unless debug tracing is active. Reports that indicate error conditions are typically displayed using the EZZ33431 message. For example, when an attempt is made to use a USM user with an authentication key that does not match the key that is configured at the SNMP agent, the usmStatsWrongDigests report is received.
Figure 83 on page 571 shows the output received by an SNMP manager when the authentication key sent by an snmp command did not match the key defined at the agent. The command issued in the z/OS UNIX shell was:

```
$ snmp -h v374 -v walk usmUserStatus
EZZ33431 Report received : usmStatsWrongDigests
EZZ33011 Error return from SnmpRecvMsg()
```

Following are other common reports:

**usmStatsUnknownUserNames**
Indicates a request was received for a user that is not defined at the SNMP agent.

**usmStatsUnsupportedSecLevels**
Indicates a request was received for a defined user, but the user was not configured at the SNMP agent to use the security level specified in the request.

**usmStatsDecryptionErrors**
Indicates an encrypted request was received at the SNMP agent, but the request could not be decrypted. This can be the result of an invalid privacy key.

### 0.0.0.0 address in traps from the SNMP agent

SNMPv1 traps contain the IP address of the originating agent encoded as part of the protocol data unit. The address field is four bytes long. If SNMPv1 traps are received from the z/OS Communications Server SNMP agent with an agent address of 0.0.0.0, it is most likely due to the fact that the agent obtained an IPv6 address for itself when it initialized. To avoid this situation, the SNMP agent can be started with the -A parameter to request that the SNMP agent obtain an IPv4 address for itself when initializing. See the z/OS Communications Server: IP Configuration Reference for more information.

### I/O error for SNMP PING

Tivoli NetView for z/OS users can issue a PING request by using SNMP PING. SNMP I/O error problems are reported when a major return code of 2 (internally detected error) and a minor return code of 4 (some I/O error occurred) are received when issuing an SNMP PING. This type of problem is generally caused by an error in the PROFILE.TCPIP data set.

**Documentation**
The PROFILE.TCPIP data set should be available for initial diagnosis of SNMP I/O problems. Additional documentation that might be needed later is described in “Analysis” on page 564.

**Analysis**
Obtain the following documentation:

- SNMP query stack job SYSPRINT output
- SNMP query stack level two trace output
- SNMP query stack IUCV communication trace output

The following documentation might also be needed in some cases, but it is suggested that TCP/IP customer support be contacted before this documentation is obtained:

- Dump of SNMP address space
- TCP/IP packet trace

Information about obtaining a dump can be found in z/OS MVS Diagnosis: Tools and Service Aids manual for your release of MVS. Obtaining SNMP traces is discussed “SNMP traces” on page 566.
Traps not forwarded by trap forwarder daemon

Problems with traps not getting forwarded by the trap forwarder daemon are most likely the result of configuration errors or problems in the network.

Documentation

The following documentation should be available for initial diagnosis:

- TRAPFWD.CONF file
- Trapfwd traces, level 3
- Traces from the sending agent (the originator of the trap)
- Trace from the receiving client (the target of the forwarded trap)

Analysis

Use the following checklist to check for traps not forwarded by trap forwarder daemon:

1. Is the target address correctly configured in the TRAPFWD.CONF file?
   - If the target is designated by a host name, check the trapfwd trace to determine whether the hostname was correctly resolved to an IP address. If the target is designated by an IPv6 colon-hexadecimal address, then your TCP/IP stack must be running with IPv6 support. If the stack is not running with IPv6 support, then the trap forwarder daemon cannot forward traps to IPv6 listener addresses.

2. Is the trap being received at the trap forwarder daemon?
   - If trapfwd traces indicate the trap is not being received at the trapfwd daemon, examine traces from the SNMP agent sending the trap. Determine whether the SNMP agent did send the trap.

3. Are there network problems between the trap forward daemon and the target client?
   - By issuing an SNMP GET request at the target client to the SNMP agent on the same host as the trap forward daemon, you can determine whether UDP packets are correctly reaching the client.

4. Are the UDP packets being discarded due to congestion at the TCP/IP stack?
   - If the trapfwd trace indicates that the trap is correctly being sent from the trap forwarder daemon to the target client, but the trap is not being received, consider setting NOUDPQueueLimit on the UDPCONFIG statement. This is used to specify that UDP should not have a queue limit and would prevent traps from being lost due to congestion.

If the above analysis does not correct the problem, the following documentation should be gathered and the IBM Software Support Center should be contacted:

- UDP packet trace on the TCP/IP stacks where the originating SNMP agent, the trap forwarder daemon, and the target client are running.

Incorrect address in forwarded trap

Documentation

The following documentation should be available for initial diagnosis:

- TRAPFWD.CONF file
- Trapfwd traces, level 3
- Traces from the sending agent (the originator of the trap)
- Trace from the receiving client (the target of the forwarded trap)

Analysis

Use the following checklist to check for an incorrect address in forwarded trap:

1. What is the version of the SNMP trap?
In the case of SNMPv1 traps, the address from which the trap originated is encoded within the trap packet. A manager that needs the originating address should look into the SNMP packet to get the address.

If the address is 0.0.0.0, the most likely cause is that the trap originated at an IPv6 address. If the trap originated at the z/OS SNMP Agent, see “0.0.0.0 address in traps from the SNMP agent” on page 564.

In the case of SNMPv2 traps, the originating address is not encoded within the trap PDU. If a manager uses the address from which the trap packet is received, it would not be the originating address but the address at which the trap forwarder daemon is running. If the manager needs the originating address if SNMPv2 traps, the trap forwarder should be configured to append the originating address to the trap and the manager should be capable of reading the address from the end of the received trap packet. For more information about the format in which the address is appended, see the z/OS Communications Server: IP User’s Guide and Commands.

2. Is it an SNMPv2 trap?

Check to see whether the ADD_RECVFROM_INFO is specified correctly in the TRAPFWD.CONF file. If it is not specified, then add the option to the configuration file. Note, the receiving manager must be capable of processing the RECVFROM information at the end of the trap packet.

If the above analysis does not correct the problem, collect the above documentation and contact the IBM Software Support Center.

SNMP traces

There are several types of traces that can be useful in identifying the cause of SNMP problems:

- Manager traces
- Agent traces
- Subagent traces
- TRAPFWD traces

These traces are discussed in the following topics.

Starting manager traces

To obtain traces when the SNMP manager being used is the z/OS UNIX snmp command, issue snmp with the -d option. You can specify a trace level of 0-4. A trace level of 0 provides no tracing, while a level 4 provides all traces. Tracing for snmp is done on a per-request basis. Traces return to the console, but they can be redirected to a file issuing the OMVS redirect operand (>).

When NetView SNMP is being used, traces for the SNMP Query Engine can be obtained by starting the SNMP Query Engine and specifying -d trace_level where trace_level is one of the following:

1 Display errors.

2 In addition to trace level 1, also display SNMP query stack protocol packets exchanged between the SNMP query stack and the SNMPIUCV subtask, with the exception of TRAP packets sent to NetView from the query stack.

3 In addition to trace level 2, also display decoded SNMP protocol packets sent and received along with some additional informational messages.

4 In addition to trace level 3, display the BER-encoded packets received from NetView or from an SNMP agent. Also, add display of SNMP query stack protocol packets for TRAPs sent from the query stack to NetView.
For example:

```bash
//SNMPQE EXEC PGM=SQESERV,REGION=4096K,TIME=1440,PARM=' -d 3'
```

Also, the -it option can be used to obtain a trace of IUCV communication.

SNMP Query Engine trace output is sent to the SYSPRINT DD specified in the Query Engine JCL.

**Starting SNMP agent traces**

**If agent is not running**

If the SNMP agent is not already running, specify the -d parameter when you invoke the agent. You specify this parameter based on the method by which you start the SNMP agent:

- Using the start options in the JCL used to start the SNMP agent (more common). For example,
  ```bash
  //OSNMPD EXEC PGM=EZASNMPD,REGION=4096K,TIME=1440,PARM=' -d 8'
  ```
- Using the z/OS UNIX shell, using the `snmpd` command. For example:
  ```bash
  snmpd -d 255 &
  ```

Use one of the following trace levels or a combination of them:

1. Trace SNMP requests
2. Trace SNMP responses
4. Trace SNMP traps
8. Trace DPI packets level 1
16. Trace DPI internals level 2
32. Internal trace (debug level 1)
64. Extended trace (debug level 2)
128. Trace DPI internals level 2

**Combining trace levels:** To combine trace levels, add trace level numbers. For example, to request SNMP requests (level 1) and SNMP responses (level 2), you would request trace level 3.

Trace records are sent to the file specified by the daemon.debug entry in the SYSLOG configuration file. For more information see z/OS Communications Server: IP Configuration Guide.

**If agent is already running**

You can use the MVS MODIFY command to start and stop trace dynamically. Use of this support is restricted to the users with MODIFY command privilege.

If you start the agent from JCL, you have no difficulty knowing the proclname. However, if you start the agent from the z/OS UNIX shell, the agent generates a message to syslogd. This message indicates the job name the agent is running; this is the job name to specify on the MODIFY command.

For example, assume the proclname is OSNMPD and you want to change the trace level to 3 (tracing SNMP requests and responses). Enter:

```bash
MODIFY OSNMPD,trace,level=3
```
For more information about using the MVS MODIFY command, see z/OS Communications Server: IP System Administrator's Commands.

**Starting TCP/IP subagent traces**

To start the TCP/IP subagent traces, code the ITRACE statement in the PROFILE.TCPIP data set or in the data set specified on the VARY TCPIP,OBEYFILE command. For more information, see z/OS Communications Server: IP Configuration Reference.

```
ITRACE ON SUBAGENT level
```

where `level` is one of the following values:

1

General subagent trace information.

2

General subagent trace information plus DPI traces.

3

General subagent trace information plus extended dump trace. This level provides storage dumps of useful information, such as storage returned by the IOCTL calls.

4

General subagent trace information, plus extended dump trace and DPI traces.

The trace output is sent to the syslogd. Trace records are found in the file specified by the daemon.debug entry in the SYSLOG configuration file. For more information, see z/OS Communications Server: IP Configuration Guide.

To stop TCP/IP subagent traces, code the ITRACE statement in the PROFILE.TCPIP data set or in the data set specified on the VARY TCPIP,OBEYFILE command:

```
ITRACE OFF SUBAGENT
```

For more information about the VARY command, see z/OS Communications Server: IP System Administrator's Commands.

**Starting OMPROUTE subagent traces**

To start OMPROUTE subagent tracing, start OMPROUTE with the -s1 option or issue the MODIFY SADEBUG command. Output is sent to syslogd. For details, see “Starting OMPROUTE tracing and debugging from the z/OS UNIX System Services shell” on page 701 and “Starting OMPROUTE tracing and debugging using the MODIFY command” on page 702.

**Starting Network SLAPM2 subagent traces**

To start Network SLAPM2 subagent tracing, start the Network SLAPM2 subagent with the -d option or by issuing the MODIFY DEBUG,LEVEL command. Output is sent to syslogd.

The Network SLAPM2 subagent trace levels are 0-511. There are nine levels of tracing provided. Each level selected has a corresponding number. The sum of the numbers associated with each level of tracing selected is the value which should be specified as level. After the Network SLAPM2 Subagent is started, tracing options can be dynamically changed using the MVS MODIFY command.

The numbers for the trace levels are:

0

No tracing

1

Trace Network SLAPM2 Subagent Error and System Console Messages

2

Trace Network SLAPM2 Subagent Warning Messages
Starting TN3270E Telnet subagent traces

To start the TN3270E Telnet subagent traces, code the TNSATRACE keyword on the TNSACONFIG statement in the PROFILE.TCPIP data set or in the data set specified on the VARY TCPIP,OBEYFILE command. For more information, see z/OS Communications Server: IP Configuration Reference.

If the subagent is not currently tracing, the subagent must first be disabled. Disable the subagent by using the VARY TCPIP,OBEYFILE command where the data set for the command contains:

```
TELNETGLOBALS
TNSACONFIG DISABLED
ENDTELNETGLOBALS
```

Then re-enable the subagent by using the VARY TCPIP,OBEYFILE command where the data set for the command contains:

```
TELNETGLOBALS
TNSACONFIG ENABLED TNSATRACE
ENDTELNETGLOBALS
```

The trace output is sent to the syslogd. Trace records are found in the file specified by the daemon.debug entry in the SYSLOG configuration file. For more information, see z/OS Communications Server: IP Configuration Guide.

Starting TRAPFWD traces

The following topics provide information about starting TRAPFWD traces.

If TRAPFWD is not running

If TRAPFWD is not already running, specify the -d parameter during startup. You can start the TRAPFWD trace in one of the following ways:

- Through the start options in the JCL used to start the TRAPFWD. For example,

```
//TRAPFWD EXEC PGM=EZASNTRA,REGION=4096K,TIME=NOLIMIT,
//PARM='POSIX(ON) ALL31(ON)/-d 3'
```

- Through OMVS, using the `trapfwd` command. For example,

```
trapfwd -d 3 &
```

Use one of the following trace levels:

1. Minimal tracing, trace address from which the trap is received.
In addition to 1, trace addresses to which the trap packet is forwarded.

In addition to 2, trace trap packets.

Trace records are sent to the file specified by the daemon.debug entry in the SYSLOG configuration file. For more information see z/OS Communications Server: IP Configuration Guide.

**If TRAPFWD is already running**

You can use the MVS MODIFY command to start and stop the trace dynamically. Use of this support is restricted to users with MODIFY command privilege.

If you start the trapfwd from JCL, you have no difficulty knowing the proctype. However, if you start the trapfwd from OMVS, the trapfwd generates a message to syslogd. This message indicates the job name the trapfwd is running; this is the job name to specify on the MODIFY command.

For example, assume that the proctype is TRAPFWD and you want to change the trace level to 3. You would enter the following:

```
MODIFY TRAPFWD,trace,level=3
```

For more information about using the MVS MODIFY command, see z/OS Communications Server: IP System Administrator's Commands.

**Trace examples and explanations**

The following examples are shown in this topic:

- Agent trace
- TCP/IP subagent traces
- TRAPFWD trace
- NetView SNMP Query Engine trace
- NetView SNMP Query Engine IUCV Communication trace

Figure 81 on page 570 was produced by using `snmp get sysUpTime.0`. When the SNMP agent is tracing responses, it makes the following entry in the syslogd output file:

```
Dec 19 15:55:38  snmpagent.9.: SNMP logging data follows ==============
Dec 19 15:55:39  snmpagent.9.: Log_type:        snmpLOGresponse_out
Dec 19 15:55:39  snmpagent.9.:    send rc:      0
Dec 19 15:55:39  snmpagent.9.:    destination:  UDP 127.0.0.1 port 5000
Dec 19 15:55:39  snmpagent.9.: version:         SNMPv1
Dec 19 15:55:39  snmpagent.9.: community:       public
Dec 19 15:55:39  snmpagent.9.:  ('70 75 62 6c 69 63'h)
Dec 19 15:55:39  snmpagent.9.: addressInfo:     UDP 127.0.0.1 port 5000
Dec 19 15:55:39  snmpagent.9.: PDUtype:         GetResponse ('a2'h)
Dec 19 15:55:39  snmpagent.9.: request:         1
Dec 19 15:55:39  snmpagent.9.: error-status:    noError (0)
Dec 19 15:55:39  snmpagent.9.: error-index:     0
Dec 19 15:55:39  snmpagent.9.: varBind oid:     1.3.6.1.2.1.1.3
Dec 19 15:55:39  snmpagent.9.: name:    sysUpTime.0
Dec 19 15:55:39  snmpagent.9.: value: 5900 - 59.00 seconds
Dec 19 15:55:39  snmpagent.9.: End of SNMP logging data:
```

*Figure 81. SNMP agent response trace*
In the following scenario, the SNMP agent attempted to initialize, but it was not successful. The port it was using was already in use. The trace shown in Figure 82 on page 571 was obtained with SNMP agent tracing set to 7.

```
Dec 19 11:57:52  snmpagent.16777227.: EZZ6235I socket function failed for SNMP inet udp socket; EDC5112I Resource temporarily unavailable.
Dec 19 11:57:52  snmpagent.16777227.: ... errno = 112, errno2 =12fc0296
```

Figure 82. SNMP agent trace of unsuccessful initialization

**Note:** Errno 112 translates to Resource temporarily unavailable. The errno is used primarily by IBM service in diagnosing the error. In this case, issue the Netstat CONN/-c command to determine whether TCP/IP is running and, if so, which ports are in use.

Figure 83 on page 571 shows the trace produced for the agent when the authentication key sent by a manager does not match the key defined at the agent. The command receives a report indicating usmStatsWrongDigests.

```
IDSTMVS.S@AU1104.SOURCE.S@AGV123(1624): rc=-65 (SNMP_RC_USM_WRONG_DIGEST)
  from snmp_process_message()
```

Figure 83. SNMP messages and agent trace for nonmatching key

Figure 84 on page 571 shows the output received by an SNMP manager and the trace produced for the agent when the operator attempted to retrieve data not within the defined view. The command issued in the z/OS UNIX shell was:

```
snmp -h v374a -v get usmUserStatus.12.0.0.0.2.0.0.0.0.9.67.35.37.2.117.49
```

```
OUTPUT RECEIVED BY THE MANAGER
usmUserStatus.12.0.0.0.2.0.0.0.0.9.67.35.37.2.117.49 = noSuchObject

AGENT TRACE
IDSTMVS.S@AU1104.SOURCE.S@AGV123(1624): RC=-30 (SNMP_RC_NOT_IN_VIEW)
  from snmp_process_message()
```

Figure 84. SNMP messages and agent trace when data not in defined view

The following return codes in SNMP agent traces typically indicate configuration errors:

- **SNMP_RC_NOT_AUTHENTICATED** - indicates the SNMP agent received an SNMPv1 or SNMPv2c request with a community name that was not valid for use by the IP address making the request.
- **SNMP_RC_NOT_IN_VIEW** - indicates the SNMP agent received an SNMPv3 request for a MIB object that is not defined to be accessible by the community name or user name making the request.
- **SNMP_RC_USM_UNKNOWN_USERNAME** - indicates the SNMP agent received an SNMPv3 request for a username not configured at the SNMP agent.
- **SNMP_RC_USM_WRONG_DIGEST** - indicates the SNMP agent received an SNMPv3 request for which the authentication key for the user making the request was not valid.
- **SNMP_RC_USM_DECRYPTION_ERROR** - indicates the SNMP agent received an encrypted request, but the request could not be decrypted because the encryption key for the user making the request was not valid.
- **SNMP_RC_USM_UNSUPPORTED_SECLEVEL** - indicates the SNMP agent received a request for a defined user, but the user was not configured to use the security level specified in the request.

**SNMP agent traces**
TCP/IP subagent trace

When requests for MIB variables supported by the TCP/IP subagent fail with an indication that the variable is not supported (noSuchName or noSuchObject), one possibility is that the TCP/IP subagent was unable to connect to the SNMP agent.

Figure 85 on page 572 illustrates a scenario where the subagent is unable to connect because the password it is using is not accepted by the SNMP agent. (The password used by the subagent is defined or defaulted on the SACONFIG statement in the TCP/IP profile.) The following traces were obtained with SNMP agent traces set to 15 and the subagent traces (as set on the ITRACE profile statement) set to 3.

```
Apr  4 16:28:17 MVS097 snmpagent[67108869]: EZZ6225I SNMP agent: Initialization complete
Apr  4 16:28:21 MVS097 M2SubA[50331651]: VS.1320 do_open_and_register: Connect to SNMP agent failed, will keep trying
Apr  4 16:28:31 MVS097 M2SubA[50331651]: VS.2543 do_connect_and_open .... getting agent info from config
Apr  4 16:28:31 MVS097 M2SubA[50331651]: 08B7A4A0  82818497  A6404040  40404040  40404040  *badpw*
Apr  4 16:28:31 MVS097 M2SubA[50331651]: 08B7A4B0  40404040  40404040  40404040  40404040  *
Apr  4 16:28:31 MVS097 M2SubA[50331651]: 08B7A49C  000000A1  *....*
Apr  4 16:28:31 MVS097 M2SubA[50331651]: VS.2556 do_connect_and_open: port 161
Apr  4 16:28:31 MVS097 M2SubA[50331651]: VS.2567 do_connect_and_open: hostname_p => 9.67.35.37
Apr  4 16:28:31 snmpagent[67108869]: IDSTMVS.SO064350.SOURCE.S@AGV123(1623): rc=-14 (SNMP_RC_NOT_AUTHENTICATED) from snmp_process_message()
Apr  4 16:28:34 MVS097 snmpagent[67108869]: IDSTMVS.SO064350.SOURCE.S@AGV123(1623): rc=-14 (SNMP_RC_NOT_AUTHENTICATED) from snmp_process_message()
```

Figure 85. SNMP subagent trace

NetView SNMP query engine trace

This topic discusses the output produced by the SNMP query stack trace.

Figure 86 on page 574 shows an example of the output produced by the SNMP query stack trace. This trace was produced by starting the SNMP query stack address space with start option -d 4, which is the maximum amount of trace records produced. In the figure, the column labeled "trc lvl" shows the lowest trace level required to see that particular trace entry. For example, lines five through nine have a "trc lvl" of four. This means that only the -d 4 trace option shows this type of trace entry. On the other hand, lines 10 through 17 have a "trc lvl" of two. This means that trace level two or higher produces this trace information.

**Guideline:** The column headed "line no." numbers the trace records for reference in the discussion that follows the figure. Neither the "trc lvl" nor the "line no." column appear in the actual trace output.

The following sequence of events occurred to create the trace output:

1. Started the SNMP query stack address space
   - Trace output lines in the range 1–3
2. Started the SNMPICUV subtask at the NetView host (attempted connection to the query stack when started)
   - Trace output line 4
3. Issued an SNMP TRAPSON request (request 1001)
   - Trace output lines in the range 5–27
4. Incoming SNMP Trap-PDU received from SNMP agent
   - Trace output lines in the range 28–61
5. Issued an SNMP TRAPSOFF request (request 1002)
   - Trace output lines in the range 62–82
6. Incoming SNMP Trap-PDU received from SNMP agent
   Trace output lines in the range 83–104
7. Issued an SNMP GET request (request 1003)
   Trace output lines in the range 105–148
8. Received the response to request 1003
   Trace output lines in the range 149–191
9. Issued an SNMP GETNEXT request (request 1004)
   Trace output lines in the range 192–235
10. Received the response to request 1004
    Trace output lines in the range 236–278
11. Issued an SNMP SET request (request 1005)
    Trace output lines in the range 279–326
12. Received the response to request 1005
    Trace output lines in the range 327–369
13. Issued an SNMP MIBVNAME request (request 1006)
    Trace output lines in the range 370–397
14. Issued an SNMP PING request (request 1007)
    Trace output lines in the range 398–429
15. Issued an SNMP GET request for a variable name not defined in the hlq.MIBDESC.DATA data set (request 1008)
    Trace output lines in the range 430–462
16. Stopped the SNMPIUCV subtask of the NetView program
    Trace output line 463
Using 'TCPCS.mibdesc.data' as MIB description file
There are 56 client connections possible
Accepted new client connection
Received following NVquery packet:

dumping packet of 19 bytes:
00 11 01 01 02 06 00 00 03 e9 00 00 00 00 00

major version: 1
minor version: 1
release: 1
native set: EBCDIC
packet type: TRAP REQUEST
filter id: 1001
network mask: 0.0.0.0
desired network: 0.0.0.0

Received following SNMP_trap packet:
dumping packet of 43 bytes:
00 0d 01 01 01 02 07 00 00 03 ea 00 00 03 e9

major version: 1
minor version: 1
release: 1
native set: EBCDIC
packet type: TRAP
filter id: 1001
agent address: 9.67.114.37
generic trap: 4 (0X4)
specific trap: 0 (0X0)
time stamp: 9680
variable-bindings {}

Decoded SNMP PDU:

version version-1,
community '4d56534c'H,
data {
  trap {
    enterprise 1.3.6.1.4.1.2.1.2.1.4,
    agent-addx {
      internet '09437225'H
    },
    generic-trap authenticationFailure,
    specific-trap 0,
    time stamp 9680,
    variable-bindings {}
  }
}

major version: 1
minor version: 1
release: 1
native set: EBCDIC

Received following NVquery packet:
dumping packet of 19 bytes:
00 11 01 01 02 06 00 00 03 e9 00 00 00 00 00

major version: 1
minor version: 1
release: 1
native set: EBCDIC

Received following NVquery packet:
dumping packet of 15 bytes:
00 0d 01 01 01 02 07 00 00 03 ea 00 00 03 e9

major version: 1
minor version: 1
release: 1
native set: EBCDIC

Figure 86. SNMP query engine traces
Diagnosing Simple Network Management Protocol (SNMP) problems
146     }
147 }
148 EZA6380I sending SNMP request to 9.67.114.37
4 149 EZA6295I Received following SNMP_response packet:
150 EZA6393I dumping packet of 39 bytes:
151 02 01 00 02 01 00 04 04 53 4e 4d 50 a2 1a 02 01 01
152 01 00 02 01 00 03 00 0f 00 01 00 04 03 01 01 02
153 01 00 03 43 02 0a 00
3 154 EZA6424I Decoded SNMP PDU:

155 {  
156     version version-1,  
157     community '534e4d50'H,  
158     data {  
159         get-response {  
160             request-id 1,  
161             error-status noError,  
162             error-index 0,  
163             variable-bindings {  
164                 name 1.3.6.1.2.1.1.3,  
165                 value {  
166                     application-wide {  
167                         ticks 18600  
168                     }  
169                 }  
170 }  
171 }  
172 }  
173 }  
174 }

2 176 EZA6359I major version: 1  
177 EZA6360I minor version: 1  
178 EZA6361I release: 1  
179 EZA6363I native set: EBCDIC  
180 EZA6364I packet type: RESPONSE  
181 EZA6367I sequence id: 1003  
182 EZA6388I major error: 0  
183 EZA6389I minor error: 0  
184 EZA6390I error index: 0  
185 EZA6391I error text len: 0  
186 EZA6392I error text: no error  
187 EZA6380I name length: 16  
188 EZA6381I name: 1.3.6.1.2.1.1.3  
189 EZA6382I value type: time ticks  
190 EZA6384I value length: 4  
191 EZA6387I value: 18600
4 192 EZA6292I Received following NVquery packet:  
193 EZA6305I dumping packet of 42 bytes:  
194 00 28 01 01 01 02 02 00 00 03 ec 00 05 d4 e5 e2  
195 d3 00 00 05 e2 d5 d4 d7 00 00 03 01 ff 01 00 0a  
196 c9 c6 c4 c5 e2 c3 d9 4b f0 00
2 197 EZA6359I major version: 1  
198 EZA6360I minor version: 1  
199 EZA6361I release: 1  
200 EZA6363I native set: EBCDIC  
201 EZA6364I packet type: GET-NEXT  
202 EZA6367I sequence id: 1004  
203 EZA6368I hostname len: 5  
204 EZA6370I hostname: MVSL  
205 EZA6371I community len: 5  
206 EZA6373I community: SNMP  
207 EZA6374I optional length: 3  
208 EZA6375I max. retries: 1  
209 EZA6376I initial timeout: 255

210 EZA6377I backoff exponent: 1  
211 EZA6380I name length: 22  
212 EZA6381I name: 1.3.6.1.2.1.2.2.1.2.0  
3 213 EZA6424I Decoded SNMP PDU:
214 {  
215     version version-1,  
216     community '534e4d50'H,  
217     data {  
218         get-next-request {  

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request-id 2,
error-status noError,
error-index 0,
variable-bindings {
  name 1.3.6.1.2.1.2.2.1.2.0,
  value {
    simple {
      empty {}
    }
  }
}
}
}

EZA6308I sending SNMP request to 9.67.114.37

EZA6295I Received following SNMP_response packet:

EZA6305I dumping packet of 47 bytes:

EZA6424I Decoded SNMP PDU:

version version-1,
community '534e4d50'H,
data {
  get-response {
    request-id 2,
    error-status noError,
    error-index 0,
    variable-bindings {
      name 1.3.6.1.2.1.2.2.1.2.1,
      value {
        simple {
          string '49424d204c4353'H
        }
      }
    }
  }
}

EZA6359I major version: 1
EZA6360I minor version: 1
EZA6361I release: 1

Diagnosing Simple Network Management Protocol (SNMP) problems
EZA6375I  max. retries:  1
EZA6376I  initial timeout: 255
EZA6377I  backoff exponent: 1
EZA6380I  name length:  22

EZA6381I  name:  1.3.6.1.4.1.2.2.1.4.1
EZA6382I  value type:  number
EZA6384I  value length:  4
EZA6386I  value:  12345

Decoded SNMP PDU:
{
  version version-1,
  community '534e4d50'H,
  data {
    set-request {
      request-id 3,
      error-status noError,
      error-index 0,
      variable-bindings {
        name 1.3.6.1.4.1.2.2.1.4.1,
        value {
          simple {
            number 12345
          }
        }
      }
    }
  }
}

EZA6308I sending SNMP request to 9.67.114.37

Decoded SNMP PDU:
{
  version version-1,
  community '534e4d50'H,
  data {
    get-response {
      request-id 3,
      error-status noError,
      error-index 0,
      variable-bindings {
        name 1.3.6.1.4.1.2.2.1.4.1,
        value {
          simple {
            number 12345
          }
        }
      }
    }
  }
}

EZA6359I major version: 1
EZA6360I minor version: 1
EZA6361I release: 1
EZA6363I native set: EBCDIC
EZA6364I packet type: RESPONSE
EZA6367I sequence id: 1005
EZA6381I name length: 22
EZA6382I name: 1.3.6.1.4.1.2.2.1.4.1
EZA6384I value type: number
EZA6386I value length: 4
Diagnosing Simple Network Management Protocol (SNMP) problems
The following is an explanation of the traces in Figure 86 on page 574.

- Line 1 is an information message listing the actual name of the data set being used as the hlq.MIBDESC.DATA data set.
- Line 2 is an informational message indicating that the SNMP query stack has been successfully started.
- Line 3 is an informational message indicating the number of client connections the query stack allows. (A client connection is a connection from a program using the query stack protocol to communicate with the SNMP query stack to initiate SNMP requests. For example, the SNMPIUCV subtask of the NetView program is a client connection).
- Line 4 is an information message indicating that the SNMPIUCV subtask of the NetView program has successfully contacted the query stack.
- Lines 5–8 are the encoded packet received from the client (the SNMPIUCV subtask) by the query stack. This particular packet is the TRAPSON request.
- Lines 9–16 are the decoded SNMPIUCV request. The decoded packet indicates that this request is number 1001 (line 14), and was a TRAPSON request (line 13) for network mask 0.0.0.0 (line 15) with the desired network 0.0.0.0 (line 16).
- Lines 17–27 are the response sent back to SNMPIUCV from the query stack. The response (line 21) is to request number 1001 (line 22) and indicates that the TRAPSON request was successful (lines 23–27).
- Line 28 indicates that an SNMP Trap-PDU was received. Lines 29–32 are the actual BER encoded SNMP packet as it was received by the query stack.
- Lines 33–49 are the decoded version of the trap packet reported by lines 28–32.
- Lines 50–61 are the trap information being passed from the query stack up to the SNMPIUCV subtask to be displayed to the NetView operator. This trap is being forwarded to the NetView program because the IP address of the agent sending the trap (line 56), when ANDed with the network mask (line 15) matches the desired network (line 16) of filter number 1001 (line 55) that was set by the TRAPSON request 1001 (line 14) received previously (lines 9–16).
- Lines 62–64 show an incoming query stack packet sent from SNMPIUCV to the query stack.
- Lines 65–71 are the decoded packet received in lines 62–64. This packet is the TRAPSOFF request (line 69). It requests that trap filter 1001 (line 71) be turned off.
- Lines 72–82 are the response from the query stack to the SNMPIUCV subtask. The response indicates that the TRAPSOFF request was completed successfully (lines 78–82).
- Lines 83–87 indicate that another SNMP Trap-PDU was received from an agent.
- Lines 88–104 are the decoded Trap-PDU. Note that following this decoded PDU, there is no indication of the trap being forwarded to SNMPIUCV. This is because the trap filter has been turned off, so the query stack receives the trap but does not forward the information to SNMPIUCV.
- Lines 105–109 indicate another request from SNMPIUCV being received by the query stack.
Lines 110–125 are the decoded query stack request. The request from SNMPIUCV was to issue a GetRequest-PDU (line 114) to host MVSL (line 117), using community name SNMP (line 119) and requesting variable 1.3.6.1.2.1.1.3 (line 125). Lines 121–123 are the retry information that SNMPIUCV has gotten from the SNMPARMS member of the DSIPARMS data set.

Lines 126–147 are the decoded SNMP GetRequest-PDU that the query stack has built as a result of the SNMPIUCV request received in lines 110–125. This PDU has been assigned request number 1 (line 132). This number is used to correlate the response when it is received.

Line 148 indicates that the encoded SNMP GetRequest-PDU has been sent to the SNMP agent at the specified IP address. This should be the IP address of the host specified in line 117.

Line 149 indicates that an SNMP GetResponse-PDU was received. Lines 150–153 are the encoded GetResponse-PDU.

Lines 154–175 are the decoded GetResponse-PDU. This was a GetResponse (line 159) in response to request number 1 (line 160, matches up to the request number in the request, line 132). The request was completed with no errors (lines 161–162). The requested variable 1.3.6.1.2.1.1.3 (line 165) has a value of 18600 timeticks (line 168).

Lines 176–191 are the query stack response to SNMPIUCV request number 1003 (lines 115 and 181). The response contains the information received from the agent in the GetResponse-PDU in lines 154–175.

Lines 192–196 are the next query stack protocol requests received from SNMPIUCV by the query stack.

Lines 197–212 are the decoded version of the query stack request. This is a GetNext request (line 201) to host MVSL (line 204) for variable 1.3.6.1.2.1.2.2.1.2.0 (line 212). The request number associated with this request is 1004 (line 202).

Lines 213–234 are the decoded SNMP GetRequest-PDU built as a result of the query stack request received in lines 197–212. This GetRequest-PDU is request number 2 (line 219).

Line 235 indicates that the encoded GetRequest-PDU has been sent to the requested host.

Lines 236–240 indicate that a GetResponse-PDU has been received.

Lines 241–262 are the decoded GetResponse-PDU. This is the response to request number 2 (line 247) for variable 1.3.6.1.2.1.2.1.2.1.2.1.2.1 (line 252). The value of the variable is a display string with the ASCII value of 'X'49424D204C4353' (line 255). The GetNext request completed successfully (lines 248–249).

Lines 263–278 are the query stack response to SNMPIUCV request number 1004 (line 268). The response contains the information from the GetResponse-PDU (lines 241–262). Note that the variable in line 255 has been converted to the proper display format in line 278.

Lines 279–284 are the next query stack protocol request from SNMPIUCV to the query stack.

Lines 285–303 are the decoded query stack request. It is a SET request (line 289) to host MVSL to set variable 1.3.6.1.4.1.2.2.1.4.1 (line 300) to 12345 (line 303). This is request number 1005 (line 290).

Lines 304–325 are the decoded SNMP SetRequest-PDU built as a result of the request received in lines 285–303. This is request number 3 (line 310).

Line 326 indicates that the SetRequest-PDU has been sent to the specified host.

Lines 327–331 indicate that a GetResponse-PDU has been received.

Lines 332–353 are the decoded GetResponse-PDU. This PDU is the response to the SetRequest-PDU number 3 (line 338). It was completed successfully (lines 339–340) and variable 1.3.6.1.4.1.2.2.1.4.1 (line 343) was set to 12345 (line 346).

Lines 354–369 are the query stack response to request 1005 (line 359) containing the information received in the GetResponse-PDU received in lines 332–353.

Lines 370–373 are the next query stack request packet from SNMPIUCV.

Lines 374–381 are the decoded query stack request. This is a MIBVNAME request (line 378) requesting the name of variable 1.3.6.1.2.1.1.1 (line 381). The request number is 1006 (line 379).

Lines 382–397 are the query stack response (line 386) to request 1006 (line 387). The request completed successfully (lines 388–392) and the name of variable 1.3.6.1.2.1.1.1 (line 394) is sysDescr (line 397).
• Lines 398–401 are the next query stack request packet from SNMPIUCV.

• Lines 402–413 are the decoded query stack request packet. This is a PING request (line 406) to ping host MVSL (line 409). The request number is 1007 (line 407).

• Lines 414–429 are the query stack response (line 418) to request 1007 (line 419). The PING completed successfully (lines 420–424) and the round-trip response time was 76 milliseconds (line 429). Note that no SNMP PDUs were generated as a result of the PING request. The SNMP query stack uses a raw socket to send a PING to the requested host and SNMP protocols are not involved.

• Lines 430–434 are the next query stack request packet received from SNMPIUCV.

• Line 435 indicates that an error occurred while the query stack was decoding the request packet. The MIB variable name in the request was unknown to the query stack.

• Lines 435–451 are the decoded query stack request. This is a GET request (line 440). The variable name is unknown (line 451). This is request 1008 (line 441).

• Lines 452–462 are the query stack response (line 456) to SNMPIUCV request 1008 (line 457). The request was unsuccessful. The query stack returns major error code 2 (line 458), minor error code 7 (line 459), unknown variable (line 462). Note that no SNMP PDUs were generated since the query stack could not resolve the variable name.

• Line 463 indicates that the client connection (SNMPIUCV) has been terminated. This is the result of the STOP TASK=SNMPIUCV command.

**NetView SNMP query engine IUCV communication trace**

Figure 87 on page 583 shows an example of the output produced by the IUCV communication trace. This trace was produced by starting the SNMP query stack address space with start option -it.
Figure 87. SNMP IUCV communication traces

sock_request_inet return parms:
  f=25 d=4 rl=00000000 rd=0005db44 rd1=16 pdh=0 pdl=0
  rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
sock_request_inet entry parms:
  f=2 d=4 rl=00000000 rd=0005d9c rd1=16 pdh=0 pdl=0
  rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0

IUCV interrupt from TCPIP, fd=254, path=1 type=7 (Incoming Reply)

Figure 87. SNMP IUCV communication traces

sock_request_inet return parms:
  f=25 d=4 rl=00000000 rd=0005db44 rd1=16 pdh=0 pdl=0
  rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
sock_request_inet entry parms:
  f=2 d=4 rl=00000000 rd=0005d9c rd1=16 pdh=0 pdl=0
  rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0

IUCV interrupt from TCPIP, fd=254, path=1 type=7 (Incoming Reply)
f=2 d=4 rl=00000000 rd=0005da9c rd1=16 pdh=0 pdl=0
rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
sock_request_inet entry params:
f=25 d=5 rl=00000000 rd=0005db64 rd1=16 pdh=0 pdl=0
rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
Rc=0 on IUCV_SEND to TCPCS , fd=5, path=1, iprcode=0, ipmsgid=11, iucvname=00032508
Rc=0 on IUCV_NEXTBUFF, fd=5 buf (ipbfadr2) is at 00000000
Rc=1 on IUCV_NEXTBUFF, fd=5 buf (ipbfadr2) is at 00005584
IUCV interrupt from TCPIP, fd=-254, path=1 type=7 (Incoming Reply)
sock_request_inet return parms:
f=25 d=5 rl=00000000 rd=0005db64 rd1=16 pdh=0 pdl=0
rc=5 err=0 rpl=00000000 rpb=00000000 rpbl=0
sock_request_inet entry parms:
f=2 d=5 rl=00000000 rd=0005daa8 rd1=16 pdh=0 pdl=0
rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
Rc=0 on IUCV_SET to , fd=6, path=0, iprcode=0, ipmsgid=0, iucvname=SNMPQE
ciucv_data area (ipbfadr2) is at 00005480
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
sock_request_inet entry parms:
f=13 d=5 rl=00000000 rd=00000000 rd1=0 pdh=0 pdl=5
rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
Rc=0 on IUCV_SEND to TCPCS , fd=5, path=1, iprcode=0, ipmsgid=12, iucvname=00032508
Rc=0 on IUCV_NEXTBUFF, fd=5 buf (ipbfadr2) is at 00000000
Rc=1 on IUCV_NEXTBUFF, fd=5 buf (ipbfadr2) is at 000055ac
IUCV interrupt from TCPIP, fd=-254, path=1 type=7 (Incoming Reply)
sock_request_inet return parms:
f=13 d=5 rl=00000000 rd=00000000 rd1=0 pdh=0 pdl=5
rc=0 err=0 rpl=00000000 rpb=00000000 rpbl=0
Rc=0 on IUCV_SET to , fd=6, path=0, iprcode=0, ipmsgid=0, iucvname=SNMPQE
ciucv_data area (ipbfadr2) is at 00005480
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
sock_request_inet entry parms:
f=25 d=7 rl=00000000 rd=0005db2c rd1=16 pdh=0 pdl=0
rc=7 err=0 rpl=00000000 rpb=00000000 rpbl=0
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
Rc=0 on IUCV_SEND to TCPCS , fd=7, path=1, iprcode=0, ipmsgid=14, iucvname=00032508
Rc=0 on IUCV_NEXTBUFF, fd=7 buf (ipbfadr2) is at 00000000
Rc=1 on IUCV_NEXTBUFF, fd=7 buf (ipbfadr2) is at 000055fc
IUCV interrupt from TCPIP, fd=-254, path=1 type=7 (Incoming Reply)
sock_request_inet return parms:
f=25 d=7 rl=00000000 rd=0005db2c rd1=16 pdh=0 pdl=0
rc=7 err=0 rpl=00000000 rpb=00000000 rpbl=0
SQE1001 -- SNMP Query Engine running and awaiting queries...
df=3 in callers rmask
df=4 in callers rmask
df=5 in callers rmask
df=6 in callers rmask
df=7 in callers rmask
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
fd=3 inetselect now TRUE
fd=6 iucvselect now TRUE
in inetselect
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
Rc=0 on IUCV_SEND to TCPCS , fd=254, path=1, iprcode=0, ipmsgid=15, iucvname=00032508
wait ecblist=5dc5c, ecccount=2
iucvposted=1073741824, waitposted=0, callposted=0
in iucvposted
Rc=1 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00005624
IUCV interrupt from TCPIP, fd=-254, path=1 type=7 (Incoming Reply)
Rc=0 on IUCV_NEXTBUFF, fd=-254 buf (ipbfadr2) is at 00000000
in gotmsgcomp
fd=3 inetselect now TRUE
fd=6 iucvselect now TRUE
nfs=0, return=1
sock_request_inet entry parms:
Diagnosing Simple Network Management Protocol (SNMP) problems
The following sequence of events occurred to create the trace output:

1. Started the SNMP query stack
2. Connected to the query stack from the SNMPIUCV subtask
3. Disconnected the SNMPIUCV subtask from the query stack

**TRAPFWD Trace**

The trap forwarder daemon uses syslog functions to write out debug information and traces. Diagnostic data is written using “trapfwd” as identifier.

Figure 88 on page 586 illustrates a TRAPFWD trace.
Chapter 24. Diagnosing Policy Agent problems

The z/OS UNIX Policy Agent (PAGENT) provides administrative control for policies. This topic provides information and guidance to diagnose Policy Agent problems, and it contains the following subtopics:

- “Overview” on page 587
- “QoS policy” on page 588
- “QoS policy scope” on page 588
- “Gathering diagnostic information” on page 589
- “Diagnosing Policy Agent problems” on page 591

Overview

The Policy Agent can act in any of several roles, depending on configuration options:

- The Policy Agent can act as the Policy Decision Point (PDP) on a single system, installing policies in one or more z/OS Communications Server stacks.
- The Policy Agent can act as a centralized policy server, providing PDP services for one or more remote policy clients.
- The Policy Agent can act as a policy client, retrieving remote policies from the policy server. Each stack in a Common INET (CINET) environment that is configured to the Policy Agent acts as a separate policy client.
- A single Policy Agent can act as a policy client or a policy server, but not both.

Policy Agent reads policies defined in local or remote configuration files, or reads by way of the Lightweight Directory Access Protocol (LDAP) from an LDAP server. These policies are then installed in one or more TCP/IP stacks. Policy Agent can be configured to install identical policies to multiple (or all) stacks, or can install different sets of policies to each stack individually. Policy Agent can also monitor its configuration files and the LDAP server periodically for changed policies, and install new or changed policies as changes occur. The basic types of policies are:

- Quality of Service (QoS)
- Intrusion Detection Services (IDS)
  See Chapter 26, “Diagnosing intrusion detection problems,” on page 631 for more information about diagnosing IDS policies.
- IPSec
  See Chapter 29, “Diagnosing IP security and defensive filter problems,” on page 663 for more information about diagnosing IPSec policies.
- Application Transparent Transport Layer Security (AT-TLS)
- Policy-based routing (Routing)
  See “Steps for diagnosing problems with IP routing to a destination when using policy-based routing” on page 30 for more information about diagnosing routing policies.

See z/OS Communications Server: IP Configuration Guide for more information about configuring and starting Policy Agent, as well as defining policies.
QoS policy

You need to become familiar with the following terms to understand QoS policies:

**Quality of Service (QoS)**
The overall service that a user or application receives from a network, in terms of throughput, delay, and such.

**Service Differentiation**
The ability of a network to provide different QoS levels to different users or applications based on their needs.

**Service Level Agreement (SLA)**
A contract, in business terms, provided by a network service provider that details the QoS that users or applications are expected to receive.

**Service Policy**
Administrative controls for a network, which are needed to achieve the QoS promised by a given SLA.

**Integrated Services**
A type of service that provides end-to-end QoS to an application, using the methodology of resource reservation along the data path from a receiver to a sender.

**Differentiated Services**
A type of service that provides QoS to broad classes of traffic or users, for example, all FTP traffic to a given subnet.

**Resource ReSerVation Protocol (RSVP)**
A protocol that provides for resource reservation in support of Integrated Services.

QoS policy scope

QoS policies can be defined with different scopes. The following scopes are supported:

**DataTraffic**
The policy applies to generic data traffic. This type of policy is in support of Differentiated Services.

**RSVP**
The policy applies to RSVP data traffic. This type of policy is in support of Integrated Services.

The TCP/IP stack maps TCP, UDP, and RAW traffic to QoS policies based on the selection criteria defined in the policy. Search criteria can include, but are not limited to, items such as source and destination IP addresses and ports, protocol, and interfaces. The mapping of DataTraffic scoped policies occurs at connect time for TCP traffic, and for each packet for UDP and RAW traffic. However, for UDP and RAW, the mappings are cached such that subsequent packets sent to the same destination use the cached mapping. RSVP scoped policies are only mapped when the RSVP Agent adds a reservation requested by an RSVP application. The mapping is removed when the reservation is removed. See Chapter 25, “Diagnosing RSVP agent problems ,” on page 617 for more information about the operation of RSVP.

You can see the effect of defined QoS policies in the following ways:

- Use the Network SLAPM2 Subagent to display service policy and mapped application information, as well as to manage and display Network SLAPM2 performance monitoring.
- Use the z/OS UNIX `pasearch`, z/OS UNIX `netstat`, and TSO NETSTAT commands as follows:
  - The `pasearch` command shows defined policies.
  - The NETSTAT SLAP or `netstat -j` command shows performance metrics for active QoS policy rules.
  - The NETSTAT ALL or `netstat -A` command has additional information for each active connection that shows the QoS policy rule name if the connection maps to a QoS policy.

See the z/OS Communications Server: IP System Administrator’s Commands for more information about the Netstat command, the `pasearch` command, and the Network SLAPM2 Subagent.
Import services

The IBM Configuration Assistant for z/OS Communications Server can request existing information from the Policy Agent. When the Policy Agent is providing this import service, the IBM Configuration Assistant for z/OS Communications Server is acting as an import requestor. The import requestor can make the following kinds of requests:

• Request that existing policy configuration files be imported for further changes and additions. These policy files are called import configuration files; the resulting policies are called import policies.
• Request that TCP/IP profile information be imported. This profile information can be used by the import requestor as configuration data.

See the Policy-based networking information in z/OS Communications Server: IP Configuration Guide for more details.

Gathering diagnostic information

Policy Agent writes logging information to a log file. The level of logged information is controlled by the LogLevel configuration statement and the -d startup option. This information (loglevel and debug level) can also be changed after startup using the MODIFY command as shown in the following example:

```
MODIFY procname,LOGLEVEL,LEVEL=127
MODIFY procname,DEBUG,LEVEL=2
```

Error, console, warning, and event LogLevel messages are written by default. To gather more diagnostic information, you can specify a LogLevel value greater than the default or specify debug level 1. This debug level has the side effect of setting the maximum LogLevel value as well.

If you are using both a policy server and one or more policy clients, be sure to gather the log files from all affected Policy Agent applications.

Use the debug levels as follows:

**Debug level 1**
Use debug level 1 for most debugging, except Sysplex Distributor performance monitor. This debug value gives extra debugging messages and uses the maximum LogLevel for logging.

**Debug level 2**
Use debug level 2 to verify Policy Agent processing of LDAP objects, or if a problem is suspected in how LDAP objects are defined.

**Debug level 4**
Use debug level 4 for summary information concerning Sysplex Distributor performance monitor QoS fraction calculations.

**Debug level 8**
Use debug level 8 for detailed information concerning Sysplex Distributor performance monitor QoS fraction calculations, and additional Sysplex Distributor debugging.

**Debug level 16**
Use debug level 16 to assist with memory allocation and leak problems. This debug value causes memory allocation and free requests to be logged inline. This can be used in conjunction with the -m startup option and the MODIFY MEMTRC command to debug memory problems.

**Debug level 32**
Use debug level 32 for detailed information about all policies as they are installed in the TCP/IP stack.

**Debug level 64**
Use debug level 64 for detailed locking information within Policy Agent.

**Debug level 128**
Use debug level 128 for details about remote PAPI connections on the policy server, and about connections to the policy server on the policy client.


**Debug level 256**
Use debug level 256 for details about requests to discover TCP/IP profile information from import requestors.

Use the trace option **-t** to turn on LDAP client library debugging. Use the trace levels as follows:

**Trace level 0**
Use trace level 0 for no LDAP client library debugging. This is the default.

**Trace level 1**
Use trace level 1 to turn on LDAP client library debugging. Note that the destination of LDAP client debug messages is **stderr**. This is controlled by the LDAP client library, not Policy Agent. Using trace level 1 turns on the following LDAP DEBUG options:

- LDAP_DEBUG_TRACE
- LDAP_DEBUG_PACKETS
- LDAP_DEBUG_ARGS
- LDAP_DEBUG_CONNS
- LDAP_DEBUG_BER
- LDAP_DEBUG_FILTER
- LDAP_DEBUG_MESSAGE
- LDAP_DEBUG_STATS
- LDAP_DEBUG_THREAD
- LDAP_DEBUGPARSE
- LDAP_DEBUG_PERFORMANCE
- LDAP_DEBUG_REFERRAL
- LDAP_DEBUG_ERROR

**Trace option disabled**
If you start Policy Agent with the trace option disabled, the stderr output destination is closed.

**Restriction:** You cannot turn on the trace option later with the MODIFY command.

See z/OS Communications Server: IP Configuration Reference for details on how to use the LogLevel, debug level, and trace level.

Log output can be directed either to a set of log files or to the syslog daemon (syslogd). This can be accomplished with the **-l** startup option or the PAGENT_LOG_FILE environment variable. If output is directed to log files, the number and size of the files can be controlled using the PAGENT_LOG_FILE_CONTROL environment variable. This environment variable can be used to extend the size of the log information collected if necessary. For example, if a large LDAP configuration is used with debug level 2, the default log file size and number might not be sufficient to capture all of the information needed. In this case, use the environment variable to increase the number or size, or the number and size, of the log files. See z/OS Communications Server: IP Configuration Guide for more details on using LogLevel, the **-d** startup option, and the environment variables, as well as the location of the log file.

The following additional information might be useful in diagnosing Policy Agent problems:

- Output from the pasearch command
- Output from the NETSTAT IDS or **netstat -k** commands
- Output from the NETSTAT SLAP or **netstat -j** commands
- Output from the NETSTAT ALL or **netstat -A** commands for active connections mapped to policies
- Output from the ipsec command for IPSec policies
- Output from the NETSTAT TTLS or **netstat -x** command for AT-TLS policies
- SNMP output from walks of the Network SLAPM2 subagent MIB tables
- TCP/IP CTRACE output, using the POLICY, INTERNET and IOCTL CTRACE options
Diagnosing Policy Agent problems

Policy Agent problems generally fall into one of the following categories:

- “Initialization problems” on page 591
- “Policy definition problems” on page 592
- “Policy client connection problems” on page 598
- “Policy client retrieval problems” on page 602
- “Import requestor connection problems” on page 604
- “Import requestor retrieval problems” on page 609
- “LDAP object retrieval problems” on page 610
- “LDAP object storage problems” on page 612
- “Policy Agent and Sysplex distribution problems” on page 614
- “Memory allocation/leakage problems” on page 615

Initialization problems

If Policy Agent does not complete initialization, or fails to install any policies in one or more stacks, run it with the -d 1 startup option, and check the log file for error conditions. If Policy Agent fails to initialize, message EZZ8434I is issued to the console. Check the log file for the specific error encountered.

Table 41 on page 591 lists some common Policy Agent initialization problems.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy Agent started from a user ID without superuser authority</td>
<td>Policy Agent must be started from a superuser</td>
<td>EZZ8434I message, along with messages in the log file indicating that superuser authority is required and showing an exit code value of 27.</td>
</tr>
<tr>
<td>Policy Agent not authorized to security product</td>
<td>Policy Agent must be authorized to a security product profile. See z/OS Communications Server: IP Configuration Guide for details about setting up the proper authorization.</td>
<td>EZZ8434I message, along with messages in the log file indicating that the user is not authorized to start Policy Agent and showing an exit code value of 18.</td>
</tr>
<tr>
<td>When the SERVAUTH class is active, either:</td>
<td>See “Common AT-TLS startup errors” on page 637 for how to handle this startup error.</td>
<td>EZZ4248E message, and in the Policy Agent log file you see the SYSERR message that indicates that the socket could not open with errno= Resource temporarily unavailable., errno2=74610296.</td>
</tr>
</tbody>
</table>

Diagnosing Policy Agent problems 591
### Table 41. Common Policy Agent initialization problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Unable to read configuration file | • The correct configuration file must be specified. See z/OS Communications Server: IP Configuration Guide for the search order used to locate the main configuration file.  
• The file must exist.  
• The permission bits must be correctly set for a z/OS UNIX file system file.  
• Because multiple configuration files might be configured, you might need to check these files also. | EZZ8434I message, along with messages in the log file indicating that the configuration file could not be opened and showing an exit code value of 1. |
| Unable to load one or more dynamic link libraries (DLLs) needed when Policy Agent is configured as a policy client | Policy Agent must have access to several DLLs at run time when configured as a policy client. These are needed to access PAPI functions and to establish an SSL connection to the policy server. Policy Agent accesses the DLLs using the LIBPATH environment variable. Check that the LIBPATH environment variable is specified, and that it contains the directory in which the DLLs reside. This is normally /usr/lib. | EZZ8780I message, along with messages in the log file indicating problems loading one or more of the following DLLs:  
• papi.dll  
• GSKSSL  
• GSKCMS31 |

### Policy definition problems

If you do not see the expected results when defining policies, use the `pasearch` command to display policies (active or inactive) known by Policy Agent. Use this command to check whether policies are active or inactive and whether they contain the specifications that were expected.

**Guidelines:**

- Policy rules with complex conditions (using CNF/DNF logic) are processed by Policy Agent to arrive at a "working" set of conditions. These are the only conditions displayed by default using pasearch (use the `-o` option to display the original set of conditions as specified).
- The pasearch output displays overall time ranges and time of day ranges in UTC format, as well as the specified time zone, if other than UTC.

You can dynamically refresh Policy Agent so that it can pick up any changes made, including changes to policies on the LDAP server (or configuration file). Use the MODIFY proclame, REFRESH command to restart Policy Agent from the beginning of its configuration files, or MODIFY proclame, UPDATE command to re-read the configuration files.

To check whether QoS policies are being installed and used correctly, use the NETSTAT commands. Use the NETSTAT SLAP or `netstat -j` command to display active QoS policy statistics for QoS policies installed in the stack, as opposed to the policies in Policy Agent. The NETSTAT ALL or `netstat -A` command shows which QoS policy rule (if any) is mapped to active connections.

For further diagnosis of the following policy types, see the topics listed below:

- Intrusion Detection Services (IDS) policy definition problems
See Chapter 26, “Diagnosing intrusion detection problems,” on page 631 for more information about diagnosing IDS policy definition problems.

- IPSec policy definition problems
  See Chapter 29, “Diagnosing IP security and defensive filter problems,” on page 663 for more information about diagnosing IPSec policy definition problems.

- Application Transparent Transport Layer Security (AT-TLS) policy definition problems

You might encounter some of the policy definition problems listed in Table 42 on page 593.

### Table 42. Policy definition problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| GSKCMS31 DLL not found | Policy Agent must have access to the GSKCMS31 DLL at run time. This is needed for IPSec KeyExchange policies. The IPSec policy being validated failed.  
Policy Agent accesses the GSKCMS31 DLL using the LIBPATH environment variable.  
Check that the LIBPATH environment variable is specified, and that it contains the directory in which the GSKCMS31 DLL resides. This is normally /usr/lib.                                                                 | Policy Agent logs a system error message and object error message. |
| GSKSSL DLL not found | Policy Agent must have access to the GSKSSL DLL at run time. This is needed for AT-TLS policies.  
Policy Agent loads the AT-TLS policies into the TCP/IP stack, but because Policy Agent was unable to verify with System SSL that the configured cipher suites were valid, they are validated when the TLS/SSL environment is initialized for TCP/IP connections. If any values are not valid within the cipher suites, this could result in TCP/IP connections failing. Policy Agent accesses the GSKSSL DLL using the LIBPATH environment variable.  
Check that the LIBPATH environment variable is specified, and that it contains the directory in which the GSKSSL DLL resides. This is normally /usr/lib.                                                                 | Policy Agent logs a system error message and warning message. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Version 1 QoS policies to version 2 QoS policies conversion | The following circumstances might lead to problems:  
  • When converting such policies to version 2, be sure to also swap the source and destination attributes when the version 1 Direction is Inbound. The specified interface is also related to Direction.  
  In version 1 only a single interface is specified, while both inbound and outbound interfaces are specified in version 2. When migrating a version 1 policy, be sure to specify an InboundInterface for Direction Inbound, and an OutboundInterface for Direction Outbound.  
  • When converting version 1 rules with Direction Both specified, create two version 2 rules, one for each direction. Also, specify InboundInterface for the inbound rule and OutboundInterface for the outbound rule, if the version 1 rule specified both Interface and Direction Both.  
  • When converting policies with different PolicyScope values, be sure to logically merge the scopes in the version 2 policy action. Any such merge should always result in a PolicyScope value of Both. | Discrepancies between version 1 and version 2 policy definitions. |
| Policy groups or rules are discarded when defined on an LDAP server. | Policy groups and policy rules defined on an LDAP server can refer to other LDAP objects (such as policy actions or time periods). When any referenced object cannot be found on the LDAP server, the referencing object is discarded.  
  Specify the correct reference Distinguished Names on LDAP objects that reference other objects. | Discarded policy groups or rules |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies with complex conditions (using CNF or DNF) are not mapping correctly.</td>
<td>Because some conditions are logically ANDed, a result that is not valid can occur. For example, two or more distinct interfaces cannot be ANDed and still be true. Or two non-overlapping port ranges also cannot be ANDed. Policy Agent tries to detect these types of errors and discard the policy rules with an error message, but there are cases that cannot be detected (for example, logical ANDs between CNF/DNF levels, or when negated conditions are used). In these cases, a policy rule can be installed that can never be true. Similar problems could occur when ORing conditions. For example, a very broad condition might map much more traffic than was intended, simply because it is one of a set of conditions that is ORed together. Use the <code>pasearch</code> command to display policy rules with complex conditions. By default, the &quot;working&quot; set of conditions is displayed (after Policy Agent has attempted to collapse and summarize the complex conditions). This working set includes the summary of each condition level, as well as the overall &quot;global&quot; summary condition. Use the <code>pasearch -o</code> option to also display the original set of specified conditions. This helps to show how the working set was derived.</td>
<td>Difficulty configuring complex policy conditions using CNF or DNF.</td>
</tr>
</tbody>
</table>

Wrong policy being mapped to traffic | At times, two or more policy rules are logically mapped to the same set of traffic packets. When this happens, the rule with the highest weight is selected. The weight depends on two factors. When the policy rule priority is not specified, the weight depends on the number of attributes specified in the policy conditions. When policy rule priority is specified, the weight is the specified priority plus 100, which is always higher than the weight derived from counting the number of attributes. If more than one rule is found with the same weight, the first such rule is selected to be mapped. Be sure to specify priority in policy rules to better control situations where multiple rules map to the same set of traffic. | Policy rule priority settings are inadequate to control situations where multiple rules map to the same set of traffic. |
### Table 42. Policy definition problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Policies are not installed in the TCP/IP stack. | Perform the following actions, based on what caused the problem:  
  - The stack in which policies should be installed must be configured using a TcpImage statement in the Policy Agent configuration file.  
  - The time periods configured in the policies must be correct. Verify the specifications of the day of week and time of day are correct. Verify that the specified time zone is correct. For time zones other than local time, the specified time periods might not be currently active.  
  - If the stack was started or restarted after Policy Agent was started, check that the temporary file (/tmp/tcpname.Pagent.tmp) used by the stack to inform Policy Agent of restarts has not been deleted. | Unexpected or missing set of policies.  
Perform the following steps to diagnose QoS problems:  
  - Issue `pasearch -q` to see all QoS policies that are active in Policy Agent. See z/OS Communications Server: IP System Administrator's Commands for more information about the `pasearch -q` command. If you are running multiple stacks, ensure that pasearch is reporting on the stack you are interested in.  
  - Issue `NETSTAT SLAP` or `netstat -j` command to see how the stack mapped your QoS statement. See z/OS Communications Server: IP System Administrator's Commands for more information about the `netstat` command. If you are running multiple stacks, ensure that your resolver configuration correctly identifies the stack you are interested in. Ensure that your QoS policies are correctly defined. For more information about policy-based networking, see z/OS Communications Server: IP Configuration Guide.  
  - See Chapter 26, “Diagnosing intrusion detection problems,” on page 631 for more information about diagnosing IDS policy definition problems.  
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>QoS policies not mapping to the expected traffic</td>
<td>Incorrectly specified selection criteria on the PolicyRule statement for the policy. If you think data traffic should be mapped to certain policies, but is not, check to make sure you have specified the selection criteria correctly on the PolicyRule statement for the policy. For example, TCP policies are mapped on a per connection basis, whereas for UDP and RAW, the policy is mapped on a per packet basis. As an example of TCP traffic, consider an ftp GET request from a remote client. The connection request from the client is mapped as inbound data, while the data flow is mapped as outbound data. You can use either source or destination fields in the policy rule to map both traffic flows, but the definitions must be consistent with this way of mapping. Check that the policy is not unnecessarily restrictive in its specification of IP addresses and ports. For RSVP scoped policies, remember that the policy is only mapped to data traffic while an RSVP reservation is in effect.</td>
<td>A blank policy rule name is displayed for an active connection using the NETSTAT ALL or <code>netstat -A</code> command.</td>
</tr>
<tr>
<td>Timing windows when switching policies based on time</td>
<td>If policy rules are defined such that different sets of policies are activated at different times (for example at each shift), be aware of nonoverlapping vs. overlapping time specifications. For example, if Rule1 is active from 00:00 to 07:29, and Rule2 is active from 07:30 to 04:00, there is a one minute interval gap between these 2 rules. Because the minimum time resolution used by Policy Agent is one minute, there is a period of one minute when neither policy is active.</td>
<td>Different sets of policies are activated at different times (for example at each shift).</td>
</tr>
<tr>
<td>Policies defined in an MVS data set are not being installed.</td>
<td>When an MVS data set is used to define policies, ensure that sequence numbers are not part of the file, because these cause parsing errors. In ISPF, use the NUMBER OFF and UNNUM or NUMBER OFF or UNNUM commands to remove the sequence numbers.</td>
<td>Parsing errors occur.</td>
</tr>
</tbody>
</table>
Table 42. Policy definition problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>

Note 1. Be aware of the following processing behavior:

- In version 1, source always meant local, while destination always meant remote. In version 2, source and destination mean exactly what they imply. When version 1 policies specify Direction Inbound, the semantics for source and destination are opposite between the two versions. As a result, although the specified source and destination attributes are displayed as they are specified by the `paseazch` command, the attributes are swapped when the policies are installed in the stack.

- Similarly, when Direction Both is specified in a version 1 policy, the following policies are installed in the stack:
  - Outbound direction with source and destination attributes intact
  - Inbound direction with the attributes swapped

- PolicyScope values exist in both the policy rule and action in version 1, but only in the policy action in version 2. For any policies that specified different PolicyScope values for the rule and the associated action in version 1, the scope values are merged in the policy action. For example, if the rule specified PolicyScope Both, and the associated action specified PolicyScope DataTraffic, the resulting scope value in the policy action is Both.

Policy client connection problems

When acting as a policy client, Policy Agent needs to connect to a policy server. The policy client can be configured with just a primary, or both a primary and a backup, policy server. See z/OS Communications Server: IP Configuration Guide, Policy Agent and policy applications for more information about how the policy client connects to a policy server.

If the policy client does not connect successfully, run Policy Agent on the policy client and policy server with the `-d 128` startup option, and check the log files for error conditions. Connection problems are indicated by message EZZ8780I or message EZZ8782I. Check the log files for the specific error encountered.

Table 43 on page 599 describes common policy client connection problems.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Incorrect configuration on the policy client or policy server | • The policy server must be configured with the ClientConnection statement specifying the port to which policy clients connect.  
  • If you use secure connections from any policy clients, the policy server must be configured with AT-TLS policies that allow those policy clients to establish SSL connections to the policy server.  
  • The policy client must be configured with the ServerConnection statement specifying the host name or IP address, and port of the primary and optional backup policy server, as well as connection retry information.  
  • If you want to use a secure connection to the policy server, you must configure the policy client with SSL information about the ServerConnection statement. See the policy-based networking topic in z/OS Communications Server: IP Configuration Guide for details about setting up the correct configuration. | Message EZZ8780I or EZZ8782I, along with messages in the log files indicating the particular connection problem details. |
| Incorrect SSL configuration on the policy client or policy server | If you use secure connections from the policy client:  
  • The policy server must be configured with AT-TLS policies that allow the policy clients to establish SSL connections to the policy server.  
  • The policy server must be configured with a certificate that allows the policy clients to authenticate the server.  
  • If a self-signed server certificate is used, the policy client must import the server's certificate into the client's key ring.  
  • The ServerConnection statement on the policy client must be configured with the correct SSL parameters. See the policy-based networking topic in z/OS Communications Server: IP Configuration Guide for details about setting up the correct configuration. | Message EZZ8780I or EZZ8782I, along with messages in the log files indicating the particular connection problem details. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
|Mismatched security configuration between the policy client and policy server| The configuration on the policy client must match the configuration on the policy server with respect to SSL and AT-TLS:  
  - If the policy client is configured with SSL parameters on the ServerConnection statement, the policy server must have an AT-TLS policy that protects connections from that policy client.  
  - If the policy client is not configured with SSL parameters on the ServerConnection statement, the policy server must not have an AT-TLS policy that protects connections from that policy client.  
  Use the `pasearch` command to display the AT-TLS policies on the policy server, and verify that the selection criteria in the policy rules select only those policy clients that use SSL. Look for policy rules that specify the port specified on the ClientConnection statement as the local port, and in particular, verify that the remote IP address and remote port parameters on those policy rules are correct for your configuration.  
  See the policy-based networking topic in `z/OS Communications Server: IP Configuration Guide` for details about setting up the correct configuration.  
  Message EZZ8780I or EZZ8782I, along with messages in the log files indicating the particular connection problem details.|
|Incorrect certificate name specified on the ServerSSLName parameter on the ServerConnection statement| ```  
  - If the AT-TLS policy on the policy server specifies HandshakeRole Server, the ServerSSLName parameter on the ServerConnection statement on the policy client must specify the name of the server's certificate.  
  - If the AT-TLS policy on the policy server specifies HandshakeRole ServerWithClientAuth, the ServerSSLName parameter on the ServerConnection statement on the policy client must specify the name of the client's certificate.  
  See the policy-based networking topic in `z/OS Communications Server: IP Configuration Guide` for details about setting up the correct configuration.  
``` | Message EZZ8780I or EZZ8782I, along with messages in the log files indicating the particular connection problem. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Policy client not authorized to access policy server | • The policy server must be configured with one or more user IDs and credentials for the set of policy clients that are authorized to connect.  
**Rule:** If you use a password for credentials, the password must match the password configured using the AuthBy password parameter on the PolicyServer statement on the policy client.  
• The policy client must be configured with a PolicyServer statement for each stack that will retrieve policies from the policy server, indicating the user ID and credentials that will be used to access the policy server.  
See the policy-based networking topic in z/OS Communications Server: IP Configuration Guide for details about setting up the correct authorization. | Message EZZ8780I or EZZ8782I, along with messages in the log files indicating the particular authorization problem details. |
| Incorrect passticket configuration on the policy client or policy server | If the policy client is configured to use a passticket on the PolicyServer statement, the proper PTKTDATA class profiles must be defined on both the policy server and policy client.  
See the policy-based networking topic in z/OS Communications Server: IP Configuration Guide for details about setting up the correct configuration. | Message EZZ8780I or EZZ8782I, along with messages in the log files indicating the particular connection problem details. |
| The policy server is not listening on the port defined on the ClientConnection statement. | If the ClientConnection statement is configured on the policy server, the port specified on this statement may need to be reserved using the PORT statement in the TCP/IP profile.  
See z/OS Communications Server: IP Configuration Guide for details about setting up the correct configuration. | Message EZZ8788I, along with messages in the log files, indicating the particular connection problem details. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Duplicate policy client name reported  | If you use the configuration file import service on the policy server, you might encounter a duplicate policy client name for a policy client. The reason for this is that temporary names are generated in order to process a configuration file import. If a policy client tries to connect to the policy server while a configuration file import is in progress, it's possible that the policy client name matches the generated temporary name.  
If this happens, issue a MODIFY UPDATE command on the policy client to cause it to reconnect to the policy server, once the configuration file import service has completed. | Message EZZ8781I followed by message EZZ8782I, along with messages in the log files indicating a duplicate policy client name was detected.                                                                                                                               |

**Policy client retrieval problems**

When acting as a policy client, Policy Agent retrieves policies for one or more policy types, on behalf of one or more stacks, from a policy server. The choice of local or remote policy retrieval can be made separately for each policy type, and for each configured stack. See z/OS Communications Server: IP Configuration Guide, Policy Agent and policy applications for more information about policy client retrieval of remote policies.

If the policy client does not successfully retrieve policies, run Policy Agent on the policy client and policy server with the -d 128 startup option, and check the log files for error conditions. Retrieval problems are indicated by message EZZ8438I. Check the log files for the specific error encountered.

Table 44 on page 603 describes common policy client retrieval problems.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Incorrect configuration on the policy client or policy server | - The policy server should be configured with one or more DynamicConfigPolicyLoad statements that match the client name. The DynamicConfigPolicyLoad statement determines the configuration files that get loaded after a policy client successfully connects. If a matching DynamicConfigPolicyLoad statement is not found, the policy server will attempt to load policies from a default file. Ensure that the correct set of DynamicConfigPolicyLoad statements is specified, and that the correct configuration files are specified on these statements.  
- The policy client must be configured with a PolicyServer statement for each stack that will retrieve policies from the policy server. The ClientName specified on this statement is used to match a DynamicConfigPolicyLoad statement on the policy server. If the ClientName parameter is not specified, the default client name used is `remotesysname_tcpimage` where:  
  `remotesysname` value is the policy client system name and `tcpimage` value is the policy client image name.  
See z/OS Communications Server: IP Configuration Guide, Policy Agent and policy applications, and z/OS Communications Server: IP Configuration Reference, general configuration file statements topic for more information. | Incorrect or no policies retrieved from the policy server. |
Table 44. Common policy client retrieval problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect regular expressions coded on the DynamicConfigPolicyLoad statement</td>
<td>The DynamicConfigPolicyLoad statements can be configured with regular expressions to match against policy client names. Regular expressions are very powerful, but also can be complex, and might not produce results that are intuitive. For example, the expression [a-z] matches any lower case alphabetic character, which means that any string containing at least one such character will match. As another example, the expression[^abc] means any character except a, b, or c matches. So the only strings that won't match are those containing ONLY the characters a, b, or c. See z/OS Communications Server: IP Configuration Guide, Policy Agent and policy applications, and z/OS Communications Server: IP Configuration Reference, DynamicConfigPolicyLoad statement for more information.</td>
<td>Incorrect or no policies retrieved from the policy server.</td>
</tr>
<tr>
<td>Policy client not authorized to access policies on the policy server</td>
<td>The policy server must be configured with SERVAUTH profiles that allow the policy clients to access policies. The format of the SERVAUTH profiles is: EZB.PAGENT.sysname.image.ptype where: • sysname is the policy server system name • image is the policy client name Rule: The image portion of the profile name on the policy server must match or include the name of the policy clients. Each policy client name is configured or defaulted using the ClientName parameter on the PolicyServer statement. • ptype is the policy type (QOS, IDS, IPSEC, ROUTING, or TTLS) See z/OS Communications Server: IP Configuration Guide, Policy Agent and policy applications for more information.</td>
<td>Incorrect or no policies retrieved from the policy server.</td>
</tr>
</tbody>
</table>

Import requestor connection problems

The import requestor connects to a Policy Agent. The IBM Configuration Assistant for z/OS Communications Server can be an import requestor. See z/OS Communications Server: IP Configuration Guide for information about the configuration file import service.
If the import requestor does not connect successfully, run Policy Agent with the -d 128 startup option, and check the log files for error conditions. Connection problems are indicated by message EZD1578I in the log. Check the log files for the specific error encountered.

Table 45 on page 605 describes common import requestor connection problems.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect configuration on Policy Agent</td>
<td>You must configure the Policy Agent with the ServicesConnection statement specifying the port and TCP/IP stack name to which the import requestor will connect. See z/OS Communications Server: IP Configuration Guide, configuration file import service, for details about setting up the correct configuration.</td>
<td>Message EZD1578I, along with messages in the log files, indicating the particular connection problem details.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause/action</td>
<td>Symptom</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| Incorrect SSL configuration on the Policy Agent or import requestor | • If the import requestor is using SSL, you must configure the Policy Agent with a SAF keyring and the Security parameter set to Secure on the ServicesConnection statement.  
  – The Policy Agent generates and installs an AT-TLS policy that allows the import requestors to establish SSL connections to the Policy Agent.  
  – You must configure a certificate in a SAF keyring that allows the import requestors to authenticate the server.  
  **Tip:** This option only supports TLSv1.0 and is not recommended for securing the import connection. The recommended approach is to specify Security Basic and supply user defined AT-TLS policies that provide the required protection.  
  • If the import requester is not using SSL, you must configure the Policy Agent with the Security parameter set to Basic on the ServicesConnection statement and use a default unsecure connection. You must not configure an AT-TLS policy that includes the port configured on the ServicesConnection statement.  
  • If the import requester is using user defined SSL, you must configure the Policy Agent with the Security parameter set to Basic on the ServicesConnection statement.  
  – You must define AT-TLS policies for the ServicesConnection ImageName and port that are configured for this secure SSL connection.  
  – You must configure the matching import requester and Policy Agent AT-TLS policies.  
  See z/OS Communications Server: IP Configuration Guide, configuration file import service, for details about setting up the correct configuration. | Message EZD1578I, along with messages in the log files, indicating the particular connection problem details. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Policy Agent did not issue message EZD1576I indicating it is ready for services connection requests.</td>
<td>If you are using secured connections for import requestors, and have AT-TLS policies configured on a policy server, the Policy Agent waits for the remote AT-TLS policies to be retrieved and installed before installing the generated AT-TLS policy for the port specified on the ServicesConnection statement. If the policy server is down or cannot be contacted immediately, the generated AT-TLS policy cannot be installed and the Policy Agent does not listen for import requestor connections.</td>
<td></td>
</tr>
</tbody>
</table>
| • Verify the policy server is available and the Policy Agent is active.  
• You might consider using a backup policy server to handle policy client connections when the primary is not available.  
• The MODIFY SRVLSTN command could be used to force the generated AT-TLS policy to be installed before the remote AT-TLS policies are installed.  
• Run the policy client and policy server with debug level 128 and check the Policy Agent log files to determine the cause of any connectivity problems. |
| Message EZD1576I is not issued, and import requestors cannot connect to the Policy Agent.  
Message EZD1578I, along with messages in the log files, indicating the particular connection problem details. |

Diagnosing Policy Agent problems
### Table 45. Common import requestor connection problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| The Policy Agent did not issue message EZD1576I indicating it is ready for services connection requests. | If you are using secured connections for import requestors, and have local or remote AT-TLS policies configured that contain errors, Policy Agent waits for the local or remote AT-TLS policies to be installed.  
- Correct the configured AT-TLS policies and refresh policies.  
- The MODIFY SRVLSTN command could be used to force the generated AT-TLS policy to be installed before the local or remote AT-TLS policies are installed.  
See z/OS Communications Server: IP System Administrator's Commands for information about the MODIFY command and z/OS Communications Server: IP Configuration Guide, for AT-TLS data protection information. | Message EZZ8438I, indicating errors in the local or remote AT-TLS policies for a TCP/IP image, where the secured connections for import requestor is requested.  
Message EZD1578I, along with messages in the log files indicating the particular connection problem details.  
Message EZD1576I is not issued, and import requestors cannot connect to the Policy Agent. |
| Import requestor does not successfully connect to the Policy Agent. | If you are using secured connections for import requestors and the SAF keyring is correct but the connection from the import requestor fails, (indicating key ring problems) check the following:  
- If the key ring certificate has expired, then update the expiration date and issue the MODIFY SRVLSTN command for Policy Agent to reinstall the generated AT-TLS policy and to restart the listen for services requestor connections  
- If the contents of the key ring has changed, but the key ring name is unchanged, issue the MODIFY SRVLSTN for Policy Agent to reinstall the generated AT-TLS policy and to restart the listen for services requestor connections  
See z/OS Communications Server: IP System Administrator's Commands for information about the MODIFY command and z/OS Communications Server: IP Configuration Guide, for AT-TLS data protection information. | Message EZD1576I is issued, but import requestors cannot connect to the Policy Agent. |
### Table 45. Common import requestor connection problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Policy Agent is not listening on the port defined on the ServicesConnection statement.</td>
<td>If the ServicesConnection statement is configured, the port specified on this statement may need to be reserved using the PORT statement in the TCP/IP profile. See z/OS Communications Server: IP Configuration Guide for details on setting up the correct configuration.</td>
<td>Message EZD1578I, along with messages in the log files, indicating the particular connection problem details.</td>
</tr>
<tr>
<td>Import requestor not authorized to access Policy Agent system</td>
<td>The Policy Agent system must be configured with one or more user IDs and credentials for the set of import requestors that are authorized to connect. <strong>Rule:</strong> If you use a password for credentials, the password must match the password configured on the import requestor. If you use the IBM Configuration Assistant for z/OS Communications Server as the import requestor, the user ID and password are configured on the Import Policy Data panel or request panels for discovery import (for example Discover Stack Local Addresses panel). See z/OS Communications Server: IP Configuration Guide for details on setting up the correct configuration.</td>
<td>Message EZD1578I, along with messages in the log files, indicating the particular connection problem details.</td>
</tr>
</tbody>
</table>

### Import requestor retrieval problems

The import requestor retrieves import policies from the Policy Agent. Table 46 on page 610 describes common import requestor retrieval problems.
Table 46. Common import requestor retrieval problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import requestor not authorized to access import policies on the Policy Agent.</td>
<td>The Policy Agent must be configured with SERVAUTH profiles that allow the import requestor to access import policies. The format of the SERVAUTH profiles is: EZB.PAGENT.sysname.image.ptype where: • sysname is the local system name • image is the import request name Rule: The image portion of the profile name on the policy server must match or include the import request name. If you use the IBM Configuration Assistant for z/OS Communications Server as the import requestor, the import request name is configured on the Flat File Import panel. • ptype is the type (CFGSERV, IDS, IPSEC, ROUTING, or TTLS) See z/OS Communications Server: IP Configuration Guide, configuration file import service, for details about setting up the correct configuration.</td>
<td>Incorrect or no import policies retrieved from the Policy Agent.</td>
</tr>
</tbody>
</table>

LDAP object retrieval problems

Before you begin, if you are having problems receiving policies from an LDAP server, run Policy Agent with the -d 1 or 2 startup options.

In Table 47 on page 611, select actions as indicated according to the problem you are experiencing.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to connect to the LDAP server</td>
<td>Check the attributes specified on the ReadFromDirectory statement in the configuration file that relate to the LDAP server connection. These include the primary and backup server addresses and ports, the user ID and password, and SSL parameters.</td>
<td>Message EZZ8440I is issued to the console. If Policy Agent fails to connect to the LDAP server, check the log file for the specific error encountered. The Policy Agent keeps trying to connect to the server, using a sliding time window (one minute, then at five minute intervals, with the maximum time between connect attempts being 30 minutes). <strong>Tip:</strong> If a backup LDAP server is configured, the EZZ8440I message is only issued if neither the primary or backup server can be connected.</td>
</tr>
<tr>
<td>No objects, or incorrect objects, retrieved from the LDAP server</td>
<td>Check that the schema version specified on the ReadFromDirectory statement in the configuration file matches the version defined on the LDAP server. The different versions are distinguished by the set of supported object classes. See z/OS Communications Server: IP Configuration Guide for supported schema object classes.</td>
<td>Missing or incorrect policies are displayed by the <code>pasearch</code> command, or the NETSTAT SLAP or <code>netstat -j</code> commands.</td>
</tr>
<tr>
<td>Wrong set of objects retrieved from the LDAP server</td>
<td>Check that the search and selection criteria specified on the ReadFromDirectory statement in the configuration file are correct. For version 1 policies, verify that the correct Base and SelectedTag attributes are used. For version 2 and later policies, check the SearchPolicyBaseDN, SearchPolicyGroupKeyword, SearchPolicyKeyword, and SearchPolicyRuleKeyword attributes.</td>
<td>Missing or incorrect policies are displayed by the <code>pasearch</code> command, or the NETSTAT SLAP or <code>netstat -j</code> commands.</td>
</tr>
<tr>
<td>LDAP DLL not found</td>
<td>Check that the LIBPATH environment variable is specified, and that it contains the directory in which the LDAP DLL (GLDCLDAP) resides. This is normally <code>/usr/lib</code>. Policy Agent accesses the LDAP DLL using the LIBPATH environment variable.</td>
<td>Policy Agent terminates unexpectedly with a CEEDUMP. The reason for termination in the CEEDUMP indicates that the LDAP DLL (GLDCLDAP) was not found.</td>
</tr>
</tbody>
</table>

**Restriction:** Policy Agent must have access to the LDAP DLL at run time.
Table 47. LDAP object retrieval problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1 policies not shared among multiple TCP/IP stacks</td>
<td>Policy Agent uses two attributes when it searches an LDAP server for version 1 policies that apply to a given TCP/IP image. One attribute is the TCP/IP image name and the other is a selector tag. The selector tag attribute can be defined such that LDAP scopes the search. The TCP/IP image name attribute is set by default to scope the search for a particular image. Each of the two attributes (TCPImageName and SelectorTag) is a multivalue field, meaning you can specify TCPImageName/SelectorTag multiple times in one object defined to LDAP. Both multiple MVS images and multiple TCP/IP stacks can exist. If a policy object is to be used in multiple MVS LPARs, that object can have multiple SelectorTag attributes defined, one for each LPAR. If a policy object is to be used in multiple TCP/IP images, that object can have multiple TCPImageName attributes defined, one for each image.</td>
<td>Version 1 policies not shared among multiple TCP/IP stacks</td>
</tr>
</tbody>
</table>

LDAP object storage problems

Policies can be defined on an LDAP server using the appropriate definitions, known as schemas. The policies are defined as object classes with certain attributes, which are a superset of the attributes that can be defined in a local file using the PolicyAction and PolicyRule statements. Policy Agent acts as an LDAP client to communicate with and retrieve policies from an LDAP server. Policy Agent uses an LDAP DLL to perform its LDAP client functions.

Before you begin, if you are having problems initializing the LDAP server with the Policy Agent schema definitions or adding policy objects to the server, perform the following steps to diagnose LDAP object storage problems.

In Table 48 on page 613, select actions as indicated according to the problem you are experiencing.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
</table>
| Unable to add the Policy Agent schema definitions to an LDAPv3 server  | The Policy Agent LDAPv3 schema definition files are shipped as the following sample files:  
• pagent_r8qosschema.ldif  
• pagent_r5idsschema.ldif  
These files need to be installed on the LDAP server in the proper order as an object in the server's database, rather than as configuration information. This process is known as schema publication. See RFCs 1804 and 2251. The files need to be specified on `ldapmodify` commands to modify the cn: schema entry in the server's database, in the order as specified in z/OS Communications Server: IP Configuration Guide. Verify that the `<suffix>` value on the first noncomment line of these files has been changed to the suffix value defined for your LDAP server, as explained in the prologues in these files. For more information about installing the schema definition files, see z/OS Communications Server: IP Configuration Guide. | Symptoms can include error messages issued by the server. Because server implementations are different, check the documentation for your server for the types and locations of error or log messages. |
Table 48. LDAP object storage problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause/action</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to add policy objects to an LDAP server</td>
<td>Check the following:</td>
<td>Symptoms can include error messages issued by the server. Since server implementations are different, check the documentation for your server for the types and locations of error or log messages. A typical error message might indicate object class violation. There are several possible reasons for an LDAP server rejecting a policy object. The following symptoms correspond to the numbered actions in the cause and action column.</td>
</tr>
<tr>
<td></td>
<td>1. Are the Policy Agent schema definitions installed on the LDAP server?</td>
<td>1. If the server does not know about policy attributes or object classes, then it fails any objects that contain them.</td>
</tr>
<tr>
<td></td>
<td>2. Are the correct object classes identified for any attributes you have defined in the object? For example, the <code>ibm-policySubtreesAuxContainedSet</code> attribute is defined for the <code>ibm-policySubtreesPtrAuxClass</code> object class.</td>
<td>2. If you define a policy object with this attribute attached, but do not include the object class value, the server flags the object as an object class violation.</td>
</tr>
<tr>
<td></td>
<td>3. Does the server recognize all of your objects?</td>
<td>3. The symptoms for this are missing objects when you search the server or errors when adding the objects. Some servers can impose strict syntax rules on ldif files that contain objects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lines that separate objects might need just a single newline character. If the separator lines contain other characters, the following object is processed as a continuation of the previous object. If the object file was transferred using FTP from a host, character translation might result in characters other than newlines separating objects. These additional characters must be removed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• There must be no blanks at the ends of lines.</td>
</tr>
</tbody>
</table>

Policy Agent and Sysplex distribution problems

The Policy Agent sysplex distributor (SD) performance monitor function can be used to calculate outbound network performance information, such as TCP packet loss and timeout ratios, for applications
being distributed to on SD target nodes. The calculated performance information is in the form of QoS weight fractions calculated for each DVIPA/Port service level. The QoS weight fractions are used to adjust the WLM weight: the higher the Qos fraction calculation, the lower the adjusted WLM weight. For more information about QoS fractions, see the section about Sysplex Distributor Policy Performance Monitoring Configuration in the z/OS Communications Server: IP Configuration Guide.

Steps for diagnosing Policy Agent/Sysplex distribution problems
Diagnose Policy Agent/Sysplex distribution problems.

Before you begin
If you suspect problems with the calculated QoS weight fractions, run Policy Agent with debug level 4 or 8.

Procedure
Perform the appropriate steps for the problem you are experiencing:

• For debug level 4, Policy Agent displays a summary calculation for each DVIPA/Port XCF address and service level.
  The summary information includes the retransmit fraction, connection limit fraction, throughput fraction, and the final QoS fraction that resulted. For example:

  Calculating for DVIPA: 193.1.1.36, Port: 8000, XCF@: 193.1.1.36, SLName: 'Gold_Service'
  Fractions: rexmit: 0, connLimit: 100, thruput: 0 QoS used: 100

• For debug level 8, Policy Agent displays the intermediate values used to generate the above fractions. For example:

  Calculating for DVIPA: 193.1.1.36, Port: 8000, XCF@: 193.1.1.36, SLName: 'Gold_Service'
  Retransmit Fraction: 0 (Retransmit Bytes: 544, Timeouts: 1, Octets Sent: 81362424, Segments Sent: 143194)
  Connection limit Fraction: 100 (Max Connections: 3, Active Connections: 3)
  Throughput Fraction: 0 (Out Bytes: 81362424, Throughput: 10848, Conn Throughput: 3616 Profile Rate: 0, Min Rate 2000)
  QoS Fraction used : 100

Guideline: If the throughput fraction gets set to 100% for any service level, message EZZ8447I is issued. To see which service levels caused this message to be issued, run Policy Agent with debug level 8 and check the log file.

What to do next
For more information see Chapter 11, “Diagnosing dynamic VIPA and sysplex problems,” on page 361.

Memory allocation/leakage problems
Policy Agent allocates memory for many resources, such as:

• Policy rules and actions
• Sysplex Distributor lists and weight fraction arrays
• Policy performance data arrays
• LDAP search results

If it appears that Policy Agent is using too much memory, or memory leakage is suspected, use the following tools, possibly in conjunction with other tools outside the scope of Policy Agent, such as dump formatters and Language Environment memory tracing.

Use the -m startup option to keep track of all Policy Agent memory allocation and free requests. All memory allocations are recorded in a memory trace buffer, and all memory free requests find the corresponding entry and remove it. If this option is specified, Policy Agent automatically reports any memory leakage at termination time, because any entries left in the buffer after all memory free requests
have been processed are by definition memory leaks. Note that if the memory trace buffer fills up, the memory trace function is dynamically turned off and no more memory tracing is performed. If this occurs, specify a larger value for the -m startup option when Policy Agent is restarted.

Use the MODIFY MEMTRC command to log a snapshot of Policy Agent memory allocations. This command dumps the contents of the memory trace buffer to the log file. As a result, it only has an effect when the -m startup option was specified.

Use debug level 16 to record memory allocation and free requests inline in the log file. This debug level is independent of the -m startup option. Note that using this debug level can result in significantly more information being recorded, so specify larger and/or more log files using the PAGENT_LOG_FILE_CONTROL environment variable.
Chapter 25. Diagnosing RSVP agent problems

The z/OS UNIX RSVP Agent provides end-to-end resource reservation services on behalf of applications. This topic provides information and guidance to diagnose z/OS UNIX RSVP Agent problems and contains the following sections:

- “Overview” on page 617
- “Policies and RSVP processing” on page 619
- “Gathering diagnostic information” on page 620
- “Diagnosing RSVP agent problems” on page 620

Overview

The RSVP Agent provides an RSVP application programming interface (RAPI) for QoS-aware applications to use. Applications use RAPI to register their intent to use RSVP services, to describe their data traffic, and to explicitly request that network resources be reserved on their behalf. The RSVP Agent communicates with its peers (other RSVP Agents running on z/OS or other platforms) in the network, with QoS-aware sender and receiver applications, and with the TCP/IP stack to affect resource reservations. See RFC 2205 for more information about RSVP, and z/OS Communications Server: IP Programmer’s Guide and Reference for more information about RAPI.

The following terms must be defined to understand RSVP processing:

**Quality of Service (QoS)**

The overall service that a user or application receives from a network, in terms of throughput, delay, and such.

**QoS-Aware Application**

An application that explicitly requests QoS services from the RSVP agent.

**Service Differentiation**

The ability of a network to provide different levels of QoS to different users or applications based on their needs.

**Service Level Agreement (SLA)**

A contract in business terms provided by a network service provider that details the QoS that users or applications are expected to receive.

**Service Policy**

Administrative controls for a network, in order to achieve the QoS promised by a given SLA.

**Integrated Services**

A type of service that provides end-to-end QoS to an application, using the methodology of resource reservation along the data path from a receiver to a sender.

**Differentiated Services**

A type of service that provides QoS to broad classes of traffic or users, for example all FTP traffic to a given subnet.

**Resource ReSerVation Protocol (RSVP)**

A protocol that provides for resource reservation in support of Integrated Services.

Reservation types, styles, and objects

There are two types of Integrated Services reservations used by the RSVP Agent:
**Controlled Load**

This reservation type is designed to make the network behave as though it were not loaded, even if one or more of the network elements are experiencing a heavy traffic load. See RFC 2211 for more information about this service.

**Guaranteed**

This reservation type is designed to allow the network to compute the maximum delay data traffic receives from the network, based on the traffic specification and other known data. See RFC 2212 for more information about this service.

In addition, there are three styles of reservation, depending on how the receiver wants to apply the reservation to its senders:

**WF (Wildcard Filter)**

This style applies a single reservation request to all senders.

**FF (Fixed Filter)**

This style pairs a given reservation request to a given sender. In this way, the receiver can apply a different reservation to each of its senders.

**SE (Shared Explicit)**

This style applies a single reservation to a list of senders. This differs from the WF style in that the list of senders is finite. Additional senders that appear in the future do not automatically inherit an SE style reservation.

Several objects are used in RSVP and RAPI to describe data traffic and reservations. These objects are as follows:

**Tspec (traffic specification)**

The Tspec is used to describe the sending application data traffic characteristics. It consists of an object known as a token bucket and other related values. A token bucket is a continually sustainable data rate, and the extent to which the rate can exceed the sustainable level for short periods of time. More detail concerning token buckets and other Integrated Services parameters and processing can be found in RFCs 2210, 2211, 2212, and 2215.

The Tspec contains these values:

- **r**
  Token bucket rate, in bytes per second

- **b**
  Token bucket depth, in bytes

- **p**
  Peak rate, in bytes per second

- **m**
  Minimum policed unit (minimum packet size to be considered), in bytes

- **M**
  Maximum packet size (MTU), in bytes

**Rspec (guaranteed receiver specification)**

An Rspec consists of two values that further describe a reservation request when Guaranteed service is being used:

- **R**
  Requested rate, in bytes per second

- **S**
  Slack term, in microseconds

**Flowspec (reservation specification)**

The flowspec is the object used by a receiver application to indicate an actual reservation to be made. The actual makeup of the flowspec depends on the type of reservation. For Controlled Load, the flowspec takes the same form as the sender Tspec (although the form is the same, the receiver might specify different values than the sender). For Guaranteed, the flowspec takes the form of a Tspec followed by an Rspec.
Policies and RSVP processing

Policies can be defined with RSVP scope. The RSVP Agent obtains a service policy for which traffic is mapped (if any) from the Policy Agent when an application that is using RAPI indicates it is a sender (when the Tspec is first provided), or when it requests a reservation as a receiver (when the Rspec is first provided for Guaranteed service). At both of these times, if a service policy is defined that maps to the data traffic, the RSVP Agent uses values in the service policy to limit the request from the application. Specifically, the following are limited:

- Total number of RSVP flows.
  The MaxFlows keyword on the PolicyAction statement of the policy definition can be used to limit the total number of application flows that use RSVP services.
- Tspec token bucket values.
  The MaxRatePerFlow and MaxTokenBucketPerFlow keywords on the PolicyAction statement of the policy definition can be used to limit the r and b values, respectively, in the sender supplied Tspec.
- Rspec values.
  The MaxRatePerFlow keyword on the PolicyAction statement of the policy definition can be used to limit the R value in the receiver supplied Rspec.
- Reservation type.
  The FlowServiceType keyword on the PolicyAction statement of the policy definition can be used to limit the type of reservation requested. A Guaranteed type request is considered to be “greater than” a Controlled Load type request. So if an application requests Guaranteed, but the policy limits the type to Controlled Load, the reservation uses Controlled Load.

RSVP processing proceeds as follows.

When an application uses RAPI to indicate it is a sender, the RSVP Agent packages the sender Tspec (along with other information) in an RSVP PATH packet, and sends the packet to the final destination. The packet is sent using RAW sockets, with the IP Router Alert option set. This option causes each router that supports RSVP to intercept the PATH packet, for the purpose of remembering the PATH request, and to insert a "previous hop" object into the packet, which is then sent again to the final destination. This causes the packet to eventually arrive at the destination, with all RSVP routers in the data path aware of the RSVP flow.

At the destination, the RSVP Agent passes the PATH packet to the application, using RAPI. The receiver application uses the Tspec and other information to arrive at a reservation request (flowspec). The receiver application uses RAPI to pass this flowspec to the RSVP Agent. The RSVP Agent then sends an RSVP RESV packet (containing the flowspec and other information) to the previous hop.

Each router or host along the path back to the sender receives this RESV packet, uses the flowspec to install the appropriate reservation (if possible), and forwards the RESV to its previous hop. In this way, each RSVP-capable router or host along the data path installs the reservation according to its capabilities. At the sender, the RSVP Agent receives the RESV packet information to the sender application, which then has information that indicates the actual reservation in place. The sender might choose to wait for the reservation to be in place, or might begin sending data before this happens (although such data is treated by the network as though no reservation were in place). Any router or host that is incapable of supporting the requested reservation might send an error to the receiver, which is then free to perhaps try a lesser reservation.

The z/OS UNIX RSVP agent can provide actual resource reservations on ATM interfaces. The RSVP agent passes the reservation request to the TCP/IP stack, where a bandwidth reserved SVC is established on the ATM link to support the reservation request. The RSVP agent can also cause the Type of Service (TOS) byte to be set for any given RSVP flow, by using the OutgoingTOS keyword on the PolicyAction statement of a defined service policy.
Gathering diagnostic information

The RSVP Agent writes logging information to a log file. The level of logged information is controlled by the LogLevel configuration statement. By default, only error and warning messages are written. To gather more diagnostic information, you can specify a LogLevel value. The maximum information is logged with a LogLevel value of 511. See z/OS Communications Server: IP Configuration Guide for more details on using LogLevel, as well as the location of the log file.

The following information can also be useful in diagnosing RSVP Agent problems:

- Output from the TSO NETSTAT SLAP or `netstat -j` commands
- Output from the `pasearch` command for RSVP scoped policies
- SNMP output from walks of the Network SLAPM2 Subagent MIB tables
- TCP/IP CTRACE output, using the INTERNET and IOCTL CTRACE options
- Policy Agent log output if RSVP scoped policies are defined

Diagnosing RSVP agent problems

Problems with the RSVP agent generally fall into one of the following categories:

- Initialization Problems
- Application Problems
- Service Policy Problems

Initialization problems

Before you begin, if the RSVP Agent does not complete initialization, run it with LogLevel set to 511 and check the log file for error conditions.

Common problems are listed in Table 49 on page 620:

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSVP Agent not authorized to security product</td>
<td>The RSVP Agent must be authorized to a security product profile. See z/OS Communications Server: IP Configuration Guide for details on setting up the proper authorization.</td>
</tr>
<tr>
<td>Unable to read configuration file</td>
<td>Is the correct configuration file specified? See z/OS Communications Server: IP Configuration Guide for the search order used to locate the configuration file. Does the file exist? Are the permission bits correctly set for a z/OS UNIX file system file?</td>
</tr>
<tr>
<td>Unable to associate with the TCP/IP stack</td>
<td>Is the associated TCP/IP stack started? The RSVP Agent uses the TCP/IP image name specified in the configuration file, or uses the standard resolver search order, to locate the name of the TCP/IP stack. The log file indicates the stack name being used.</td>
</tr>
</tbody>
</table>
Table 49. Common RSVP initialization problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to initialize interfaces</td>
<td>The RSVP Agent needs to initialize each interface for which it is configured. A pair of &quot;mailboxes&quot; are created for each interface. Check for error messages while creating the &quot;rsvp&quot; and &quot;rsvp-udp&quot; mailboxes for each interface. An error received while trying to join a multicast group on an interface that is not multicast capable is expected, and looks like: [WARNING:......mailslot_create: setsockopt(MCAST_ADD) failed - EDC5121I Invalid argument.]</td>
</tr>
</tbody>
</table>

Application problems

Before you begin, determine whether a Qos-aware application using RAPI is experiencing problems. If so, check the items listed in Table 50 on page 621.

Table 50. RSVP application problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAPI DLL not found</td>
<td>An application using RAPI must have access to the RAPI DLL at run time. This is normally accomplished with the LIBPATH environment variable. Check that the LIBPATH environment variable is specified and that it contains the directory in which the RAPI DLL (rapi.dll) resides, which should be /usr/lib.</td>
</tr>
<tr>
<td>Error RAPI_ERR_NORSVP received</td>
<td>If the application receives a RAPI_ERR_NORSVP error code when calling a RAPI function, ensure that the RSVP Agent has been successfully started.</td>
</tr>
</tbody>
</table>

Policy problems

Before you begin, determine whether you are having problems with policies with RSVP scope. Policies with RSVP scope can be defined and made available by way of the Policy Agent.

If problems are encountered using such policies, check the items listed in Table 51 on page 621.

Table 51. RSVP policy problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSVP policies not being applied to data flows</td>
<td>If the limits imposed by defined RSVP-scoped policies are not taking effect, check that the Policy Agent has been successfully started. The Policy Agent must be active in order for the RSVP Agent to retrieve these policies. Check that the policies are correctly defined. For example, do not specify both inbound and outbound interfaces in a single policy condition because such a policy never maps to any traffic on an end host node. Also, check both the RSVP Agent and Policy Agent log files for errors dealing with obtaining policies.</td>
</tr>
</tbody>
</table>
Table 51. RSVP policy problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy values not being used or are incorrect</td>
<td>If the values being used in the policies to limit Tspec and Rspec values do not appear to be correct, or do not seem to be applied to RSVP data traffic, be aware that the service policy and Tspec/Rspec units of measure are different. Specifically, the following are different:</td>
</tr>
<tr>
<td></td>
<td>If the Service Policy Unit is:</td>
</tr>
<tr>
<td></td>
<td>• MaxRatePerFlow: kilobits/second, the Tspec/Rspec Unit is r/R: bytes/second</td>
</tr>
<tr>
<td></td>
<td>If the Service Policy Unit is:</td>
</tr>
<tr>
<td></td>
<td>• MaxTokenBucketPerFlow: kilobits, the Tspec/Rspec Unit is b: bytes</td>
</tr>
<tr>
<td></td>
<td>To arrive at the values to specify on the service policy, multiply the target Tspec/Rspec value by 8, then divide by 1000. For example, if the target Tspec b value is 6000, the corresponding MaxTokenBucketPerFlow value is 48 (6000 x 8 / 1000 = 48). See Chapter 24, “Diagnosing Policy Agent problems,” on page 587 for more information about Policy Agent.</td>
</tr>
</tbody>
</table>

Example log file

Figure 89 on page 623 demonstrates some of the RSVP Agent processing. This log file was created using a LogLevel of 511.

Lines with numbers displayed like 1 are annotations that are described following the log.
Diagnosing RSVP agent problems

Figure 89. RSVP Agent processing log
03/22 08:51:11 INFO   :..mailbox_register: mailbox allocated for dump
03/22 08:51:11 INFO   :..mailslot_create: creating mailslot for (broken) pipe
03/22 08:51:11 INFO   :..mailbox_register: mailbox allocated for pipe
07
03/22 08:51:11 INFO   :.main: rsvpd initialization complete
08
03/22 08:52:50 INFO   :.......rsvp_api_open: accepted a new connection for rapi
03/22 08:52:50 INFO   :......mailbox_register: mailbox allocated for mailbox
03/22 08:52:50 TRACE  :......rsvp_event_mapSession: Session=9.67.116.99:1047:6 does not exist
09
03/22 08:52:50 EVENT   :......api_reader: api request SESSION
10
03/22 08:52:50 TRACE  :.......rsvp_event_establishSession: local node will send
03/22 08:52:50 TRACE  :.......router_forward_getOI: source address:  9.67.116.98
03/22 08:52:50 TRACE  :.......router_forward_getOI:         out inf:   9.67.116.98
03/22 08:52:50 TRACE  :.......router_forward_getOI:         gateway:   0.0.0.0
03/22 08:52:50 TRACE  :.......router_forward_getOI:         route handle:   7f5251c8
11
03/22 08:52:50 TRACE  :.......event_establishSessionSend: found outgoing if=9.67.116.98 through
forward engine
03/22 08:52:50 TRACE  :.......rsvp_event_mapSession: Session=9.67.116.99:1047:6 exists
12
03/22 08:52:50 EVENT   :.....api_reader: api request SENDER
13
03/22 08:52:50 INFO   :.......init_policyAPI: papi_debug:  Entering
03/22 08:52:50 INFO   :.......init_policyAPI: papi_debug:  papiLogFunc = 98681F0 papiUserValue = 0
03/22 08:52:50 INFO   :.......init_policyAPI: papi_debug:  Exiting
03/22 08:52:50 INFO   :.......init_policyAPI: APIInitialize:  Entering
03/22 08:52:50 INFO   :.......init_policyAPI: open_socket:  Entering
03/22 08:52:50 INFO   :.......init_policyAPI: open_socket:  Exiting
03/22 08:52:50 INFO   :.......init_policyAPI: APIInitialize:  Exiting
03/22 08:52:50 INFO   :.......init_policyAPI: RegisterWithPolicyAPI:  Entering
03/22 08:52:50 INFO   :.......init_policyAPI: RegisterWithPolicyAPI:  Writing to socket = 22
03/22 08:52:51 INFO   :.......init_policyAPI: ReadBuffer:  Entering
03/22 08:52:51 INFO   :.......init_policyAPI: ReadBuffer:  Exiting
03/22 08:52:51 INFO   :.......init_policyAPI: RegisterWithPolicyAPI:  Exiting
03/22 08:52:51 INFO   :......rpapi_getPolicyData: RSVPFindActionName:  Entering
03/22 08:52:51 INFO   :......rpapi_getPolicyData: Writing to socket = 22
03/22 08:52:51 INFO   :......rpapi_getPolicyData: ReadBuffer:  Entering
03/22 08:52:51 INFO   :......rpapi_getPolicyData: ReadBuffer:  Exiting
03/22 08:52:51 INFO   :......rpapi_getPolicyData: RSVPFindActionName:  Exiting
03/22 08:52:51 INFO   :......rpapi_getPolicyData: found action name CLCat2 for
03/22 08:52:51 INFO   :......rpapi_getPolicyData: RSVPFindServiceDetailsOnActName:  Entering
03/22 08:52:51 INFO   :......rpapi_getPolicyData: ReadBuffer:  Entering
03/22 08:52:51 INFO   :......rpapi_getPolicyData: ReadBuffer:  Exiting
03/22 08:52:51 INFO   :......rpapi_getPolicyData: RSVPFindServiceDetailsOnActName:  Result = 0
03/22 08:52:51 INFO   :......rpapi_getPolicyData: RSVPFindServiceDetailsOnActName:  Exiting
03/22 08:52:51 INFO   :.....api_reader: appl chose service type 1
03/22 08:52:51 INFO   :......rpapi_getSpecData: RSVPGetTSpec:  Entering
03/22 08:52:51 INFO   :......rpapi_getSpecData: RSVPGetTSpec:  Result = 0
Diagnosing RSVP agent problems
03/22 08:53:22 TRACE :......router_forward_getOI: route handle: 7f5251c8
03/22 08:53:22 INFO :......rsvp_flow_stateMachine: state RESVED, event T1OUT
03/22 08:53:22 TRACE :......router_forward_getOI: out inf: 9.67.116.98
03/22 08:53:22 TRACE :......router_forward_getOI: gateway: 0.0.0.0
03/22 08:53:22 TRACE :......router_forward_getOI: route handle: 7f5251c8
03/22 08:53:22 INFO :......rsvp_flow_stateMachine: state RESVED, event T1OUT
03/22 08:53:22 TRACE :......router_forward_getOI: source address: 9.67.116.98
03/22 08:53:22 TRACE :......router_forward_getOI: out inf: 9.67.116.98
03/22 08:53:22 TRACE :......router_forward_getOI: gateway: 0.0.0.0
03/22 08:53:22 TRACE :......router_forward_getOI: route handle: 7f5251c8
03/22 08:53:22 INFO :......rsvp_flow_stateMachine: state RESVED, event T1OUT
03/22 08:53:22 INFO :......rsvp_parse_objects: obj RSVP_HOP hop=9.67.116.99, lih=0
03/22 08:53:22 TRACE :......rsvp_parse_objects: STYLE is WF
03/22 08:53:22 TRACE :......rsvp_explode_packet: v=1,flg=0,type=2,cksm=54875,ttl=255,rsv=0,len=84
03/22 08:53:22 TRACE :......rsvp_event: received event from RAW-IP on interface 9.67.116.98
03/22 08:53:38 EVENT :..mailslot_sitter: process received signal SIGALRM
03/22 08:53:38 TRACE :......rsvp_flow_stateMachine: reentering state RESVED
03/22 08:53:38 TRACE :........flow_timer_start: Start T4
03/22 08:53:38 TRACE :........flow_timer_stop: Stop T4
03/22 08:53:38 INFO :......rsvp_flow_stateMachine: state RESVED, event RESV
03/22 08:53:38 INFO :......rsvp_parse_objects: obj RSVP_HOP hop=9.67.116.99, lih=0
03/22 08:53:38 TRACE :......rsvp_parse_objects: STYLE is WF
03/22 08:53:38 TRACE :......rsvp_explode_packet: v=1,flg=0,type=2,cksm=54875,ttl=255,rsv=0,len=84
03/22 08:53:38 TRACE :......rsvp_event: received event from RAW-IP on interface 9.67.116.98
03/22 08:53:53 EVENT :..mailslot_sitter: process received signal SIGALRM
03/22 08:53:53 TRACE :......rsvp_flow_stateMachine: reentering state RESVED
03/22 08:53:53 TRACE :........flow_timer_start: Start T4
03/22 08:53:53 TRACE :........flow_timer_stop: Stop T4
03/22 08:53:53 INFO :......rsvp_flow_stateMachine: state RESVED, event RESV
03/22 08:53:53 INFO :......rsvp_parse_objects: obj RSVP_HOP hop=9.67.116.99, lih=0
03/22 08:53:53 TRACE :......rsvp_parse_objects: STYLE is WF
03/22 08:53:53 TRACE :......rsvp_explode_packet: v=1,flg=0,type=2,cksm=54875,ttl=255,rsv=0,len=84
03/22 08:53:53 TRACE :......rsvp_event: received event from RAW-IP on interface 9.67.116.98
03/22 08:53:54 EVENT :..mailslot_sitter: process received signal SIGALRM
03/22 08:53:54 TRACE :......rsvp_flow_stateMachine: reentering state RESVED
03/22 08:53:54 TRACE :........flow_timer_start: Start T4
03/22 08:53:54 TRACE :........flow_timer_stop: Stop T4
03/22 08:53:54 INFO :......rsvp_flow_stateMachine: state RESVED, event RESV
03/22 08:53:54 TRACE :......rsvp_event_mapSession: Session=9.67.116.99:1047:6 exists
03/22 08:53:54 INFO :......rsvp_parse_objects: obj RSVP_HOP hop=9.67.116.99, lih=0
03/22 08:53:54 TRACE :......rsvp_parse_objects: STYLE is WF
03/22 08:53:54 TRACE :......rsvp_explode_packet: v=1,flg=0,type=2,cksm=54875,ttl=255,rsv=0,len=84
03/22 08:53:54 TRACE :......rsvp_event: received event from RAW-IP on interface 9.67.116.98
03/22 08:53:54 EVENT :..mailslot_sitter: process received signal SIGALRM
03/22 08:53:54 TRACE :......rsvp_flow_stateMachine: reentering state RESVED
03/22 08:53:54 TRACE :........flow_timer_start: Start T4
03/22 08:53:54 TRACE :........flow_timer_stop: Stop T4
03/22 08:53:54 INFO :......rsvp_flow_stateMachine: state RESVED, event RESV
03/22 08:53:54 TRACE :......rsvp_event_mapSession: Session=9.67.116.99:1047:6 exists
03/22 08:53:54 INFO :......rsvp_parse_objects: obj RSVP_HOP hop=9.67.116.99, lih=0
03/22 08:53:54 TRACE :......rsvp_parse_objects: STYLE is WF
03/22 08:53:54 TRACE :......rsvp_explode_packet: v=1,flg=0,type=2,cksm=54875,ttl=255,rsv=0,len=84
03/22 08:53:54 TRACE :......rsvp_event: received event from RAW-IP on interface 9.67.116.98
03/22 08:54:09 EVENT :..mailslot_sitter: process received signal SIGALRM
The RSVP Agent is started.

The configuration file being used is reported.

The name of the TCP/IP stack that the RSVP Agent associates itself with is reported.

The name and IP address of the interfaces configured to the associated stack are reported. Note that the RSVP Agent gets notified by the stack of any interface additions, deletions, or changes after this point.

The interfaces are initialized one by one.

Some interface types are not enabled for multicasting. Therefore, when the RSVP Agent tries to enable multicasting, a warning is reported. Such interfaces can still be used for unicasting.
RSVP Agent initialization is complete.

An application makes its first RAPI call, initializing the RAPI interface with the RSVP Agent.

The type of RAPI request is SESSION, meaning a rapi_session() call was made.

The RSVP Agent determines what the application sends based on the specified destination address not being a local interface.

The outbound interface to use for the session is returned from the stack.

The application issues a rapi_sender() call, passing the Tspec.

The Policy Agent interface is initialized.

The policy action “CLCat2” is obtained from the Policy Agent for the specified flow.

The RSVP Agent constructs an RSVP PATH packet to be sent to the destination.

The flow enters the pathed state (PATHED), meaning a PATH packet has been sent for the flow.

An RSVP RESV packet is received from the RSVP Agent at the receiver node, specifying the reservation parameters.

The RSVP Agent installs the reservation request into the TCP/IP stack and registers the flow with the Policy Agent.

The type of reservation request is shown (CL, for Controlled Load) along with the reservation parameters (the r, b, p, m, M values in Tspec format).

The RESV packet values are passed to the sender application.

The flow enters the reserved state (RESVED), meaning the reservation has been put in place and the RESV packet has been forwarded to the previous hop (in this case the sender application).

A T1 timeout occurs, meaning a PATH refresh packet is sent. This occurs every 15 seconds.

A refreshed RESV packet is received from the RSVP Agent at the receiver node. This occurs every 30 seconds.

The application issues a rapi_release() call to end the RAPI session.

The reservation is removed from the TCP/IP stack and unregistered from the Policy Agent.

A PATHTEAR packet is constructed and sent, to tear down the flow along the data path.

The flow enters the sessioned state (SESSIONED), meaning that the flow has been torn down.

The application closes the API session, resulting in an error being reported because the state of the flow is SESSIONED. This error can be ignored.
A SIGTERM signal is received (due to a `kill` command issued from the UNIX shell), and the RSVP Agent shuts itself down.
Chapter 26. Diagnosing intrusion detection problems

This topic provides information and guidance to diagnose Intrusion Detection Service (IDS) problems, including traffic regulation management daemon (TRMD) related problems. It contains the following subtopics:

- “Overview” on page 631
- “Diagnosing IDS policy problems” on page 631
- “Diagnosing IDS output problems” on page 632
- “Diagnosing TRMD problems” on page 635
- “Documentation for the IBM Software Support Center” on page 636

Overview

The Intrusion Detection Services policy is installed into the stack by the Policy Agent (PAGENT). After the policy is installed, IDS detects, processes, and reports on events as requested by the policy. TRMD, part of IDS, handles reporting IDS statistics and events to syslogd. Problems might occur in the following areas:

- Policy installation
- Output to syslogd, the console, or the IDS trace missing or volume too high
- TRMD initialization

Diagnosing IDS policy problems

This topic describes the commands used to diagnose IDS policy problems.

Some intrusion detection services (IDS) policies are not mapped until they are needed. Attack policies, scan global policies, and scan event policies for protocols ICMP and ICMPv6 are mapped immediately when the policy is installed in the stack. Scan Event policies for protocols TCP and UDP are mapped on the first occurrence of a potentially countable event. TR policies for protocol TCP are mapped when a local application does a listen() and when a client completes the three-way connection handshake. TR policies for protocol UDP are mapped when an inbound datagram arrives for a bound port.

Step for determining which IDS policies are active in Policy Agent

Determine which IDS policies are active in Policy Agent by using the `pasearch -i` command.

**Before you begin**

If you are running multiple stacks, ensure that `pasearch` is reporting on the stack you are interested in.

**Procedure**

1. Use `pasearch -i` (see `z/OS Communications Server: IP System Administrator’s Commands`) to see what IDS policies are active in Policy Agent.
2. See Chapter 24, “Diagnosing Policy Agent problems,” on page 587 if you do not see the IDS policies expected.
Step for determining how your IDS policies have been mapped by the stack

Determine how your IDS policies were mapped by the stack by using the Netstat command.

Before you begin
If you are running multiple stacks, ensure that your resolver configuration correctly identifies the stack you are interested in. Ensure that your IDS policies are correctly defined.

Procedure
• Use NETSTAT IDS or **netstat -k** (see z/OS Communications Server: IP System Administrator's Commands) to see how your IDS policies have been mapped by the stack.
• See IDS policy considerations in z/OS Communications Server: IP Configuration Guide.

Diagnosing IDS output problems

The following topics describe diagnostic steps for some problems you might encounter.

Steps for determining why IDS syslogd output is missing

Determine the cause for missing IDS syslogd output.

Procedure
Perform the following steps:
1. Ensure that Policy Agent is running on this system
2. Ensure that TRMD is running for this stack on this system. Consider using TCPIP PROFILE Autolog for TRMD.
3. Ensure that syslogd is running on this system.
4. Ensure that syslogd is configured for IDS output:
   • TRMD always writes to the syslog daemon facility.
   • Events are written to the syslog level configured in the relevant policy. Statistics are always written to INFO level.
   • If running multiple TRMDs, consider using trmd jobname prefix to separate IDS output by stack.

IDS console output

Under certain conditions, IDS suppresses console messages to avoid flooding the system console.

Scan detection is reported at most once per fast scan interval for a particular source IP address. If a scan is continually detected for the same source IP address, consider adding this address to your scan exclusion list (if this user is legitimately accessing resources). The installation also has the option of requesting notification to syslogd rather than to the console. The same criteria is used for reporting scans to syslogd as to the console.

IDS attack policy actions support the maximum event message parameter. If specified, this limits the number of times the same attack type is reported to the system console within any 5-minute time period.

Traffic regulation for protocol TCP suppresses console reporting of the following three events that could occur repeatedly.
• Only the first connection denied, when an application exceeds the TR TCP total connections limit, is reported during each port constrained period.
• Only the first connection denied, when a source host exceeds the TR TCP percentage available limit, is reported until the number of connections by that source host to this application drops below 88% of the limit and at least 2 connections below the limit.
• Connections that would exceed the TR TCP percentage of available connections per source host, but are allowed because of a higher value in QoS policy, are reported to syslogd only.

IDS packet trace output

Use the following references or guidelines for IDS packet trace output:

• See “Intrusion Detection Services trace (SYSTCPIS)” on page 142 if message EZZ4210I CTRACE DEFINE FAILED FOR CTIIDS00 is issued at stack initialization.

• Consider starting the MVS external writer. See “Formatting packet traces using IPCS” on page 90 for information about formatting the IDS packet trace in a dump.

• For IDS attack policy, packets associated with attack events can be traced. For most attack types, a single packet triggers an event and the packet is traced. To prevent trace flooding, a maximum of 100 attack packets per attack type are traced within a 5-minute interval. For the flood attack type, the first 100 packets that are discarded during the flood are traced. For the TCP queue size, global TCP stall, and EE XID flood attack types, no IDS tracing is done.

Unusual conditions

Most messages that are issued by IDS relate to the detection of an IDS condition. However, the messages that are mentioned below should be investigated because they signal conditions which affect IDS normal processing that might result in IDS information being lost or delayed.

Buffer overflow transferring message data between the stack and TRMD

The following messages in syslog indicate that IDS events or statistics are being generated at a rate that is overflowing internal buffers used to relay the messages from the stack to TRMD. These messages are a warning that actual event or statistics messages are missing from the syslog. If these messages occur frequently, then IDS policy changes are necessary to reduce the amount of IDS logging, or the amount of statistics information, being generated.

EZZ9325I TRMD Log records missing: logtype,logmissing
EZZ9326I TRMD Statistics records missing: stattype,statmissing

A large number of syslogd messages can be generated for the global TCP stall attack type if the syslogd detailed parameter is specified in the configuration. A message (either EZZ8673I or EZZ8674I) is generated for each stalled connection when a global TCP stall condition is detected and syslogd detail information has been requested. Consider updating your policy to turn off the syslogd detailed parameter for the global TCP stall attack type if these messages are causing a buffer overflow.

Repeated attacks of the same type at a high rate

A message is issued in syslog to indicate that attack policy is in place and the attack type indicated is occurring repeatedly at a high rate. To avoid flooding syslog and conserve system resources, a maximum of 100 event messages per attack type are logged to syslogd within a 5-minute interval. This limit is in effect for all attack types except the global TCP stall attack type. The following message indicates the number of duplicate attacks for which messages have been suppressed.

EZZ9327I TRMD Attack log records suppressed: attack_type,count

Scan storage constrained

The following is an example of a console message issued if scan detection attempted to obtain storage in order to track a potential scan event and could not obtain the required amount of storage.

EZZ8761I IDS EVENT DETECTED
EZZ8730I STACK TCPCS
EZZ8762I EVENT TYPE: SCAN STORAGE CONSTRAINED
EZZ8763I CORRELATOR 0 - PROBEID 0300FFF3
EZZ8766I IDS RULE N/A
EZZ8767I IDS ACTION N/A
Processing continues without adding the tracking information for this packet or for subsequent packets in the current internal interval (an internal interval is either 30 or 60 seconds). This could result in missing potential scan events.

The installation should attempt to determine the cause of the storage shortage. Scan detection itself can potentially consume large amounts of storage and should be looked at as part of the problem determination. The following are two ways to determine whether scan is consuming large amounts of storage.

- Console message EZZ8768I (EZ8768I IDS SCAN STORAGE EXCEEDED nbrmeg MB, TRACKING nbrsip SOURCE IP ADDRESSES) is issued after scan detection acquires more than a megabyte of storage. This message is reissued at each power of 2 MB increments (for example, 1 MB, 2 MB, 4 MB, 8 MB, and so on).
- The Netstat IDS command displays high-level scan information. For example:

  | SCAN DETECTION: |
  | GLOBRULENAME: IDS-RULE4 |
  | ICMPRULENAME: IDS-RULE8 |
  | TOTDETECTED: 1 DETCURRPLC: 1 |
  | DETCURRINT: 0 INTERVAL: 30 |
  | SRCIPSTRKD: 125 STRGLEV: 00000M |

  The SRCIPSTRKD field indicates the number of source IPs being tracked and the STRGLEV field indicates the number of megabytes of storage that scan is holding.

  If scan processing is contributing to the storage shortage, consider changing the scan policy. If the installation has set the scan sensitivity to HIGH on high usage ports, consider reducing the sensitivity level or removing the port from scan detection until the storage constraint is resolved.

  When scan starts to successfully obtain storage again, a SCAN STORAGE UNCONSTRAINED message is issued.

  **Excessive processing time for scans**

  The following is an example of a console message issued as a result of excessive processing time for scans:

  EZZ8761I IDS EVENT DETECTED  
  EZZ8730I STACK TCPCS  
  EZZ8762I EVENT TYPE: SCAN INTERVAL OVERRUN  
  EZZ8763I CORRELATOR 0 - PROBEID 03000F5F  
  EZZ8767I IDS RULE N/A  
  EZZ8767I IDS ACTION N/A  

  If an installation repeatedly receives this message, scan processing is not able to complete its evaluation of the source IP addresses it is tracking in its normal interval (either 30 or 60 seconds). This could delay the detection of subsequent scans. This most likely indicates that a large number of source IP addresses are being monitored. If the policy is using high scan sensitivity, the installation should consider lowering the scan sensitivity level for high usage ports.

  **Interface flood detection disabled**

  To track data for interface flood detection, private storage is obtained when IDS starts monitoring an interface. If the storage cannot be obtained, IDS is not able to detect an interface flood for the interface. A console message and a syslogd message are issued to report the condition.

  The following example shows the console message that is issued:

  EZZ8761I IDS EVENT DETECTED  
  EZZ8730I STACK TCPCS  
  EZZ8762I EVENT TYPE: INTERFACE FLOOD DETECTION DISABLED  
  EZZ8763I CORRELATOR 20 - PROBEID 04070015  
  EZZ8770I INTERFACE OSAQDIO4L  
  EZZ8765I DESTINATION IP ADDRESS 5.72.107.78 - PORT 0  
  EZZ8767I IDS RULE AttackFlood-rule  
  EZZ8767I IDS ACTION AttackLog-action  

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The following is an example of the syslogd message:

```
EZZ8658I TRMD ATTACK Interface Flood Detection Disabled: 12/23/2002 20:39:35.00,
ifcname=OSAQDIO4L, dipaddr=5.72.107.78,correlator=20,probeid=04070015,
sensorhostname=MVS34.tcp.com
```

These messages indicate a storage constraint has prevented the initialization of interface flood detection for the interface specified in the message. Interface flood detection for other interfaces is not affected.

When the problem causing the storage constraint is resolved, the Interface Flood detection support can be activated by removing the IDS ATTACK FLOOD policy and then adding the IDS ATTACK FLOOD policy again, or by stopping and restarting the interface.

**Interface flood storage constrained**

The following message in syslogd indicates that private storage needed to collect informational data related to a possible interface flood condition could not be obtained:

```
EZZ8659I TRMD ATTACK Interface Flood storage constrained:timestamp, ifcname=ifcname,
dipaddr=dipaddr, correlator=correlator, probeid=04070016, sensorhostname=sensorhostname
```

The informational data provided by the EZZ8655I and EZZ8656I syslogd messages issued for the interface in the same time period might be incomplete. Collection of informational data for the interface that requires additional storage is temporarily suspended and resumes at the start of the next one-minute interval.

### Diagnosing TRMD problems

The most common type of TRMD problem is initialization.

The TRMD writes logging information to a log file. The level of logged information is controlled by the `-d` startup option. To gather more diagnostic information, you can start the TRMD with the `-d` startup option. The maximum information is logged with the `-d 3` option. Log output is directed to the syslog daemon (syslogd). See the z/OS Communications Server: IP Configuration Reference for more details on using the `-d` startup option.

Problems with initialization of the TRMD include:

- Starting TRMD from the console.

TRMD might fail with an ABEND=S000 U4093 REASON=00000090 because an OMVS segment was not defined for the TRMD ID.

Check the job output.

```
IEF403I TRMD - STARTED - TIME=12.48.55
ICH408I JOB(TRMD ) STEP(TRMD ) CL(PROCESS )
OMVS SEGMENT NOT DEFINED
IA995I SYMPTOM DUMP OUTPUT
USER COMPLETION CODE=4093 REASON CODE=00000090
TIME=12.48.58 SEQ=00665CPU=0000 ASID=0628
PSW AT TIME OF ERROR 078D1000 8000AA7A ILC 2 INTC ID
ACTIVE LOAD MODULE ADDRESS=00007E70 OFFSET=0000
NAME=CEEBINIT
DATA AT PSW 0000AA74 - 00181610 0A0D47F0 B10A1811
GR 0: 84000000 1: 84000FFD
2: 00000000 3: 00000001
4: 0001C2A0 5: 0001C144
6: 00016560 7: 000169D0
8: 00000000 9: 098E374E
A: 00000004 B: 000A9A8
C: 00017AC0 D: 0001C018
E: 00000000 F: 00000000
END OF SYMPTOM DUMP
IEF450I TRMD TRMD - ABEND=S000 U4093 REASON=00000090
TIME=12.48.58
IEF404I TRMD - ENDED - TIME=12.48.58
$HASP395 TRMD ENDED
CEE5101C During initialization, the z/OS Unix System
```
Services callable service BPXIMSS failed. The system return code was 00000000156, the reason code was 0B0C00F9. The application will be terminated.

Verify that an OMVS segment exists for TRMD by issuing the TSO lu command from a user ID that has authority to issue the LU trmd OMVS command. If an OMVS segment does not exist, use the ALU command to update the user's OMVS data. For example, ALTUSER trmd OMVS(UID(0000) HOME('/') PROGRAM('/bin/sh')).

- The TCP/IP stack is not up and message EZZ8498I is received.
  Verify that the TCP/IP stack is up.

**Documentation for the IBM Software Support Center**

When contacting the IBM Software Support Center for problem resolution, some or all of the following information might be required:

- Gather TRMD debugging data by starting TRMD with the trmd -d 3 command. See “Diagnosing TRMD problems” on page 635.
- Start CTRACE in the stack to gather related information. See “Component trace” on page 43.
- The output from the pasearch -i command. See z/OS Communications Server: IP System Administrator's Commands.
- The output from the Netstat IDS/-k command. See z/OS Communications Server: IP System Administrator's Commands.
Chapter 27. Diagnosing Application Transparent Transport Layer Security (AT-TLS)

AT-TLS transparently performs Transport Layer Security (TLS) on behalf of the application by invoking the z/OS System Secure Socket Layer (SSL) in the TCP transport layer. System SSL provides support for the TLS and SSL protocols. AT-TLS uses a policy-based configuration, and the Policy Agent application is required to define rules and actions to the TCP/IP stack for TCP connections using AT-TLS. Displays for AT-TLS policy are provided by pasearch and Netstat.

This topic describes how to diagnose AT-TLS problems and includes the following sections:

- “Common AT-TLS startup errors” on page 637
- “Steps for diagnosing AT-TLS problems” on page 637
- “AT-TLS traces” on page 639
- “AT-TLS return codes” on page 641
- “SIOCTTLSCTL ioctl return codes” on page 646

Common AT-TLS startup errors

The following list describes startup errors, possible causes, and actions to take.

- If message EZZ4248E is written to the console and not released, one of the following might have occurred:
  - Policy Agent has not been started.
  - Policy Agent configuration does not contain a TCPImage statement for this stack, or the stack policy configuration does not contain any local or remote AT-TLS policies.
  - Policy Agent is not permitted to create a socket with this stack. Ensure that the SERVAUTH class is active. Ensure that the EZB.INITSTACK.mvsname.tcpname resource profile is defined and that Policy Agent is permitted to it. If the EZB.STACKACCESS.mvsname.tcpname resource profile is defined, ensure that Policy Agent is permitted to it.
- If message EZD1288I is displayed, the AT-TLS group is configured with FIPS140 on, but ICSF is not active. Start ICSF before starting AT-TLS groups configured with FIPS140 On.
- If applications started after the stack fail to create a socket (errno EAGAIN, errno2 JrTcpNotActive), the stack is probably being configured for AT-TLS, and the application has been started before AT-TLS policy has been installed. If this is a required network infrastructure application, permit it to the EZB.INITSTACK.mvsname.tcpname resource profile in the SERVAUTH class. If it is not a required network infrastructure application, either start it after message EZZ4248E is released or modify the application to wait a short time and try again when the errno is EAGAIN.
- If message EZD1287I TTLS Error RC: 5020 Group Init is displayed, the TCP/IP stack was not able to load the System SSL DLL required for AT-TLS processing.

Steps for diagnosing AT-TLS problems

Diagnose AT-TLS problems.

Procedure

Perform the following steps:

1. Issue pasearch -t to see all AT-TLS policies that are active in Policy Agent. See z/OS Communications Server: IP System Administrator’s Commands for more information about the
The pasearch -t command. If you are running multiple stacks, ensure that pasearch is reporting on the stack you are interested in. If you do not see the AT-TLS policies that you expected, see z/OS Communications Server: IP System Administrator's Commands for more information about displaying policy based networking information.

2. Issue Netstat TTLS Conn connid or Netstat -x Conn connid to determine whether the stack mapped a connection to AT-TLS policy and, if so, to which policy it was mapped. For more information about the netstat commands, see z/OS Communications Server: IP System Administrator's Commands. Ensure that your AT-TLS policies are correctly defined. See the AT-TLS information in z/OS Communications Server: IP Configuration Guide and the AT-TLS Policy statements in z/OS Communications Server: IP Configuration Reference for more information about configuring AT-TLS policies.

3. In cases where AT-TLS connections do not map to any policy, verify that TCPCONFIG TTLS has been specified. Netstat configuration shows the current setting of AT-TLS.

AT-TLS connection mapping is performed based on the following attributes:

- Local IP Address
- Remote IP address
- Local Port
- Remote Port
- Direction
- Job name
- User ID

The AT-TLS policy rules are searched, starting with the highest priority rules, for the first match.

Then the internal SecondaryMap table is searched by process ID and the two IP addresses used on the connection. The SecondaryMap table contains entries for active connections that are mapped by the AT-TLS policy rule to a policy with the SecondaryMap attribute specified as On. If entries are found using both methods, the one found by the AT-TLS policy rule is used unless the one found by the SecondaryMap value has a higher priority.

If a TCP connection is not matching the expected rule, do one of the following:

- Ensure that the AT-TLS policies are active and that no errors occurred. Message EZZ8438I is issued if Policy Agent encountered any errors while processing the AT-TLS policy. If errors occurred, review the Policy Agent logs for details on the error and correct the AT-TLS policy. You can use OBJERR to search the Policy Agent logs to find the errors.

- Verify the rule and actions that the policy mapped to and the priority of the rule. You can use the pasearch command can be used to view the active AT-TLS policy. AT-TLS message EZD1281I is issued with all the parameters used to map to the AT-TLS policy, if trace level 4 is on.

4. If an error message was issued by AT-TLS, review the syslogd files for message EZD1286I or the TCP/IP joblog for message EZD1287I. The error message might provide information about correcting the problem.

5. If the error is recreatable, turn on an AT-TLS trace for the connection. Turn on the trace by coding a TTLSRule specific to the failing connection. Include a TTLSConnectionAction statement that has the Trace statement set to 255 (All). If configuring using the IBM Configuration Assistant for z/OS Communications Server, the trace level can be set in each Connectivity Rule.

6. If the problem cannot be resolved from the trace, perform a packet trace or a CTRACE with option TCP to provide additional debugging information and contact IBM service.

7. If System SSL tracing is needed, enable the GSKSRVR CTRACE with option Level=255. The JOBNAME specification needs to be the TCP/IP stack name. The GSK_TRACE and GSK_TRACE_FILE environment variables cannot be used to capture System SSL tracing when using AT-TLS. For more information about this trace, see Obtaining diagnostic information in Cryptographic Services System Secure Sockets Layer Programming manual.
AT-TLS traces

AT-TLS writes messages to syslogd using the jobname of the TCP/IP started task. The AT-TLS default behavior is to write syslogd messages to the daemon facility. Other TCP/IP functions, for example the SNMP TCP/IP subagent, also use the job name of the TCP/IP started task and specify the daemon facility name when writing records to syslogd. Because the job name and syslog facility name of the AT-TLS records and the TCP/IP function records are the same, filters cannot be used to direct the AT-TLS records to a different output file. If you want AT-TLS records to go to a different output file, configure SyslogFacility Auth on the TTLSGroupAdvancedParms statement to direct the messages from that group to the Auth facility. The job name will remain the job name of the TCP/IP started task. You can then set up filtering based on the job name of the TCP/IP started task and the auth facility in the syslogd configuration file to direct AT-TLS records to a different output file.

If you are configuring using the IBM Configuration Assistant for z/OS Communications Server, you can modify the syslog facility name from the AT-TLS: Image Level Settings panel.

AT-TLS traces are enabled by setting the AT-TLS policy statement Trace to a nonzero value. A Trace statement can be configured on a TTLSGroupAction, TTLSEnvironmentAction or TTLSConnectionAction statement. See the z/OS Communications Server: IP Configuration Reference for more details about AT-TLS policy statements. The Trace levels enable different AT-TLS messages to be issued. The sum of the numbers associated with each level of tracing that you want is the value that should be specified.

If you are configuring using the IBM Configuration Assistant for z/OS Communications Server, you can set the default trace level on the AT-TLS: Image Level Settings panel, and you can override the trace level for each Connectivity Rule.

Table 52 on page 639 lists the trace level, the generated AT-TLS messages, and the syslog priority.

<table>
<thead>
<tr>
<th>Trace level</th>
<th>Traced information</th>
<th>Syslog priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Error (to Joblog)</td>
<td>EZD1287I</td>
<td>NA</td>
</tr>
<tr>
<td>2 Error</td>
<td>EZD1286I</td>
<td>err</td>
</tr>
<tr>
<td>4 - Info</td>
<td>EZD1281I, EZD1283I</td>
<td>info</td>
</tr>
<tr>
<td>8 - Event</td>
<td>EZD1282I, EZD1283I</td>
<td>debug</td>
</tr>
<tr>
<td>16 - Flow</td>
<td>EZD1282I, EZD1283I, EZD1284I</td>
<td>debug</td>
</tr>
<tr>
<td>32 - Data</td>
<td>EZD1285I</td>
<td>debug</td>
</tr>
</tbody>
</table>

Tip: Setting the Trace level to 6 enables both error messages and info messages.

The information messages trace when an AT-TLS connection is mapped to a policy (EZD1281I) and when the secure connection is successfully negotiated (EZD1283I), including the security protocol and cipher used. Using syslogd’s filtering parameters, a separate log file could be kept for AT-TLS info and error messages, enabling AT-TLS connections to be tracked.

Tip: Trace level 32 shows all the SSL headers sent and received.

Each secure connection is uniquely identified by its connection ID (ConnID). You can use the ConnID to follow a connection through the AT-TLS trace.

Sample AT-TLS trace

Figure 90 on page 641 shows an example trace of a generic server processing a secure connection. The standard syslogd prefix information has been removed from the trace.

Trace level 255 was used to generate this trace.

At-Tls return codes

At-TLS error message EZD1286I is issued to syslogd to report any errors that occur on an AT-TLS connection when the trace level 2 (Error) is set. AT-TLS error message EZD1287I is issued to the TCP/IP job log to report any errors that occur on an AT-TLS connection when the trace level 1 (Error) is set. These messages include the event that AT-TLS was processing and the return code that indicates a failure. Return codes 5001–5999 describe AT-TLS errors that can be corrected by the user. For more information about these return codes, see Table 54 on page 643. Return codes 6001–6999 describe internal AT-TLS errors. Contact IBM with the error message and syslog information, if available. Any other return code is defined by System SSL. For more information about these return codes, see z/OS Cryptographic Services System SSL Programming.

Table 53 on page 641 lists some common System SSL return codes and possible causes.

<table>
<thead>
<tr>
<th>Return code</th>
<th>Event</th>
<th>Possible cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>202</td>
<td>Environment Init</td>
<td>The key ring cannot be opened because the user does not have permission. Check the following items:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Look at message EZD1281 to verify the user ID being used for this connection and the TTLSEnvironmentAction statement that is mapped to this connection. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, you can specify the key ring on either the AT-TLS: Image Level Settings panel or on each Traffic Descriptor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure that the correct key ring is specified.</td>
</tr>
<tr>
<td>Return code</td>
<td>Event</td>
<td>Possible cause and solution</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>402</td>
<td>Connection Init</td>
<td>An SSL cipher suite could not be agreed upon between the client and server. Check the following items:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If V2Ciphers or V3Ciphers are coded, verify that the remote end supports at least one of the cipher suites coded. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, the ciphers are selected for each Security Level.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verify that the certificate that is being used for the connection supports the cipher suites. For example, V3 Cipher suite TLS_DH_DSS_WITH_DES_CBC_SHA(0C) requires a certificate that is defined with a Diffie-Hellman key.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If ClientCurves is coded, verify that the server is using a certificate that supports one of the elliptic curves.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• For ciphers defined as exportable, verify that the proper FMIDs to support the encryption level are installed.</td>
</tr>
<tr>
<td>406</td>
<td>Connection Init</td>
<td>An I/O error occurred on the socket. An I/O error occurs if the TCP socket is closed underneath the SSL protocol, such as when a reset is received. Check the following items:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure that the remote partner is enabled for secure connections.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Determine whether the secure negotiation completed. Use the AT-TLS Data trace level to determine whether the secure negotiation completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verify that the TCP data flows are sent by the remote partner. Use a TCP/IP packet trace to verify that the TCP data flows are sent by the remote partner.</td>
</tr>
</tbody>
</table>
### Table 53. Common System SSL return codes (continued)

<table>
<thead>
<tr>
<th>Return code</th>
<th>Event</th>
<th>Possible cause and solution</th>
</tr>
</thead>
</table>
| 412         | Connection Init | A common SSL protocol type cannot be agreed upon by both partners. This disagreement occurs if both partners do not support the same SSL protocol, as when the client supports only SSLv2 and the server supports only TLSv1. AT-TLS supports only SSLv2, SSLv3, and TLSv1. Check the following items:  
- Determine the protocols that are supported by the remote partner.  
- Code a TTLSEnvironmentAdvancedParms statement, which enables the common protocols. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, use a Security Level with cipher levels supported by the remote partner. |
| 422         | Connection Init | A v3Cipher that is not valid is found. Check the following items:  
- Determine whether the v3Cipher statement is coded.  
- Verify that the proper SSL FMIDs are installed to support the ciphers specified. |
| 428         | Connection Init | The private key cannot be obtained from the certificate. If the private key is stored in ICSF, ensure that ICSF was started before the Policy Agent starting. The TCP/IP job log contains a message that indicates whether System SSL detected ICSF services as available. If ICSF was not started before the Policy Agent, see technote 1433201 for instructions on how to update the AT-TLS policy to detect that ICSF is now available. |
| 434         | Connection Init | The certificate key is not compatible with the negotiated cipher suite. Ensure that the certificate that is being used supports the cipher suites that are coded with V2Ciphers or V3Ciphers. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, the ciphers are selected in each Security Level. |

Table 54 on page 643 lists some common AT-TLS return codes and possible causes.

### Table 54. AT-TLS return codes

<table>
<thead>
<tr>
<th>Return code</th>
<th>Possible cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>5001</td>
<td>ClientAuthType is set to Required or SAFCheck, but the client did not provide a certificate. Verify that the client supports client authentication and is configured to send its certificate during secure negotiation.</td>
</tr>
</tbody>
</table>
Table 54. AT-TLS return codes (continued)

<table>
<thead>
<tr>
<th>Return code</th>
<th>Possible cause and solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>5002</td>
<td>ClientAuthType is set to SAFCheck, but the certificate that is supplied by the client is not defined to SAF subsystem. If you are using RACF, define the client certificate with the RACDCERT command. For more information about using the RACDCERT command, see z/OS Security Server RACF Security Administrator's Guide.</td>
</tr>
</tbody>
</table>
| 5003        | Clear text data is received on the connection from the remote partner instead of secure data. The connection is terminated. Check the following items:  
- Ensure that the remote client is enabled for secure connections.  
- If the policy is defined with ApplicationControlled On, ensure that the application read all the cleartext data before it started the secure handshake. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, the Application Controlled setting is done in each Traffic Descriptor. |
| 5004        | The first HandshakeTimeout interval expired without receiving secure data from the remote partner. The timer is set for the number of seconds specified by the HandshakeTimeout value when the secure connection is initiated. When the first secure data is received from the remote partner, the timer is canceled. Check the following items:  
- This return code can occur if both sides of the connection are configured to be the server in the secure handshake. Review the configuration to ensure that one side acts as the client. For AT-TLS, you can specify the HandshakeRole value in either the TTLSEnvironmentAction or the TTLSConnectionAction statement. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, configure the Handshake Role value in each Traffic Descriptor.  
- Increase the HandshakeTimeout value if the remote partner is not responding within the time interval. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, you can set the Timeout value in each Traffic Descriptor; you can override the value in each Connectivity Rule. |
| 5005        | The second HandshakeTimeout interval expired and the secure handshake is not finished. This interval is set to 10 times the HandshakeTimeout interval. The secure negotiation is started and the initial secure message is received from the remote partner.  
- If the remote partner is an interactive application, such as requiring the user to select a certificate, either increase the HandshakeTimeout value or have the user try the connection again.  
- The HandshakeTimeout value might need to be increased if LDAP is being used to manage certificates. Increasing the value provides more time for the LDAP processing to occur. If you are configuring by using the Network Configuration Assistant, the Handshake Timeout value can be set in each Traffic Descriptor and can be overridden in each Connectivity Rule. |
### Table 54. AT-TLS return codes (continued)

<table>
<thead>
<tr>
<th>Return code</th>
<th>Possible cause and solution</th>
</tr>
</thead>
</table>
| 5006        | The connection is using a TTLSEnvironmentAction statement that failed to initialize a System SSL environment.  
• Use the syslog to determine why the System SSL environment failed to initialize.  
• If the TTLSEnvironmentAction statement is in error, make the necessary corrections. A System SSL environment is initialized for the corrected TTLSEnvironmentAction statement and new connections use that environment.  
• If a SAF configuration change is needed (such as changing a certificate in the key ring), make the change and then update the EnvironmentUserInstance parameter in the TTLSEnvironmentAction statement to reflect a changed action. A System SSL environment is initialized by using the modified RACF configuration and new connections use that environment. |

If you are configuring by using the Network Configuration Assistant to pick up changes that are made to a key ring, go to the AT-TLS Image Level Settings panel and click the **Reaccess Key Rings** button and update the Instance ID for the changed key ring.

<table>
<thead>
<tr>
<th>5007</th>
<th>Application data is read during processing of ciphertext negotiation. Collect the syslogd output or job log output and contact IBM.</th>
</tr>
</thead>
</table>
| 5008        | Application data was received after the local application closed the TCP connection. The data could not be presented to the application.  
• Review the local and remote applications to ensure that the TCP sockets are being closed correctly in the application flow.  
• If further diagnostic information is needed, set the trace level to 255, to trace the data flow and AT-TLS processing. |
| 5009        | AT-TLS was unable to obtain TCPIP private storage. Obtain a console dump of TCPIP and contact IBM |
| 5010        | AT-TLS was unable to obtain the ACEE for an application. Save the syslogd output and contact IBM |
| 5011        | AT-TLS does not have an Envar object for the applications ACEE. Save the syslogd output and contact IBM |
| 5012        | An internal AT-TLS error occurred. Save the syslogd output and contact IBM |
| 5013        | AT-TLS was unable to clone the SAF environment for the application. Save the syslogd output and contact IBM. |
| 5014        | AT-TLS was unable to extract ACEE into ENVAR value. Save the syslogd output and contact IBM. |
| 5015        | AT-TLS was unable to process the connection because the connection is already terminated. Review the syslogd output to determine whether the connection is terminated by the remote partner. TTLS trace level 8 (flow) and 16 (event) can be used to gather more information. |
| 5016        | AT-TLS attempted to read ciphertext negotiation data, but an internal error occurred. Save the syslogd output and contact IBM |
### Table 54. AT-TLS return codes (continued)

<table>
<thead>
<tr>
<th>Return code</th>
<th>Possible cause and solution</th>
</tr>
</thead>
</table>
| 5017        | The application tried to write data on a secure connection that is closed by the remote application.  
  - Review the local and remote applications to ensure that the TCP sockets are being closed correctly in the application flow.  
  - If further diagnostic information is needed, set the trace level to 255, to trace the data flow and AT-TLS processing. |
| 5018        | An internal error occurred processing a TTLSGroupAction. Save the syslogd output and contact IBM. |
| 5019        | Task level security could not be created. BPX1TLS failed. Save the syslogd output and contact IBM. |
| 5020        | AT-TLS was unable to load the GSKSSL library. Ensure that the SIEALNKE PDSE library is available to the TCPIP started task. For more information, see z/OS Cryptographic Services System SSL Programming. |
| 5021        | The HandshakeTimeout interval expired for the SIOCTTLSCTL TTLS_Stop_Connection request without receiving a close notify alert from the remote peer. The timer is set for the number of seconds that the HandshakeTimeout value specifies when the TTLS_Stop_Connection request is initiated. The timer is canceled when a close notify alert is received from the remote peer. Increase the HandshakeTimeout value if the remote peer is not responding within the time interval. If you are configuring by using the IBM Configuration Assistant for z/OS Communications Server, you can set the timeout value in each Traffic Descriptor; you can override the value in each Connectivity Rule. |
| 5022        | Encrypted application data is received from the remote peer when the SIOCTTLSCTL TTLS_Stop_Connection request is being processed. All application data that needs to be encrypted must be sent before the TTLS_Stop_Connection request. The application protocol needs to ensure all sending and receiving of secure data on the connection is complete before TTLS_Stop_Connection is requested. Review the application protocol to determine why the secure data is sent on the connection. |
| 5023        | AT-TLS called initACEE with a nested ENV object and requested a managed ACEE, which is not supported. If AT-TLS was processing a data connection from the FTP server, ensure the AT-TLS policy has SecondaryMap On coded for the FTP control connection. A separate TTLSRule for the FTP data connection is not supported. Otherwise, save the syslogd output and contact IBM. |
| 5024        | AT-TLS was unable to enable FIPS 140 support. See message EZD2026I for more details about the error that is received from System SSL. |

Return codes 6001–6999 describe internal AT-TLS errors.

An internal AT-TLS error occurred. Contact IBM with the error message and syslog information, if available.

---

**SIOCTTLSCTL ioctl return codes**

The SIOCTTLSCTL ioctl provides the interface for an application to query and control AT-TLS. Table 55 on page 647 describes the error codes that can be returned on this ioctl, along with the conditions under...
which each can occur. Also included for each is an indication of whether the query data fields in the ioctl contain valid returned data.

<table>
<thead>
<tr>
<th>Errno (1)</th>
<th>Ernojr</th>
<th>IOCTL request specified (2)</th>
<th>Condition causing Error</th>
<th>Valid Data? (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAccess</td>
<td>JrConnDeniedPolicy</td>
<td>INIT_CONNECTION, RESET_SESSION, RESET_CIPHER, STOP_CONNECTION</td>
<td>Mapped policy indicates that the application cannot request AT-TLS security for the connection (ApplicationControlled Off)</td>
<td>Yes</td>
</tr>
<tr>
<td>EAlready</td>
<td>JrAlreadyActive</td>
<td>INIT_CONNECTION, STOP_CONNECTION</td>
<td>An INIT_CONNECTION or STOP_CONNECTION request is previously received for the connection</td>
<td>Yes</td>
</tr>
<tr>
<td>EConnReset</td>
<td>JrTLSHandshakeFailed</td>
<td>Any</td>
<td>Initial handshake was in progress and socket is a blocking socket. Request blocked for handshake to complete. Handshake failed.</td>
<td>No</td>
</tr>
<tr>
<td>EInProgress</td>
<td>JrOK</td>
<td>INIT_CONNECTION, STOP_CONNECTION</td>
<td>Initial handshake or stop secure connection is started and socket is a non-blocking socket.</td>
<td>Yes</td>
</tr>
<tr>
<td>EINVAL</td>
<td>JrInvalidVersion</td>
<td>Any</td>
<td>Bad ioctl version number specified.</td>
<td>No</td>
</tr>
<tr>
<td>EINVAL</td>
<td>JrSocketCallParmError</td>
<td>Any</td>
<td>Length of input data is not length of ioctl structure.</td>
<td>No</td>
</tr>
<tr>
<td>EINVAL</td>
<td>JrSocketCallParmError</td>
<td>Any</td>
<td>Request type specified is not valid.</td>
<td>No</td>
</tr>
<tr>
<td>EINVAL</td>
<td>JrSocketCallParmError</td>
<td>RETURN_CERTIFICATE</td>
<td>Certificate buffer pointer = 0 or certificate buffer length = 0.</td>
<td>No</td>
</tr>
<tr>
<td>EINVAL</td>
<td>JrSocketCallParmError</td>
<td>RETURN_CERTIFICATE</td>
<td>Certificate buffer pointer != 0 or certificate buffer length != 0 and TTLS_Version is 1.</td>
<td>No</td>
</tr>
<tr>
<td>EMVSErr</td>
<td>JrUnexpectedErr</td>
<td>Any</td>
<td>Policy was not mapped before ioctl call and an error is encountered upon policy map during ioctl call.</td>
<td>No</td>
</tr>
<tr>
<td>EINVAL</td>
<td>JrBuffTooSmall</td>
<td>RETURN_CERTIFICATE</td>
<td>The certificate buffer provided is too small.</td>
<td>Yes (5)</td>
</tr>
<tr>
<td>Errno (1)</td>
<td>ErrnoJR</td>
<td>IOCTL request specified (2)</td>
<td>Condition causing Error</td>
<td>Valid Data? (3)</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>----------------------------</td>
<td>-------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>ENoBufs</td>
<td>JrBuffTooSmall</td>
<td>QUERY_ONLY</td>
<td>A TTLS_Version 2 request was issued, but the buffer was too small.</td>
<td>Yes (6)</td>
</tr>
<tr>
<td>ENotConn</td>
<td>JrGetConnError</td>
<td>Any</td>
<td>TCP connection is not yet in established state or is reset.</td>
<td>No</td>
</tr>
<tr>
<td>EOpNotSupp</td>
<td>JrOptNotSupported</td>
<td>INIT_CONNECTION, RESET_SESSION, RESET_CIPHER STOP_CONNECTION</td>
<td>Mapped policy indicates that AT-TLS is not enabled for the connection (TTLSEnabled Off).</td>
<td>Yes</td>
</tr>
<tr>
<td>EPerm</td>
<td>JrSocketCallParmError</td>
<td>INIT_CONNECTION with RESET_SESSION or RESET_CIPHER or STOP_CONNECTION, STOP_CONNECTION with RESET_SESSION or RESET_CIPHER, ALLOW_HSTIMEOUT without INIT_CONNECTION</td>
<td>Combination of requests specified is not permitted.</td>
<td>No</td>
</tr>
<tr>
<td>EPipe</td>
<td>JrUnexpectedErr</td>
<td>INIT_CONNECTION, RESET_CIPHER, STOP_CONNECTION</td>
<td>TCP connection is no longer in Established state. Two-way communication is not possible.</td>
<td>Yes</td>
</tr>
<tr>
<td>EProto</td>
<td>JrGetConnErr</td>
<td>RESET_SESSION, RESET_CIPHER</td>
<td>An INIT_CONNECTION request is not received for the connection.</td>
<td>Yes</td>
</tr>
<tr>
<td>EProto</td>
<td>JrInvalidVersion</td>
<td>RESET_CIPHER, STOP_CONNECTION</td>
<td>Connection is secured by using SSL version 2.</td>
<td>Yes</td>
</tr>
<tr>
<td>EProto</td>
<td>JrConnDeniedPolicy</td>
<td>ALLOW_HSTIMEOUT</td>
<td>The TTLS_ALLOW_HSTIMEOUT option was requested but the HandshakeRole is a client or the HandshakeTimeout value is 0.</td>
<td>Yes</td>
</tr>
<tr>
<td>EProto</td>
<td>JrTTLSStopReadDataPending</td>
<td>STOP_CONNECTION</td>
<td>A STOP_CONNECTION request is issued on a connection that has unread application data.</td>
<td>Yes</td>
</tr>
<tr>
<td>EProto</td>
<td>JrTTLSStopWriteDataPending</td>
<td>STOP_CONNECTION</td>
<td>A STOP_CONNECTION request is issued on a connection that has outstanding application write requests.</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 55. SIOCTTLSCTL error codes (continued)

<table>
<thead>
<tr>
<th>Errno (1)</th>
<th>Errnojr</th>
<th>IOCTL request specified (2)</th>
<th>Condition causing Error</th>
<th>Valid Data? (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EProtoType</td>
<td>JrSocketTypeNotSupported</td>
<td>Any</td>
<td>Socket is not a TCP socket.</td>
<td>No</td>
</tr>
<tr>
<td>EWouldBlock</td>
<td>JrOK</td>
<td>Any</td>
<td>SSL handshake is in progress and socket is a non-blocking socket. (4)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Notes:

1. For the numeric values of the error codes, see the following topics:
   - If you are using the BPX APIs, see the return codes in z/OS UNIX System Services Messages and Codes.
   - If you are using the TCP/IP APIs, see the return codes in z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.

2. The entry Any indicates that any valid request or valid combination of request types was specified as follows:
   - **request_type**
     - The listed request_type value was specified alone or in any valid combination of request_type.
   - **request_type, request_type[, request_type]**
     - One of the listed request types was specified alone or in any valid combination of request types.
   - **request_type with request_type**
     - The listed pair of request types was specified together.
   - ! request_type
     - Any valid combination of request types that does not include the listed request_type was specified.

3. Yes indicates that query data fields in the ioctl control block contain valid returned data. No indicates that the query data fields are unmodified.

4. For a non-blocking socket, you can wait for the handshake to complete by issuing Select or Poll for Socket Writable.

5. Certificate is not returned because the buffer was not large enough to hold it.

6. Output data is returned for output requests which completely fit in the buffer provided.
Chapter 28. Diagnosing Defense Manager daemon problems

This topic describes how to diagnose Defense Manager daemon (DMD) problems, and contains the following subtopics:

- “Overview of diagnosing Defense Manager daemon problems” on page 651
- “Defense Manager daemon debug information” on page 657
- “TCP/IP services component trace for the Defense Manager daemon” on page 657
- “Enabling CTRACE at Defense Manager daemon startup” on page 658

Overview of diagnosing Defense Manager daemon problems

The DMD oversees the addition, modification and deletion of TCP/IP stack defensive filters. Problems with the DMD may be categorized as follows:

- DMD configuration problems
- DMD internal problems
- DMD problems interacting with an external component such as:
  - `ipsec` command
  - Secure Access Facility

The DMD provides log output using syslogd and internal trace information using component trace (CTRACE). The log output is sufficient for diagnosing most DMD problems and is the first place to look if you suspect a problem.

Table 56 on page 652 lists common DMD problems.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ipsec</strong> command cannot be used to update or delete a defensive filter installed in the stack</td>
<td>The <strong>ipsec -F display</strong> command lists defensive filters that cannot be updated or deleted. An <strong>ipsec -F update</strong> command to update a defensive filter fails with message: <strong>EZD1550I Defense Manager daemon reported an error - filter is not found</strong></td>
<td>Under normal circumstances the DMD's defensive filter files are in sync with the defensive filters in each running stack. However, there are several operational errors that can lead to a mismatch where defensive filters are installed in the stack but the DMD does not have any knowledge of them. The <strong>ipsec -F display</strong> command will display the defensive filters installed in the stack. However, the filters cannot be referenced by name to update or delete them. One possible cause of this mismatch is if the administrator removes the DmStackConfig statement from the DMD configuration while there are active defensive filters in the stack. If this was done to disable defensive filtering then only a partial disablement was done. No new defensive filters will be added to the stack but the existing ones remain. The user has 2 choices to complete the disablement. The MODIFY FORCE_INACTIVE command can be used to disable defensive filtering. Or the DmStackConfig statement can be added back to the configuration file with Mode Inactive. In both cases, any existing defensive filters will be deleted from the stack. If the DmStackConfig statement was removed inadvertently and defensive filtering should remain enabled for the stack, add the DmStackConfig statement back to the configuration file and refresh the configuration. All of the active defensive filters should be addressable again and new defensive filters can be added. Refreshing the DMD configuration with the wrong configuration file could result in the apparent deletion of a stack. For example, if DMD is started with configuration file <code>/etc/security/dmd.conf</code> which has a DmStackConfig statement for TCPCS2 and TCPCS3, then a refresh is done with configuration file <code>/etc/security/dmd.conf1</code> which only has a DmStackConfig statement for TCPCS2, it will appear that DmStackConfig has been deleted for TCPCS3. The configuration should be refreshed with the correct configuration file. Any active defensive filters should be addressable again. Another possible cause is that the DMD is started with the DefensiveFilterDirectory parameter in the DMD configuration file set to the wrong location. To correct the problem, stop the DMD. The DefensiveFilterDirectory parameter cannot be changed on a MODIFY REFRESH. Correct the DefensiveFilterDirectory value and restart the DMD. All of the active defensive filters should be addressable again.</td>
</tr>
<tr>
<td>Problem</td>
<td>Symptom</td>
<td>Cause/response</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| The DMD cannot be started. The configuration file cannot be read. | The following message sequence is written to the MVS console:  

EZD1610I THE DEFENSE MANAGER DAEMON INITIALIZATION SEQUENCE HAS BEGUN  
EZD1617I AN ERROR OCCURRED WHILE READING THE DEFENSE MANAGER DAEMON CONFIGURATION FILE /etc/security/dmd.conf - RETURN CODE 2  
EZD1604I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS BEGUN  
EZD1605I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS COMPLETED | The configuration file must exist and the DMD must have the right permissions to read it.  
If the configuration data is not in the default location (that is, /etc/security/dmd.conf), ensure that the environment variable DMD_FILE is set to the name of the MVS data set or z/OS UNIX file that contains the configuration data.  
If the DMD is defined with a non-zero UID, ensure that the DMD has permission to read the configuration file. This requires that the DMD user has both read access to the configuration file, as well as access to the directory containing the configuration file.  
**Tip:** The /var/dm directory must be set up to allow DMD to create, delete, read, and write files to it. You might want to create the configuration file in the /var/dm directory and use the DMD_FILE environment variable to specify the configuration file. |
| The DMD cannot be started. The /var/dm directory does not exist and cannot be created. | The following message sequence is written to the MVS console:  

EZD1610I THE DEFENSE MANAGER DAEMON INITIALIZATION SEQUENCE HAS BEGUN  
EZD1604I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS BEGUN  
EZD1605I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS COMPLETED | The directory /var/dm must exist or the DMD must have the right permissions to create it. If the DMD needs to create the dm subdirectory, /var must exist.  
If the DMD is defined with a non-zero UID, create the /var/dm directory before starting the DMD. The directory should be owned by the DMD userid and the DMD should be able to create, delete, read, and write files to the directory.  
The following message is written to syslog:  

EZD1624I The Defense Manager daemon socket directory /var/dm does not exist and cannot be created - errno 111 EDC5111I Permission denied |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
</table>
| The DMD cannot be started. The directory `/var/dm` exists but the DMD is not able to create a file in the directory. | The following message sequence is written to the MVS console:  
EZD1610I THE DEFENSE MANAGER DAEMON INITIALIZATION SEQUENCE HAS BEGUN  
EZD1732I AN ERROR OCCURRED WHILE TRYING TO ACCESS THE DMD DIRECTORY `/var/dm` - ERRNO 111 EDC5111I Permission denied.  
EZD1617I AN ERROR OCCURRED WHILE READING THE DEFENSE MANAGER DAEMON CONFIGURATION FILE `/etc/security/dmd.conf` - RETURN CODE 3  
EZD1604I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS BEGUN  
EZD1605I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS COMPLETED | If the DMD is defined with a non-zero UID, the directory should be owned by the DMD userid and the DMD should be able to create, delete, read, and write files to the directory. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Cause/response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The DMD cannot be started. The defensive filter directory does not exist.</td>
<td>The following message sequence is written to the MVS console: &lt;br&gt; EZD1610I THE DEFENSE MANAGER DAEMON INITIALIZATION SEQUENCE HAS BEGUN &lt;br&gt; EZD1621I AN ERROR OCCURRED WHILE TRYING TO ACCESS DEFENSIVE FILTER DIRECTORY /var/dm/filters - ERRNO 129 EDC5129I No such file or directory. &lt;br&gt; EZD1617I AN ERROR OCCURRED WHILE READING THE DEFENSE MANAGER DAEMON CONFIGURATION FILE /etc/security/dmd.conf - RETURN CODE 3 &lt;br&gt; EZD1604I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS BEGUN &lt;br&gt; EZD1605I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS COMPLETED</td>
<td>The defensive filter directory specified in the DMD configuration file on the DefensiveFilterDirectory keyword must be created before starting the DMD. The DMD must be able to create, delete, read, and write files to the directory. &lt;br&gt; If the DMD is defined with a non-zero UID, the directory should be owned by the DMD userid and the DMD should be able to create, delete, read, and write files to the directory.</td>
</tr>
<tr>
<td>Problem</td>
<td>Symptom</td>
<td>Cause/response</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| The DMD cannot be started. Files cannot be written to the defensive filter directory. | The following message sequence is written to the MVS console:  
EZD1610I THE DEFENSE MANAGER DAEMON INITIALIZATION SEQUENCE HAS BEGUN  
EZD1621I AN ERROR OCCURRED WHILE TRYING TO ACCESS DEFENSIVE FILTER DIRECTORY /var/dm/filters - ERRNO 111 EDC5111I Permission denied.  
EZD1617I AN ERROR OCCURRED WHILE READING THE DEFENSE MANAGER DAEMON CONFIGURATION FILE /etc/security/dmd.conf - RETURN CODE 3  
EZD1604I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS BEGUN  
EZD1605I THE DEFENSE MANAGER DAEMON SHUTDOWN SEQUENCE HAS COMPLETED | The DMD must be able to create, read, write, and delete files from the defensive filter directory specified in the DMD configuration file on the DefensiveFilterDirectory keyword.  
If the DMD is defined with a non-zero UID, the directory should be owned by the DMD userid and the DMD should be able to create, delete, read, and write files to the directory. |
| The DMD starts but the process ID is not written to a file. | The following message is written to the MVS console if the directory portion of the PID file location does not exist:  
EZD1603I THE DEFENSE MANAGER DAEMON FAILED TO WRITE ITS PROCESS ID 67108892 TO /var/dm/dmd.pid - ERRNO 129 ERRNO DESCRIPTION EDC5129I No such file or directory. | The directory portion of the PID file location specified by the DMD_PIDFILE environment variable or defaulted to /var/dm must be created before starting the DMD. The DMD must be able to write the PID file to the directory.  
If the directory does not exist, create it. If the DMD is defined with a non-zero UID, the directory should be owned by the DMD userid and the DMD should be able to create, delete, read, and write files to the directory. |
Defense Manager daemon debug information

The SyslogLevel parameter in the DMD configuration file controls the level of DMD internal debug information that is sent to syslog. See z/OS Communications Server: IP Configuration Reference for more information.

Abends during DMD processing

Messages and error-related information should be sent to the system console when an abend occurs during DMD processing. A dump of the error is needed unless the symptoms match a known problem. System dumps of the DMD include Language Environment data. The Language Environment IPCS verbexit LEDATA can be used to format this information. See z/OS Language Environment Debugging Guide for more information. The following command is a sample IPCS `verbexit ledata` command:

```
verbx ledata ‘asid(68) tcb(007E5E88) ceedump ntheads(*)’
```

Tip: In this example, the DMD asid is 0x68 and the address of the abended DMD TCB is 0x007E5E88.

DMD error codes

Several messages display a return code and reason generated by the DMD. These return codes and reasons are displayed by the `ipsec` command.

TCP/IP services component trace for the Defense Manager daemon

The DMD uses component trace support to trace internal operations. For short descriptions of other tracing procedures, such as displaying trace status, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

For detailed information, see the following:

- z/OS MVS Diagnosis: Tools and Service Aids for information about component trace procedures.
- z/OS MVS Initialization and Tuning Reference for information about the component trace SYS1.PARMLIB member.
- z/OS MVS System Commands for information about commands.
- z/OS MVS Programming: Authorized Assembler Services Guide for procedures and return codes for component trace macros.

CTRACE options

You can specify component trace options at DMD initialization or after the DMD has initialized.

Table 57 on page 657 lists the DMD trace options.

<table>
<thead>
<tr>
<th>Trace event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>Select all types of records. Be aware that this option slows performance.</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>Select the DMD's minimum level of tracing. This level includes the INIT, EXCEPT, and TERM categories.</td>
</tr>
<tr>
<td>INIT</td>
<td>Select the DMD initialization information.</td>
</tr>
<tr>
<td>TERM</td>
<td>Select the DMD termination information.</td>
</tr>
</tbody>
</table>
Table 57. Defense manager daemon (DMD) trace options (continued)

<table>
<thead>
<tr>
<th>Trace event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCEPT</td>
<td>Select the DMD exception information.</td>
</tr>
<tr>
<td>CONFIG</td>
<td>Select the DMD configuration information.</td>
</tr>
<tr>
<td>COMMANDS</td>
<td>Select processing of DMD commands from the console or command line.</td>
</tr>
<tr>
<td>LOGMSGS</td>
<td>Select the DMD syslog messages. These entries can be used to easily correlate system log messages to a specific point in the CTRACE log.</td>
</tr>
<tr>
<td>ROUTING</td>
<td>Select the DMD threading and request dispatching information.</td>
</tr>
<tr>
<td>SERIAL</td>
<td>Select the DMD serialization information.</td>
</tr>
<tr>
<td>EVENT</td>
<td>Select the DMD event information.</td>
</tr>
<tr>
<td>SOCKETS</td>
<td>Select the DMD socket information.</td>
</tr>
<tr>
<td>PERFORM</td>
<td>Select the DMD performance information.</td>
</tr>
<tr>
<td>REQUESTS</td>
<td>Select the DMD request/response information.</td>
</tr>
<tr>
<td>FLOW</td>
<td>Select the DMD code flow information.</td>
</tr>
<tr>
<td>STORAGE</td>
<td>Select the DMD storage information.</td>
</tr>
<tr>
<td>CONTROL</td>
<td>Select the DMD control information.</td>
</tr>
<tr>
<td>DEBUG</td>
<td>Select the DMD debugging information.</td>
</tr>
<tr>
<td>VERBOSE</td>
<td>Select the DMD verbose debugging information.</td>
</tr>
</tbody>
</table>

Enabling CTRACE at Defense Manager daemon startup

A default minimum component trace is always started during DMD initialization. Use a parmlib member to customize the parameters that are used to initialize the trace. The default DMD component trace parmlib member is the SYS1.PARMLIB member CTIDMD00. The parmlib member name can be changed using the DMD_CTRACE_MEMBER environment variable.

**Rule:** The DMD reads the DMD_CTRACE_MEMBER environment variable only during initialization. Changes to DMD_CTRACE_MEMBER after server initialization have no affect.

**Restriction:** In addition to specifying the trace options, you can also change the DMD trace buffer size. The buffer size can be changed only at DMD initialization and has a maximum size of 256 MB.

If the CTIDMD00 member or the member that is specified in DMD_CTRACE_MEMBER is not found when starting the DMD, the following message is issued:

IEE5381 member:Name MEMBER NOT FOUND IN PARMLIB

When this occurs, the DMD component trace is started with a buffer size of 1 MB and the MINIMUM tracing option.
**DESCRIPTION** = This parmlib member causes component trace for
* the TCP/IP Defense Manager daemon application to be initialized
* with a trace buffer size of 1M
* This parmlib member only lists those TRACEOPTS
* values specific to DM. For a complete list
* of TRACEOPTS keywords and their values see
* z/OS MVS Initialization and Tuning Reference.

TRACEOPTS
  * Optionally start external writer in this file (use both
    WTRSTART and WTR with same wtr_procedure)
  * ON OR OFF: PICK 1
  * BUFSIZE: A VALUE IN THE RANGE OF 128K TO 256M
    CTRACE buffers reside in the Defense Manger daemon's private
    storage which is in the region's address space.
  * OPTIONS: NAMES OF FUNCTIONS TO BE TRACED, OR "ALL"

OPTIONS()
  * 'ALL'
  * 'MINIMUM'
  * 'INIT'
  * 'TERM'
  * 'EXCEPT'
  * 'CONFIG'
  * 'ROUTING'
  * 'COMMANDS'
  * 'LOGMSGS'
  * 'SERIAL'
  * 'EVENT'
  * 'SOCKETS'
  * 'REQUESTS'
  * 'FLOW'
  * 'STORAGE'
  * 'CONTROL'
  * 'VERBOSE'
  * 'DEBUG'
  * 'PERFORM'

Figure 91. SYS1.PARMLIB member CTIDMD00
Steps for enabling the CTRACE at Defense Manager daemon startup
Edit the CTIDMD00 parmlib member appropriately and start the DMD.

Procedure
1. Edit the CTIDMD00 parmlib member and specify TRACEOPTS ON, the desired buffer size with the BUFSIZE() parameter and the desired CTRACE options. To direct the CTRACE to an external writer, also specify the name of the writer JCL procedure in the WTR() parameter. See Figure 91 on page 659.
2. Start the DMD.

Steps for disabling the CTRACE at Defense Manager daemon startup
Edit the CTIDMD00 parmlib member appropriately and start the DMD.

Procedure
1. To disable the CTRACE at DMD startup, edit the CTIDMD00 parmlib member and specify TRACEOPTS OFF.
2. Start the DMD.

Step for enabling the CTRACE after the Defense Manager daemon has started
After the DMD is started, enable the CTRACE to an internal buffer or to an external writer.

Procedure
Perform the appropriate step:
- Issue the following console commands to enable the CTRACE to an internal buffer:

```
TRACE CT,ON,COMP=SYSTCPDM,SUB=(dmd_jobname)
R xx,OPTIONS=(option[,option2...]),END
```
- Issue the following console commands to enable the CTRACE to an external writer:

```
TRACE CT,WTRSTART=writer_proc
TRACE CT,ON,COMP=SYSTCPDM,SUB=(dm_jobname)
R xx,OPTIONS=(option[,option2...]),WTR=writer_proc,END
```

Step for disabling the CTRACE after the Defense Manager daemon is started
After the DMD is started, disable the CTRACE to an internal buffer or to an external writer.

Procedure
Perform the appropriate step:
- Issue the following console commands to disable the CTRACE to an internal buffer:

```
TRACE CT,OFF,COMP=SYSTCPDM,SUB=(dm_jobname)
```
- Issue the following console commands to disable a CTRACE to an external writer:

```
TRACE CT,OFF,COMP=SYSTCPDM,SUB=(dm_jobname)
TRACE CT,WTRSTOP=writer_proc
```

Displaying the CTRACE status
To display the CTRACE status, issue the following console command:

```
D TRACE,COMP=SYSTCPDM,SUB=(dm_jobname)
```
Enabling CTRACE after Defense Manager daemon initialization

After DMD initialization, you must use the TRACE CT command to change the component trace options. Each time a new Component Trace is initiated, all prior trace options are turned OFF and the new options are put into effect. You can specify the trace options with or without the parmlib member. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for more information.

Formatting Defense Manager daemon trace records

You can format component trace records using IPCS panels or a combination of the IPCS panels and the CTRACE command, either from a dump or from external-writer files. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details.

Enter any combination of values as options to filter the CTRACE entries. The options must be entered using the following format: TYPE(option[,option]...).

You can use any of the options listed in Table 57 on page 657, except ALL and MINIMUM.
Chapter 29. Diagnosing IP security and defensive filter problems

This topic describes how to diagnose IP security problems including problems with defensive filters. It contains the following subtopics:

- “Overview of diagnosing IP security and defensive filter problems” on page 663
- “Steps for diagnosing IP security problems” on page 664
- “Steps for diagnosing defensive filter problems” on page 665
- “Steps for diagnosing the cause for missing IP security or defensive filter syslogd output” on page 667
- “Steps for verifying IP security and defensive filter operation” on page 670
- “Tools for diagnosing IP security and defensive filter problems” on page 682

Overview of diagnosing IP security and defensive filter problems

IPSec configuration files are input to the Policy Agent to establish a TCP/IP stack IP filter policy, Key Exchange policy, and LocalDynVpn policy. These configuration files consist of a number of configuration statements and parameters documented in z/OS Communications Server: IP Configuration Reference and can be configured manually into a flat file. Optionally, IBM provides an IBM Configuration Assistant for z/OS Communications Server, which provides wizards and a set of reusable objects (at a different level of abstraction than if configured manually). The IBM Configuration Assistant for z/OS Communications Server ultimately produces the Policy Agent configuration files on your behalf.

When diagnosing problems, it might be helpful to understand the relationship of the GUI level objects to the configuration file objects. Table 58 on page 663 provides a brief mapping of these objects.

<table>
<thead>
<tr>
<th>Policy Agent Object</th>
<th>IBM Configuration Assistant for z/OS Communications Server Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>IpDataOffer</td>
<td>Configured in security levels implementing dynamic tunnels</td>
</tr>
<tr>
<td>IpDynVpnAction</td>
<td>Security level implementing dynamic tunnels</td>
</tr>
<tr>
<td></td>
<td>A numeric suffix is appended to the Security Level name to guarantee uniqueness.</td>
</tr>
<tr>
<td>IpFilterRule</td>
<td>Connectivity rule</td>
</tr>
<tr>
<td></td>
<td>A numeric suffix is appended to the connectivity rule name to guarantee uniqueness.</td>
</tr>
<tr>
<td>IpManVpnAction</td>
<td>Security level implementing manual tunnels</td>
</tr>
<tr>
<td></td>
<td>A numeric suffix is appended to the security level name to guarantee uniqueness.</td>
</tr>
<tr>
<td>IpService</td>
<td>Configured in traffic descriptors</td>
</tr>
<tr>
<td></td>
<td>A numeric suffix is appended to the traffic descriptor name to guarantee uniqueness.</td>
</tr>
</tbody>
</table>
The Policy Agent installs IP security policy into the stack and the IKE daemon. Specifically, IP filter policy is installed in the stack and Key Exchange policy and LocalDynVpn policy are installed in the IKE daemon. The stack enforces IP filter policy after it has been successfully installed. The IKE daemon enforces Key Exchange policy and LocalDynVpn policy after they have been successfully installed. The Traffic Regulation Management daemon (TRMD) reports IP security events to syslogd on behalf of the stack.

**Defensive filters:**

Defensive filters are deny filters that can be added through the `ipsec` command, typically by an external security information and event manager that detects an attack. Defensive filters can only be installed in a TCP/IP stack that has IP security enabled. Defensive filters are given higher priority than IP security filters. That is, IP filter processing will first check a packet against any installed defensive filters for a match, before checking the IP security filters.

Problems can occur in the following areas:

- IP security policy installation
- IP security and defensive filter output to syslogd
- IP security operation
- Adding and managing defensive filters

**Steps for diagnosing IP security problems**

Diagnose IP security problems.

**Procedure**

Perform the following steps:

1. Issue `pasearch -v a` to see all IP security policies that are active in policy agent. See z/OS Communications Server: IP System Administrator's Commands for more information about the `pasearch -v a` command. If you are running multiple stacks, ensure that pasearch is reporting on the stack you are interested in. See Chapter 24, “Diagnosing Policy Agent problems,” on page 587 if you do not see the IP security policies that you expected.

**Tips:**

- IP security policies that are active in the Policy Agent might not be active in the stack. Issue `ipsec -f display` and locate the Source field to determine the source of the policy that is active in the
If the Source field indicates Stack Policy, then the policy that is active in the Policy Agent corresponds to the policy that is active in the stack.

- Defensive filters are not defined in the policy agent configuration file so defensive filters are not displayed by pasearch.

2. Issue `ipsec -f display` to see how the stack mapped your IpFilterPolicy statement. See z/OS Communications Server: IP System Administrator’s Commands for more information about the `ipsec -f` command. If you are running multiple stacks, ensure that your resolver configuration correctly identifies the stack you are interested in. Ensure that your IP security policies are correctly defined. See the IP security information in z/OS Communications Server: IP Configuration Guide.

**Tip:** When the command `ipsec -f display` command is issued with a scope of `-c current`, any defensive filters installed in the stack will be displayed along with IP security filters.

## Steps for diagnosing defensive filter problems

Diagnose defensive filter problems.

**Procedure**

Perform the following step to display defensive filters:

1. Issue `ipsec -F display` to display active defensive filters.

   See z/OS Communications Server: IP System Administrator’s Commands for more information about the `ipsec -F` command. The defensive filters installed in a stack can be displayed or the global defensive filters can be displayed. If you are running multiple stacks and you want to display defensive filters installed in a specific stack, specify the `-p stacknameoption` or ensure that your resolver configuration correctly identifies the stack you are interested in. To display global defensive filters, specify the `-G` option.

Perform the following steps to determine why defensive filters are not being successfully added to a stack:

2. Ensure that IP security is enabled for the stack.
   
   Specify IPSECURITY on the IPCONFIG statement in the TCP/IP profile. In addition, specify IPSECURITY on the IPCONFIG6 statement in the TCP/IP profile if support is needed for IPv6 defensive filters. See z/OS Communications Server: IP Configuration Reference for more information about the IPCONFIG IPSECURITY and IPCONFIG6 IPSECURITY statements.

3. Ensure that the Defense Manager daemon (DMD) is managing defensive filters for the stack.
   
   The TCP/IP stack name must be listed in the DMD configuration file to enable defensive filters for the stack. The mode specified on the DmStackConfig statement for the stack must be Active or Simulate. See z/OS Communications Server: IP Configuration Reference for more information about the DMD configuration file.

4. Ensure that the user has security product authorization to issue the `ipsec` command to add a defensive filter.

   See "ipsec command security" in z/OS Communications Server: IP System Administrator’s Commands for more information about defining the necessary SERVAUTH profiles.

Perform the following step if administrative access is being denied by a defensive filter:

5. Exclude the administrator's IP address from defensive filter checking.

   Use the Exclude keyword on the DmStackConfig statement in the DMD configuration file to specify the administrator’s IP address. See z/OS Communications Server: IP Configuration Reference for more information about the Exclude keyword in the DMD configuration file.

Perform the following steps if a stack’s defensive filters are not blocking traffic:

6. Ensure that the filter’s mode is set to Block.

   The Action field on the `ipsec -F display` report should indicate Defensive Block. If the Action field indicates Defensive Simulate, issue `ipsec -F update` to change the filter’s mode. See z/OS
Communications Server: IP System Administrator's Commands for more information about the 
**ipsec -F** command.

7. Ensure that the stack's mode in the DMD configuration file is set to Active.

A mode of Simulate will override the individual filter's setting. It will allow a packet to match a defensive filter, generate a message, and then continue to be processed. The mode must be set to Active to cause the individual filter's mode setting to be honored. See z/OS Communications Server: IP Configuration Reference for more information about specifying a stack and its mode in the DMD configuration file. The MODIFY DISPLAY command can be issued for the DMD to display the active configuration settings. See z/OS Communications Server: IP System Administrator's Commands for more information about the MODIFY command.

Perform the following step if a defensive filter is discarding traffic that should be permitted:

8. Delete the defensive filter if it is causing legitimate traffic to be discarded.

Issue the **ipsec -F delete** command to delete the defensive filter from the stack. See z/OS Communications Server: IP System Administrator's Commands for more information about the **ipsec -F** command.

Perform the following steps to disable defensive filtering for a stack:

9. Update the DMD configuration file to disable defensive filters for a stack.

Specify a mode of Inactive for the stack on the DmStackConfig statement. See z/OS Communications Server: IP Configuration Reference for more information about the DMD configuration file.

10. Issue the MODIFY REFRESH command for the DMD.

See z/OS Communications Server: IP System Administrator's Commands for more information about the MODIFY command.

**Tip:** If you are unable to update your DMD configuration file, the MODIFY FORCE_INACTIVE command can be issued for the DMD to disable defensive filtering for the stack. A later MODIFY REFRESH will use the DMD configuration file. If you want defensive filtering to remain disabled, you should update the DMD configuration file as soon as possible.

**Tip:** Removing the DmStackConfig statement from the DMD configuration file will not delete existing defensive filters from the stack. If you removed the DmStackConfig statement, the defensive filters will remain in the stack until expiration. To remove the defensive filters from the stack immediately, add the DmStackConfig statement back to the DMD configuration file with a mode of Inactive or issue the MODIFY FORCE_INACTIVE command for the stack.

Perform the following step to remove all defensive filters from a stack:

11. Perform one of the following actions:

- Issue the **ipsec -F delete -N all -p stackname** command to delete all existing defensive filters from the stack. This will also delete them from the DMD's persistent storage so the filters will not be reinstalled if the stack were to be stopped and restarted. Defensive filtering remains enabled for the stack and new filters can be added to the stack. See z/OS Communications Server: IP System Administrator's Commands for more information about the **ipsec -F** command.

- Disable defensive filtering for a stack as described earlier. This will remove all existing defensive filters from the stack and the DMD's persistent storage. It will also prevent new defensive filters from being installed in the stack.

**Tip:** The following actions will not remove defensive filters from the stack.

- Stopping and restarting the stack. The DMD will reinstall defensive filters when the stack is restarted.
- Stopping DMD. Existing defensive filters remain installed in the stack until expiration.
Steps for diagnosing the cause for missing IP security or defensive filter syslogd output

Determine the cause for missing IP security or defensive filter syslogd output.

**Procedure**

Perform the following steps:

1. Ensure that Policy Agent is running on this system if IP security policy is defined.
2. Ensure that TRMD is running for this stack on this system. Consider using TCPIP PROFILE Autolog for TRMD. See “Diagnosing TRMD problems” on page 635 for more information.
3. Ensure that syslogd is running on this system.
4. Ensure that syslogd is configured for IP security and defensive filter output. TRMD always writes IP security and defensive filter log records to the syslog local4 facility.

<table>
<thead>
<tr>
<th>Table 59. IPSec messages logged by TRMD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message</strong></td>
</tr>
<tr>
<td>EZD0827I Remote port translated</td>
</tr>
<tr>
<td>EZD0811I Decapsulation failed (reason codes 8 and 9)</td>
</tr>
<tr>
<td>All other IPSec messages logged by TRMD.</td>
</tr>
</tbody>
</table>

**Note:**

a. If IP security policy is configured to log permits and denies, TRMD sends those messages to syslogd using facility local4.

b. If IKED is configured for logging, IKED messages are sent to syslogd using facility local4 and varied priorities.

<table>
<thead>
<tr>
<th>Table 60. Defensive filter messages logged by TRMD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message</strong></td>
</tr>
<tr>
<td>Defensive filter messages logged by TRMD</td>
</tr>
</tbody>
</table>

**Note:**

a. If a defensive filter indicates that a filter match should be logged, TRMD sends those messages to syslogd using facility local4.

b. If the DMD is configured for logging, DMD messages are sent to syslogd using facility local4 and varied priorities.

**Tips:**

- If TRMD is logging Intrusion Detection Services (IDS) messages, as well as IP Security (IPSec) messages and defensive filter messages, consider using the facility to separate the IDS messages from the IPSec and defensive filter messages. IDS messages are written to the daemon facility. IPSec and defensive filter messages are written to the Local4 facility.

- If running multiple TRMDs, consider using the syslogd -u option when starting syslogd. The -u option causes the job name of the application writing the syslogd record to be included in the syslogd record.
• If running multiple TRMDs, consider using the trmd jobname prefix to separate IPSec output by stack.

**Guidelines:**

• Ensure that syslogd is configured to write TRMD and IKED messages for IP security.
• Ensure that syslogd is configured to write TRMD and DMD messages for defensive filters.
• For example, the following lines could be added to the syslogd configuration file to organize TRMD, IKED, and DMD messages:

```plaintext
*.*.local4.* /tmp/logs/filter.log
*.*.IKED*.local4.* /tmp/logs/IKED.log
*.*.DMD*.local4.* /tmp/logs/DMD.log
*.*.trmd*.local4.* /tmp/logs/trmdfilt.log
*.*.trmd*.daemon.* /tmp/logs/ids.log
```

In the example, IKED, DMD, and TRMD IP security and defensive filter messages are all written to the log file /tmp/logs/filter.log. IKED messages are also written to the log file /tmp/logs/IKED.log. DMD messages are also written to the log file /tmp/logs/DMD.log. IP security and defensive filter TRMD messages are also written to the log file /tmp/logs/trmdfilt.log. If TRMD is logging IDS messages, those messages are written to /tmp/logs/ids.log.

• Ensure that the log files exist or syslogd is configured to create them using the -c option.
• Ensure that the log files are writable.
• Ensure that there is adequate space on the file system for writing to the log files.

Perform the following steps to reduce the amount of syslogd output for IP security and defensive filters.

a. Ensure that the logging levels for the IKE daemon are set appropriately in the IKE daemon configuration file.
   - IkeSyslogLevel - During day-to-day operation, this value should be set no higher than the default of 1. A higher value should be used for temporary diagnostic purposes only. IkeSyslogLevel can also be set to 0 to disable IKE syslog messages entirely.
   - PagentSyslogLevel - During day-to-day operation, this value should be set to the default of 0. A higher value should be used for temporary diagnostic purposes only.

b. Ensure that the logging levels for the DMD are set appropriately in the DMD configuration file.
   - SyslogLevel - During day-to-day operation, this value should be set no higher than 7. A higher value should be used for temporary diagnostic purposes only. SyslogLevel can also be set to 1 for minimum logging or 0 to disable DMD syslog messages entirely.

c. Ensure that filter logging controls are set appropriately for IP security filters.
   - Filter logging generates a message each time an inbound or outbound packet matches the filter. Exhaustive logging of IP traffic can have a negative effect on performance. Filter logging can be controlled at the individual rule level, including the ability to specify whether to log permitted traffic, denied traffic, or both.
   - To disable filter logging for profile filter rules:
     - To disable logging for a configured filter rule, set NOLOG on the IPSECRULE or IPSEC6RULE statement.
     - To disable logging for the implicit filter rules that deny all traffic not permitted by a configured rule, set NOLOGIMPLICIT on the IPSEC statement.
     - To disable filter logging for all profile filter rules, set LOGDISABLE on the IPSEC statement.
   - To disable filter logging for policy filter rules configured using the Policy Agent:
     - To disable logging for a configured filter rule, set IpFilterLogging No on the IpGenericFilterAction statement.
To disable logging for the implicit filter rules that deny all traffic that does not match a configured rule, set IpFilterLogImplicit No on the IpFilterPolicy statement.

To disable filter logging for all policy filter rules, set FilterLogging Off on the IpFilterPolicy statement.

To disable filter logging for policy filter rules configured with the IBM Configuration Assistant for z/OS Communications Server:

- To disable logging for a configured filter rule, set filter logging to No for the Connectivity Rule.
- To disable logging for the implicit filter rules that deny all traffic that does not match a configured rule, select Do NOT log implicit deny events on the IPSec: Stack Level Settings panel.
- To disable filter logging for all policy filter rules, select Disable all filter logging on the IPSec: Stack Level Settings panel.

The following messages are controlled by the configured filter logging settings described above:

- EZD0814I Packet permitted
- EZD0815I Packet denied by policy
- EZD0821I Packet denied, no tunnel
- EZD0822I Packet denied, tunnel inactive
- EZD0832I Packet denied by NAT Traversal Processing
- EZD0833I Packet denied, tunnel mismatch

d. Ensure that filter logging controls are set appropriately for defensive filters.

- Filter logging generates a message each time an inbound or outbound packet matches the defensive filter. Exhaustive logging of IP traffic can have a negative effect on performance. Filter logging can be controlled at the individual defensive filter rule level.
- To disable filter logging for a defensive filter rule, use the `ipsec -F update` command with log no specified.
- To limit filter logging for a defensive filter rule, use the `ipsec -F update` command with the loglimit keyword specified with a value of 1 - 9999. See the `ipsec -F` command in z/OS Communications Server: IP System Administrator's Commands for more information about the `ipsec -F update` command.

The following messages are controlled by the defensive filter's log and loglimit settings:

- EZD1721I Packet denied by defensive filter
- EZD1722I Packet would have been denied by defensive filter

e. Ensure that IP security and defensive filter messages being logged by the TRMD daemon are being handled appropriately.

- The TCP/IP stack invokes the TRMD daemon to log IP security and defensive filter messages to syslog. The filter logging messages described above are logged by the TRMD daemon. TRMD also logs messages that are not associated with a specific filter. For example, when a tunnel is successfully negotiated, TRMD logs message "EZD0818I Tunnel added". Also, when an IP security policy update is processed, TRMD logs message "EZD0816I IPSec Policy updated". When a defensive filter is added to the stack, TRMD logs message "EZD1723I Defensive filter added".
- There is no explicit configuration option to turn off logging for TRMD messages that are not associated with a specific filter. However, the syslog configuration file can be updated to exclude some or all TRMD messages. See Table 59 on page 667 for information about the syslog priority used to log TRMD messages. See Table 60 on page 667 for information about the syslog priority used to log defensive filter TRMD messages.
- Include the following line in your syslog configuration file to exclude IP security TRMD messages logged with a priority of debug. IP security and defensive filter TRMD messages with
a priority of info or higher would be written to /tmp/trmdlog. Messages with a priority of debug would not be written to the file.

```plaintext
*.TRMD*.local4.info /tmp/trmdlog
```

Include the following line in your syslog configuration to exclude all IP security and defensive filter TRMD messages.

```plaintext
*.TRMD*.*.*;*.TRMD*.local4.none /tmp/trmdlog
```

All messages with job name TRMD* would be selected. Then all TRMD messages using facility local4 would be excluded. In effect this excludes all IP security and defensive filter TRMD messages from being written to /tmp/trmdlog.

### Steps for verifying IP security and defensive filter operation

Verify IP security and defensive filters operations.

**Before you begin**

Identify the characteristics of the IP traffic for which IP security operation is to be verified. The characteristics of IP traffic that are subject to IP security control are described by the IpFilterRule or IPSECRULE (for IPv4) or IPSEC6RULE (for IPv6) statement. See [z/OS Communications Server: IP Configuration Reference](https://www.ibm.com/support/docview.wss?uid=swg21385334) for more information about the IpFilterRule, IPSECRULE and IPSEC6RULE statements.

**About this task**

Figure 92 on page 671 shows the decisions involved for IP security operation.
Verify IP Security Operation

1. Identify IP Resources

2. IP Security Enabled? Yes → Activate IP Security
   No → IP Security Desired?

3. No → Done
   Yes → Defensive filtering Desired?

4. Stack configured in DMD? Yes → Add stack to DMD configuration with desired Mode
   No → Desired Mode configured in DMD?

5. Yes → Update stack in DMD configuration with desired Mode
   No → IP Filter properly configured for Resource?

6. Yes → Correct IP Filter Policy
   No → IPSec Protection Configured?

7. Yes → Verify IP Security Policy Enforced
   No → Dynamic IPSec Configured?

8. Yes → Verify Dynamic IPSec Protection
   No → Verify Manual IPSec Protection

Figure 92. Overview of verifying IP security operation
Procedure

Perform the following steps:

1. Use the Netstat CONFIG/-f command to determine whether the TCP/IP stack is configured for IP security for IPv4, IPv6, or both.

   For information about the Netstat command, see z/OS Communications Server: IP System Administrator's Commands.

   Do one of the following:
   - If the stack is not configured for IP security for the IP protocol that you want, proceed to step “2” on page 672.
   - If the stack is configured for IP security for the IP protocol that you want, proceed to step “3” on page 672.

2. If you want IP security enabled for IPv4, configure the stack for IPv4 IP security using the IPCONFIG IPSECURITY statement in the TCP/IP profile. If you want IP security enabled for IPv6, configure the stack for IPv6 IP security using the IPCONFIG6 IPSECURITY statement in the TCP/IP profile.

   See z/OS Communications Server: IP Configuration Reference for more information about the IPCONFIG IPSECURITY and IPCONFIG6 IPSECURITY statements. See z/OS Communications Server: IP Configuration Guide for general information about IP security concepts, including IP filtering.

3. Use the MODIFY command to display the configuration values for the Defense Manager daemon (DMD).

   For more information about the MODIFY command, see z/OS Communications Server: IP System Administrator's Commands.

   If you want defensive filtering enabled, do one of the following:
   - If the stack name is not listed in the DMD configuration, proceed to step “4” on page 672.
   - If the stack name is listed in the DMD configuration but does not have the mode that you want, proceed to step “5” on page 672.
   - If the stack name is listed in the DMD configuration with the mode that you want, proceed to “6” on page 672.

   Otherwise, if you do not want defensive filtering, proceed to “6” on page 672.

4. Update the DMD configuration file to include a DmStackConfig statement for the stack for which you want defensive filtering. Specify the defensive filtering mode, Active or Simulate, on the DmStackConfig statement with the stack name. See z/OS Communications Server: IP Configuration Reference for more information about the DMD configuration file. Proceed to “6” on page 672.

5. Update the DMD configuration file to specify the defensive filtering mode, Active or Simulate, on the DmStackConfig statement. See z/OS Communications Server: IP Configuration Reference for more information about the DMD configuration file.

6. Use the `ipsec -t` command to determine which IP filter applies to the identified IP packet.

   At the top of the `ipsec -t` command output, note whether Source indicates Stack Profile or Stack Policy.

   Limited IP filter controls can be configured using the IPSECRULE statement (for IPv4) and the IPSEC6RULE statement (for IPv6) in the TCP/IP profile. Full IP security capability, including manual and dynamic IPSec protection, requires use of the Policy Agent for IP security policy configuration.

   Locate the Type field in the `ipsec -t` command output to determine the type of filter. If the Type field indicates Defensive, then the filter is a defensive filter. Defensive filters are not configured but are added to the stack by the `ipsec` command. Typically, this is done by an external security information and event manager that detects an attack. However, the `ipsec` command can be issued manually by a user with the appropriate authority to add a defensive filter.

   **Tip:** The `ipsec -t` command can return multiple filter rules because the actual packet filtering compares more attributes than might be supplied as input on the `ipsec -t` command. To minimize this effect, supply as much information as possible on the `ipsec -t` command.
If the returned filter rules include a defensive filter, take the following actions:

- Locate the exclusion list at the top of the `ipsec -t` command output and determine whether there are any IP addresses listed. Traffic from IP addresses in the exclusion list will bypass defensive filters.

- Locate the Action field in the `ipsec -t` command output to determine the mode of the defensive filter. If the Action field indicates Defensive Block the filter is discarding traffic. If the Action field indicates Defensive Simulate only filter logging is done, packets continue to be processed.

- If the defensive filter rule is blocking traffic that should be allowed, determine the user that added the filter by inspecting the syslog messages. Locate the "EZD1723I Defensive filter added" defensive filter message that corresponds to this defensive filter. The userid of the user that added the filter is included in the message.

If none of the filters that are returned by the `ipsec -t` command include the action for the identified IP packet that you want, then correct the IP filter configuration. See z/OS Communications Server: IP Configuration Guide for general information about configuring IP filters.

7. Locate the Type field in the `ipsec -t` command output to determine whether IPSec protection is configured for the identified IP packet.

   If the Type field indicates Generic or Defensive, then IPSec protection is not configured for the identified IP packet. See “Steps for verifying IP security policy or defensive filter enforcement” on page 678 to verify that the configured policy is enforced for the IP traffic characterized by the identified IP packet.

8. Locate the Type field in the `ipsec -t` command output to determine whether manual or dynamic IPSec protection is configured for the identified IP packet.

   If the Type field indicates Manual, then see “Steps for verifying manual IPSec protection” on page 673. If the Type field indicates Dynamic or Dynamic Anchor, then see “Steps for verifying dynamic IPSec protection” on page 675.

Results

Steps for verifying manual IPSec protection

Verify manual IPSec protection.

Before you begin

Complete the steps in “Steps for verifying IP security and defensive filter operation” on page 670 in order to identify the name of an IpFilterRule for which manual IPSec protection is to be verified.

About this task

Figure 93 on page 674 shows the decisions involved for verifying manual IPSec protection.
Verify Manual IPSec Protection

Procedure

Perform the following steps:

1. Verify that manual filters that correspond to the identified IpFilterRule are installed in the stack by using the `ipsec -f display -n` command.
   
   Two filters of type Manual (1 inbound and 1 outbound) are installed in the stack for an IpFilterRule that is configured with IpManVpnAction. If the manual filter rules are not installed in the stack, then correct the IP filter policy. An IpFilterRule might be inactive (not installed) in the stack due to an IpTimeCondition. For information about the `ipsec` command, see z/OS Communications Server: IP System Administrator's Commands. See z/OS Communications Server: IP Configuration Reference for more information about the IpManVpnAction and IpTimeCondition statements.

   If IP filter rules are not installed, also verify that Policy Agent is active.

2. Obtain the IpManVpnAction name by locating the VpnActionName field in the `ipsec -f` command output.
This is the name of the IpManVpnAction policy configuration statement. Obtain the manual tunnel ID by locating the TunnelID field in the `ipsec -f display` command output. The Tunnel ID for a manual tunnel has a value of M, followed by a positive integer.

3. Verify that the manual tunnel is active.

   Use the `ipsec -m display -a` command, supplying the manual tunnel ID.

   Locate the State field in the `ipsec -m` command output and confirm that it indicates Active. If the manual tunnel is not active, then activate the tunnel using the `ipsec -m activate` command. You might consider updating the IpManVpnAction policy configuration statement to specify `Active yes`, if it is not already specified. A setting of `Active yes` causes the manual tunnel state to be set to active when the manual tunnel is installed in the stack, without the additional step of issuing `ipsec -m activate`.

   If you are using the IBM Configuration Assistant for z/OS Communications Server to configure, you can choose to automatically activate manual tunnels within each Connectivity Rule.

4. Contact the remote security endpoint's network administrator to ensure that the manual tunnel has been activated remotely.

   For traffic to flow through a manual tunnel, the remote security endpoint must also activate the manual tunnel.

5. Verify that IpManVpnAction is enforced.

   See “Steps for verifying IP security policy or defensive filter enforcement“ on page 678.

**Steps for verifying dynamic IPSec protection**

Verify dynamic IPSec protection.

**Before you begin**

Complete the steps in “Steps for verifying IP security and defensive filter operation” on page 670 in order to identify the name of an IpFilterRule for which dynamic IPSec protection is to be verified.

**About this task**

Figure 94 on page 676 shows the decisions involved for verifying dynamic IPSec protection.
Verify Dynamic IPSec Protection

1. IKE active? (No → Start IKE Daemon, Yes → 2)
2. Dynamic Anchors Installed? (No → Correct Policy, Yes → 5)
3. Dynamic Filters Installed? (No → 2, Yes → 4)
4. Dynamic Tunnel Active? (No → Check log for errors, Yes → Verify IP Security Policy Enforced)
5. Activation Started? (No → 6, Yes → Verify IP Security Policy Enforced)
6. Phase 2 SA Started? (No → 8, Yes → Refer to Phase 2 State diagram)
7. Phase 2 SA Done? (No → Check log for errors, Yes → Refer to Phase 2 State diagram)
8. Phase 1 SA Started? (No → 9, Yes → Refer to Phase 1 State diagram)
9. Phase 1 SA Done? (No → Check log for errors, Yes → Refer to Phase 1 State diagram)

Check log for errors

Figure 94. Overview of verifying dynamic IPSec protection

Procedure

Perform the following steps:

1. Verify that the IKE daemon is active.
   See “Steps for verifying server operation” on page 27.
   Tip: The IKE daemon binds to UDP ports 500 and 4500.
2. Use the `ipsec -f display -n` command to verify that dynamic anchor filters that corresponds to the identified `IpFilterRule` are installed in the stack.
Two filters of type Dynamic Anchor (1 inbound and 1 outbound) are installed in the stack for an IpFilterRule that is configured with an IpDynVpnAction. If the dynamic anchor filter rules are not installed in the stack, then correct the IP filter policy. An IpFilterRule might be inactive (not installed) in the stack due to an IpTimeCondition. For information about the `ipsec` command, see z/OS Communications Server: IP System Administrator's Commands. See z/OS Communications Server: IP Configuration Reference for more information about the IpDynVpnAction and IpTimeCondition statements. If IP filter rules are not installed, also check the following:

- Verify that policy agent is active.
- If policy agent is active, verify that the following messages appeared after IKED was started:

```
EZD1058I IKE STATUS FOR STACK stackname IS UP
EZD1068I IKE POLICY UPDATED FOR STACK stackname
```

If these messages did not appear, check the Policy Agent log for errors.

3. Use the `ipsec -f display -n` command to verify that the dynamic filters are installed in the stack.

When the IKE daemon completes a dynamic tunnel negotiation, it installs two dynamic filters to more specifically control the IP traffic that can be permitted through the dynamic tunnel.

The dynamic filters are identified with a Type field of Dynamic in the `ipsec` command output.

Do one of the following:

- If no dynamic filters are installed in the stack with the identified IpFilterRule name, then proceed to step “5” on page 677.
- If the dynamic filters are installed in the stack, then proceed to step “4” on page 677.

4. Verify that the dynamic tunnel that corresponds to the dynamic filters is active.

The IKE daemon installs a dynamic tunnel and corresponding inbound and outbound dynamic filters into the stack.

Follow these steps to perform verification:

a. Locate the dynamic tunnel ID in the TunnelID field of the `ipsec -f` command output.

   **Tip:** Be sure to look for the TunnelID identified on the filter rule with type Dynamic, rather than the filter rule with type Dynamic Anchor.

b. Use the `ipsec -y display -a` command, supplying the dynamic tunnel ID.

c. Locate the State field in the `ipsec -y` command output and confirm that it indicates Active. If the dynamic tunnel is not active, then check the IKE syslogd output for errors. Otherwise, see “Steps for verifying IP security policy or defensive filter enforcement” on page 678.

5. If no dynamic filters have been installed in the stack, then the dynamic tunnel activation might not have been started.

Consider whether you need to activate the tunnel.

- If you intend to manually start the tunnel, then you must issue the `ipsec -y activate` command. If you intend for the tunnel to be automatically activated, you must configure your LocalDynVpnPolicy to include a LocalDynVpnRule with AutoActivate Yes specified.
- If you intend for the tunnel to be activated on demand by outbound traffic, then you must configure AllowOndemand Yes on either your IpFilterPolicy or on an IpLocalStartAction associated with the IpFilterRule identified in step “2” on page 676, and you must also set the outbound traffic flow to trigger the activation.
- If the tunnel is intended to be activated by the remote security endpoint, then you must configure your KeyExchangePolicy properly, and the remote security endpoint must initiate the tunnel negotiation. If you know that you have not yet taken a required action to activate the tunnel, do so now. Otherwise, proceed to the next step.

See z/OS Communications Server: IP Configuration Guide for more information about activating dynamic tunnels.
6. Use the `ipsec -y display -b` command to display all dynamic tunnels known to the IKE daemon. In the `ipsec` command output, search for a dynamic tunnel with an IpFilterRule name that matches the identified IpFilterRule name. If there is no such dynamic tunnel, proceed to step “8” on page 678. Otherwise, proceed to step “7” on page 678.

7. If the state of the dynamic tunnel that was identified in step “6” on page 678 is not DONE, then see “Interpreting IKEv1 daemon phase 2 SA states” on page 870 or “Interpreting IKEv2 Child SA states” on page 880.
   Otherwise, check the syslogd output for errors.

8. Use the `ipsec -k display` command to see whether there is an applicable IKE tunnel negotiation in progress.
   If not, check the log for errors. Otherwise, proceed to step “9” on page 678.

9. If the IKE tunnel state is not DONE, then note the role (initiator or responder) of the IKE tunnel and see “Interpreting IKEv1 daemon phase 1 SA states” on page 864 or “Interpreting IKEv2 IKE SA states” on page 877.
   Otherwise, check the syslogd output for errors.

**Steps for verifying IP security policy or defensive filter enforcement**
Verify IP security policy or defensive filter enforcement.

**Before you begin**
Complete the steps in “Steps for verifying IP security and defensive filter operation” on page 670 in order to identify the name of an IpFilterRule or IPSECRULE or IPSEC6RULE for which IP security policy enforcement is to be verified or the name of a defensive filter.

**About this task**
Figure 95 on page 679 shows the decisions involved for verifying IP security policy enforcement.
Verify IP Security Policy Enforcement

1. Start TRMD for the stack if it is not already active. The Traffic Regulation Management Daemon (TRMD) is required to log IP filter permits and denies.

Figure 95. Overview of verifying IP security policy enforcement

Procedure

Perform the following steps:

1. Start TRMD for the stack if it is not already active. The Traffic Regulation Management Daemon (TRMD) is required to log IP filter permits and denies.
See z/OS Communications Server: IP Configuration Reference for information about starting TRMD.

2. Display the identified filter rule using the `ipsec -f display -n` command if it is an IP security filter. Display the identified filter rule using the `ipsec -f display -N` command if it is a defensive filter. Use the instructions in the following lists to temporarily activate logging for the filter if it is not already active.


- If the displayed filter Type field is Defensive, do the following:
  - If the displayed filter Logging field is not ALL, update the defensive filter’s log setting with the `ipsec -F update` command. See z/OS Communications Server: IP System Administrator’s Commands for information about the `ipsec` command.

- If the `ipsec` command header output indicates Stack Policy, do the following:
  - If the `ipsec` command header output indicates Logging NO, temporarily specify FilterLogging On on the IpFilterPolicy statement. If you are using the IBM Configuration Assistant for z/OS Communications Server to configure, select Enable filter logging on the IPSec: Stack Level Settings panel.
  - If the displayed filter Logging field is not ALL, specify IpFilterLogging Yes on the IpGenericFilterAction referenced by the IpFilterRule. If you are using the IBM Configuration Assistant for z/OS Communications Server to configure, set filter logging to Yes in each Connectivity Rule.
  - Use the MODIFY command with the Policy Agent to activate your changes, if any. See z/OS Communications Server: IP System Administrator’s Commands for more detailed information about the MODIFY command.

- If the `ipsec` command header output indicates Stack Profile, do the following:
  - If the `ipsec` command header output indicates Logging NO, specify LOGENABLE on the IPSEC statement.
  - If the displayed filter Logging field does not indicate ALL, specify LOG on the IPSECRULE or IPSEC6RULE statement.
  - Use the VARY TCPIP,,OBEYFILE command to activate your changes, if any.

3. After IP filter logging is active, check the syslog to determine whether the IP traffic that is characterized by the filter rule is being permitted or denied.

Message EZD0814I is issued when an IP packet is permitted. Message EZD0815I, EZD0821I, EZD0832I, EZD0822I, EZD0833I, or EZD1721I is issued when an IP packet is denied. If the traffic is denied, proceed to step “7” on page 681. Otherwise, proceed to step “4” on page 680.

4. If the IP traffic is being permitted, but you do not want that, correct the filter configuration.

See z/OS Communications Server: IP Configuration Guide for information about configuring IP filtering.

5. Determine whether the IP traffic is subject to IPSec protection by locating the vpnaction field in the EZD0814I message.

If the vpnaction field is not N/A then the IP traffic is subject to IPSec protection. If IPSec protection is not applied, then proceed to step “8” on page 681. Otherwise, proceed to step “6” on page 680.

6. Determine the properties of the IPSec tunnel by first locating the tunnelID field in the EZD0814I message.

Apply the following criteria to evaluate the tunnelID:

- If the first character of the tunnelID is M, use the `ipsec -m display -a` command to display the corresponding manual tunnel. If the displayed manual tunnel does not have the characteristics that you want, correct the IpManVpnAction statement. See z/OS Communications Server: IP Configuration Reference for information about the IpManVpnAction statement.

If you are using the IBM Configuration Assistant for z/OS Communications Server to configure, the IpManVpnAction corresponds to a Security Level implementing Manual Tunnels. If Security Level
does not contain the characteristics that you want, correct the Security Level. See the IBM
Configuration Assistant for z/OS Communications Server online help for additional information.

- If the first character of the tunnelID is Y, use the \texttt{ipsec -y display -a} command to display the
  corresponding dynamic tunnel. If the displayed dynamic tunnel does not have the characteristics
  that you want, correct the IpDynVpnAction statement. See z/OS Communications Server: IP
  Configuration Reference for information about the IpDynVpnAction statement.

If you are using the IBM Configuration Assistant for z/OS Communications Server to
configure, the IpDynVpnAction corresponds to a Security Level implementing dynamic tunnels. If Security Level
does not contain the characteristics that you want, correct the Security Level. See the IBM
Configuration Assistant for z/OS Communications Server online help for additional information.

7. Data traffic cannot be initiated to the remote data endpoint in certain cases when NAT traversal
support is being used.

Message EZD0832I is issued when an attempt is made to initiate data traffic if either of these
conditions is true:

- The remote security endpoint is acting as a security gateway and a NAT was detected between the
  local security endpoint and the remote security endpoint.
- The remote security endpoint is behind a NAT device performing port translation

If not the "cannot initiate case" message, proceed to “9” on page 681.

8. If the IP traffic is not being protected with IPSec, but you want IPSec protection, correct the filter
configuration.

See z/OS Communications Server: IP Configuration Guide for information about configuring IP filtering.

Tips:

- If you defined a filter rule for this traffic but packets are matching a different filter rule, consider
  whether your filter rules are ordered correctly. The filter table is searched in sequential order, so it is
  possible that a filter rule earlier in the table is overshadowing a filter rule later in the table.
- If you defined a filter rule for this traffic and packets are matching your filter rule, consider whether
  you defined the right policy action for the filter rule. You can choose an action of deny, permit, or
  IPSec protection, with further options for IPSec protection.

9. If the IP traffic is being denied, determine what type of filter is denying the traffic.

If the IP traffic is being denied by a defensive filter, message EZD1721I is issued.

- Determine the user that added the defensive filter by locating the "EZD1723I Defensive filter added"
  message that corresponds to the deny message. The userid of the user that added the filter is
  included in message EZD1723I.
- Delete the defensive filter if it is denying traffic that should be permitted. Use the \texttt{ipsec -F delete}
  command to delete a defensive filter. See z/OS Communications Server: IP System
  Administrator's Commands for information about the \texttt{ipsec} command.

If the IP traffic is being denied by an IP security filter, correct the filter configuration to change this

Tips:

- If you defined a filter rule for this traffic but packets are matching a different filter rule, consider
  whether your filter rules are ordered correctly. The filter table is searched in sequential order, so it is
  possible that a filter rule earlier in the table is overshadowing a filter rule later in the table.
- If you change the order of two filter rules that employ dynamic IPSec protection, consider whether a
  similar change is necessary in your key exchange policy. For more information about the ordering of
  key exchange policy rules, see z/OS Communications Server: IP Configuration Guide.
- If you defined a filter rule for this traffic and packets are matching your filter rule, consider whether
  you defined the right policy action for the filter rule. You can choose an action of deny, permit, or
  IPSec protection, with further options for IPSec protection.

Diagnosing IP security and defensive filter problems 681
Steps for verifying IPSec processing on zIIP

If attempting to use the zIIP IPSECURITY support (to direct IPSec AH|ESP protocol processing to zIIP), issue the Netstat STATS/-S command while the IPSec workload is running. The inbound and outbound 'Packets Handled by zIIP' counters will be rising if IPSec workload is in fact being processed on zIIP(s). If these counters are not rising while IPSec traffic is flowing, verify (a) GLOBALCONFIG ZIIP IPSECURITY parameters are specified in the TCP/IP profile (use Netstat Config/-f to verify); and (b) zIIP(s) are configured to the z/OS image (use MVS D M=CPU command to verify).

Determining the Workload Manager service class associated with IPSec workload being processed on zIIP

To verify that the new independent enclave is being used with an appropriate WLM service class issue the SDSF ENC command or view the RMF Workload Activity report. For more information regarding the SDSF function of viewing enclaves, see z/OS SDSF Operation and Customization. For additional information regarding the RMF Workload Activity report, see z/OS RMF Report Analysis.

Tools for diagnosing IP security and defensive filter problems

This topic describes tools used to diagnose IP security and defensive filter problems.

Using the ipsec command

You can use the **ipsec** command to display information about:

- IP filter rules
- Security associations
- Port translation
- SECLASS definitions
- Matching IP filter rules for a specified traffic pattern
- Network security information of an IKE daemon's active NSS IPSec clients
- NSS IPSec clients connected to NSS servers

By default, **ipsec** commands are directed to the local system. Optionally, **ipsec** commands may be directed to remote systems (NSS IPSec clients) using the **ipsec -z** option.

**Restriction:** Management of defensive filters (**ipsec -F**) is only provided through the local **ipsec** command. Remote management using an NSS server is not supported.

**ipsec -f display**

The **ipsec -f** display command displays information about the current set of filter rules in use by a stack. The current set of filter rules will include any installed defensive filters.

You can use the options listed in Table 61 on page 682 to define the display.

<table>
<thead>
<tr>
<th>Option</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>-p</td>
<td>Directs the command to a stack other than the local default stack.</td>
</tr>
<tr>
<td>-z</td>
<td>Directs the command to an NSS IPSec client.</td>
</tr>
<tr>
<td>-c profile</td>
<td>Displays information about the set of filter rules defined on the IPSEC statement in the TCP/IP profile.</td>
</tr>
</tbody>
</table>
Filter rules that are disallowed due to time conditions do not appear in the output of `ipsec -f` display command. The `pasearch` command must be used to obtain information about such filter rules. When working with an NSS client the `pasearch` command needs to be issued on the system where the client is executing. Use the `ipsec -x` command to determine where the NSS IPSec client is executing.

Several different types of filter rules exist. By default, the `ipsec -f` display output includes information about generic, defensive, dynamic anchor, dynamic, NATT anchor, and NATT dynamic filter rules. You can use the `-h` option to display information about filter rules of type NRF. NAT resolution filter (NRF) rules are present when the remote security endpoint is behind a NAT. See z/OS Communications Server: IP Configuration Guide for an explanation of filter types.

**ipsec -F display**

The `ipsec -F` display command displays information about defensive filters.

You can use the options listed in Table 62 on page 683 to define the display.

**Table 62. ipsec -F display command options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>-p</code></td>
<td>Directs the command to a stack other than the local default stack.</td>
</tr>
<tr>
<td><code>-G</code></td>
<td>Directs the command to the Defense Manager daemon (DMD) to display global defensive filters.</td>
</tr>
</tbody>
</table>

Several different types of filter rules exist. The `ipsec -F display` output only includes defensive filters.

**ipsec -F update and ipsec -F delete**

The `ipsec -F update` command can be used to update a defensive filter. The `ipsec -F delete` command can be used to delete a defensive filter.

You can use the options listed in Table 63 on page 683 to define the update and delete values.

**Table 63. ipsec -F update or delete command options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>-p</code></td>
<td>Directs the command to a stack other than the local default stack.</td>
</tr>
<tr>
<td><code>-G</code></td>
<td>Directs the command to the Defense Manager daemon (DMD) to manage global defensive filters.</td>
</tr>
<tr>
<td><code>-N</code></td>
<td>Provides the name of the defensive filter to be updated or deleted.</td>
</tr>
</tbody>
</table>

**ipsec -m display**

The `ipsec -m` display command displays information about manual tunnels installed in the stack. Use the `-p` option to direct the command to a stack other than the default stack or the `-z` option to direct the command to an NSS IPSec client. Manual tunnels can be either active or inactive. A manual tunnel must be active before traffic matching a filter rule that uses the manual tunnel can be permitted.
Manual tunnels that are not allowed to be used due to time conditions do not appear in the output of `ipsec -m` display command. Use the `pasearch` command to obtain information about such manual tunnels.

**ipsec -k display**

The `ipsec -k` display command displays information about IKE tunnels for the default stack. This information is obtained from the IKE daemon. Use the `-p` option to direct the IKE daemon to return information about a different stack or the `-z` option to direct the command to an NSS client. An IKE tunnel must be in place before a dynamic IPSec (phase 2) security association can be negotiated by the IKE daemon.

Sometimes multiple phase 1 security associations that correspond to the same IKE tunnel can occur. By default, only information about the most current phase 1 security association for an IKE tunnel is displayed. Use the `-c` option to display information about all phase 1 security associations corresponding to an IKE tunnel.

Security associations for use by a dynamic tunnel are negotiated under the protection of a phase 1 security association. Specify the `-e` option to display information about IPSec security associations that were negotiated or that are in the process of being negotiated under the protection of a phase 1 security association.

**ipsec -y display**

The `ipsec -y` display command displays information about dynamic tunnels installed in the default stack. Use the `-p` option to direct the command to another stack or the `-z` option to direct the command to an NSS IPSec client. A dynamic tunnel must be active before traffic matching a filter rule utilizing an IpDynVpnAction can be permitted.

At times, there might be multiple IPSec security associations that correspond to the same dynamic tunnel. By default, only information about the most current IPSec security association for a dynamic tunnel is displayed. Use the `-c` option to display information about all IPSec security associations that correspond to a dynamic tunnel.

The stack only knows about IPSec security associations that have been successfully negotiated. The IKE daemon knows about IPSec security associations that have been successfully negotiated as well as those currently being negotiated. At times, it is helpful to see information about IPSec security associations that are in the process of being negotiated. The `-b` option obtains information about IPSec security associations from the IKE daemon rather than the stack.

When a stack is a target for a distributed DVIPA it might contain IPSec security associations for a dynamic tunnel that was negotiated on behalf of the distributing stack. Such security associations are known as shadow security associations. The `-s` option obtains information about shadowed security associations.

**ipsec -i**

Use the `ipsec -i` command to display the SECCLASS value assigned to interfaces defined to the default stack. The `-p` option directs the command to another stack or the `-z` option directs the command to an NSS IPSec client. The SECCLASS option of the LINK or INTERFACE statement is used to assign a security classification to an interface. The LINK or INTERFACE statement is specified in the TCP/IP profile. SECCLASS can be specified as a filtering criteria on certain IP filter rules.

**ipsec -t**

Use the `ipsec -t` command to locate active filter rules for the default stack that match a specified traffic pattern. The `-p` option directs the command to another stack or the `-z` option directs the command to an NSS IPSec client.

**ipsec -o**

Use the `ipsec -o` command to display the port translation table of the default stack. The `-p` option directs the command to another stack or the `-z` option directs the command to an NSS IPSec client. Port
translation is done as needed for TCP and UDP connections that use a dynamic security association with a remote security endpoint that is behind a NAT.

**ipsec -w**

Use the `ipsec -w` command to display network security information for each of an IKE daemon’s active NSS IPSec clients.

**ipsec -x**

Use the `ipsec -x` command to display a list of the NSS IPSec clients connected to the NSS server. Each NSS IPSec client represents a remote system made up of an IKE daemon and a TCP/IP stack. Use the client name with the `-z` option to direct any of the other `ipsec` commands to a specific client.

**Using the pasearch command**

You can use the `pasearch` commands listed in Table 64 on page 685 to display information about the IPSec policy loaded by the Policy Agent for the stack:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pasearch -v a</td>
<td>Displays all IPSec policy</td>
</tr>
<tr>
<td>pasearch -v f</td>
<td>Displays IpFilterPolicy</td>
</tr>
<tr>
<td>pasearch -v k</td>
<td>Displays KeyExchangePolicy</td>
</tr>
<tr>
<td>pasearch -v l</td>
<td>Displays LocalDynVpnPolicy</td>
</tr>
</tbody>
</table>

The `-p` option can be used to obtain policy for a specific stack. Additional pasearch options can be used to obtain a more condensed display. See z/OS Communications Server: IP System Administrator’s Commands for a complete description of the `pasearch` command syntax.

**Using syslog messages**

The IKE daemon uses syslogd to write informational messages to the local4 facility. These messages contain the following information:

- The state of the IKE daemon
- Successful and unsuccessful phase 1 and phase 2 negotiations
- Information about phase 1 and phase 2 negotiation failures

Additional IKE daemon debug information can be enabled by setting the `IKESyslog` and `PagentSyslogLevel` parameters in the IKE configuration file. See “IKE daemon debug information” on page 328 for more details and sample IKE daemon syslog output.

If you are using the IBM Configuration Assistant for z/OS Communications Server to configure, the IKE Syslog level and the Policy Agent API Syslog level can be set from the IPSec: IKE Daemon Settings panel.

The Defense Manager daemon (DMD) uses syslogd to write informational messages to the local4 facility. DMD debug information can be enabled by setting the `SyslogLevel` parameter in the DMD configuration file. For more information, see “Defense Manager daemon debug information” on page 657.

The stack uses the TRMD daemon to write informational messages. The TRMD daemon uses syslogd to write these messages to the local4 facility. To enable many of these messages, IP filter logging must be turned on at both an IP filter policy level and an individual filter rule level. See “Steps for verifying IP security policy or defensive filter enforcement” on page 678 for details about enabling IP filter logging.
Chapter 30. Diagnosing OMPROUTE problems

This topic provides information and guidance to diagnose OMPROUTE problems, and contains the following subtopics:

• “Overview” on page 687
• “Definitions” on page 689
• “Diagnosing OMPROUTE problems” on page 689
• “OMPROUTE traces and debug information” on page 701
• “Starting OMPROUTE tracing and debugging from an MVS cataloged procedure or AUTOLOG” on page 702
• “TCP/IP services component trace for OMPROUTE” on page 712
• “Commands to enable, disable, and display the status of the OMPROUTE CTRACE” on page 715

Overview

For IPv4, OMPROUTE implements the Open Shortest Path First (OSPF) protocol described in RFC 1583, "OSPF Version 2" as well as the Routing Information Protocols (RIP) described in RFC 1058, "Routing Information Protocol" (RIP Version 1) and in RFC 1723, "RIP Version 2–Carrying Additional Information" (RIP Version 2).

For IPv6, OMPROUTE implements the IPv6 OSPF protocol described in RFC 2740, "OSPF for IPv6", as well as the IPv6 RIP protocol described in RFC 2080, "RIPng for IPv6".

OMPROUTE provides an alternative to the static TCP/IP BEGINROUTES definitions. When configured properly, the MVS host running with OMPROUTE becomes an active OSPF or RIP router in a TCP/IP network. The dynamic routing protocols are used to dynamically maintain the host routing table. For example, OMPROUTE can determine that a new route has been created, that a route is temporarily unavailable, or that a more efficient route exists.

OMPROUTE has the following characteristics:

• It is a z/OS UNIX application. It requires the z/OS UNIX file system to operate.
• OMPROUTE can be started from an MVS procedure, from the z/OS shell, or from AUTOLOG. See z/OS Communications Server: IP Configuration Guide for information about OMPROUTE.
• The OMPROUTE subagent provides an alternative to DISPLAY commands for displaying IPv4 Open Shortest Path First (OSPF) protocol configuration and state information. The subagent implements the Management Information Base (MIB) variables defined in Request for Comment (RFC) 1850. The OMPROUTE subagent is controlled by statements in the OMPROUTE configuration file. For details, see z/OS Communications Server: IP Configuration Reference.
• OMPROUTE needs to be started by a RACF authorized user ID.
• OMPROUTE needs to be in an APF authorized library.
• A one-to-one relationship exists between an instance of OMPROUTE and a TCP/IP stack. OSPF/RIP support on multiple TCP/IP stacks requires multiple instances of OMPROUTE.
• All IPv4 dynamic routes are deleted from the routing table upon initialization of OMPROUTE if there are IPv4 interfaces configured to OMPROUTE as RIP or OSPF interfaces.
• All IPv6 dynamic routes (with the exception of routes learned using the IPv6 Router Discovery protocol) are deleted from the routing table upon initialization of OMPROUTE if there are IPv6 interfaces configured to OMPROUTE as OSPF or RIP interfaces.
• IPv4 Internet Control Message Protocol (ICMP) redirects are ignored when OMPROUTE is active and there are IPv4 interfaces configured to OMPROUTE as RIP or OSPF interfaces.
• IPv6 ICMP redirects are ignored when OMPROUTE is active and there are IPv6 interfaces configured to OMPROUTE as OSPF or RIP interfaces.

• OMPROUTE does not make use of the BSD Routing Parameters. Instead, the maximum transmission unit (MTU), subnet mask, and destination address parameters for IPv4 interfaces are configured using the OSPF_Interface, RIP_Interface, and Interface statements in the OMPROUTE configuration file. Also, for IPv6, OMPROUTE does not update the stack’s MTU sizes but learns them from the stack instead.

• OMPROUTE uses the MVS operator console, SYSLOGD, STDOUT, and CTRACE for its logging and tracing.
  – The MVS operator console and SYSLOGD are used for major events such as initialization, termination, and error conditions.
  – STDOUT and z/OS UNIX file system files are used for detailed tracing and debugging.
  – CTRACE is used for the following purposes:
    - Tracing the receipt and transmission of OSPF/RIP packets
    - Tracing subagent/SMTP agent packets
    - Tracing communication between OMPROUTE and the TCP/IP stack
    - Detailed tracing and debugging

  For details on using TCP/IP Services Component trace support with OMPROUTE, see “TCP/IP services component trace for OMPROUTE” on page 712 and Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

• If you want to communicate a routing protocol over an interface, configure the interface to OMPROUTE using the OSPF_INTERFACE, RIP_INTERFACE, IPV6_OSPF_INTERFACE, or IPV6_RIP_INTERFACE configuration statement.

• IPv4 interfaces that are not involved in the communication of the RIP or OSPF protocol (except VIPA interfaces) must be configured to OMPROUTE using the INTERFACE configuration statement, unless it is a non-point-to-point interface and all default values are acceptable as specified on the INTERFACE statement. All IPv4 interfaces known to the TCP/IP stack should be defined to OMPROUTE with the correct subnet mask and MTU values. For IPv4 interfaces that are not defined to OMPROUTE, OMPROUTE assigns default subnet mask and MTU values to the interfaces, with possibly undesirable results.

• IPv6 interfaces that are not involved in the communication of the OSPF or RIP protocol defaults to IPv6 generic interfaces when Global_Options Ignore_Undefined_Interfaces is coded to No (default value). The IPv6_Interface statement can be used if the IPv6 (generic) interface default values are not acceptable or you want to define additional IPv6 prefixes on the IPv6_Interface statement. If Global_Options Ignore_Undefined_Interfaces is coded to Yes, code IPv6_INTERFACE statements for all IPv6 Interfaces not involved in communication of OSPF or RIP that you want OMPROUTE to recognize.

• OMPROUTE uses a standard message catalog. The message catalog must be in the z/OS UNIX file system. The directory location for the message catalog path is set by the environment variables NLS_PATH and LANG.

• If you want OMPROUTE to completely ignore IPv4 and IPv6 interfaces that are not defined to it, code the GLOBAL_OPTIONS statement with IGNORE_UNDEFINED_INTERFACES=YES in the OMPROUTE configuration file. For details, see z/OS Communications Server: IP Configuration Guide.

• OMPROUTE is enhanced with Virtual IP Addressing (VIPA) to handle network interface failures by switching to alternate paths. The virtual routes are included in the OSPF and RIP advertisements to adjacent routers. Adjacent routers learn about virtual routes from the advertisements and can use them to reach the destinations at the MVS host.

• OMPROUTE allows for the generation of multiple, equal-cost routes to a destination, thus providing load-balancing support.

• During a temporary shortage in storage, such as CSM ECSA or CSM data space conditions or reaching the TCP/IP defined limits for ECSA or private storage, OMPROUTE temporarily suspends the route timeout processing. This is done in an attempt to prevent the loss of routing information about the local host.
OMPROUTE works best without non-replaceable static routes, and the use of non-replaceable static routes (defined using the BEGINROUTES TCP/IP configuration statement) is not recommended. Non-replaceable static routes might interfere with the discovery of a better route to the destination as well as inhibit the ability to switch to another route if the destination should become unreachable by way of the static route. For example, if you define a non-replaceable static host route through one interface and that interface becomes unreachable, OMPROUTE does not define a route to that same host through an alternate interface.

If you must define static routes, all static routes are considered to be of equal cost and non-replaceable static routes are not replaced by OSPF or RIP routes. Use extreme care when working with static routes and OMPROUTE. Set IMPORT_STATIC_ROUTES = YES on the AS_Boundary Routing or IPv6_AS_Boundary_Routing configuration statement, or both. Alternatively, set SEND_STATIC_ROUTES = YES on the RIP_Interface or IPv6_RIP_Interface configuration statement, or both. This allows the static routes to be advertised to other routers.

You can define static routes as replaceable. Unlike non-replaceable static routes, replaceable static routes are always replaced by dynamic routes learned by OMPROUTE. In other words, a replaceable static route is used only if no dynamic route is known to the destination. Replaceable static routes can be thought of as last resort routes to reach a destination when no dynamic route is known.

Definitions

OMPROUTE must be defined correctly to TCP/IP. For detailed information about TCP/IP definitions, see the information about configuring OMPROUTE in z/OS Communications Server: IP Configuration Reference.

Diagnosing OMPROUTE problems

Problems with OMPROUTE are generally reported under one of the following categories:

- Abends
- OMPROUTE connection problems
- Routing failures
- Adjacency failures
- Malformed and unexpected packets

These categories are described in the following topics.

Abends

An abend during OMPROUTE processing should result in messages and error-related information being sent to the system console. A dump of the error is needed unless the symptoms match a known problem. If a dump was not taken, ensure the Language Environment run-time options TRAP(ON,NOSPIE) TERMTHDACT(UAIMM) are set for OMPROUTE.

OMPROUTE connection problems

OMPROUTE connection problems are reported when OMPROUTE is unable to connect to TCP/IP or to one of the ports required for OSPF or RIP communication. These problems are generally caused by an error in the configuration or definitions in TCP/IP.

In a common INET environment (multiple stacks), OMPROUTE attempts to connect to a stack whose name is determined by the TCPIPjobname keyword in the resolver configuration data set or file. If OMPROUTE cannot determine the TCPIPjobname, it uses a default of INET. If OMPROUTE cannot communicate with the stack pointed to by TCPIPjobname or is unable to initialize its required ports, it issues an error message describing the problem and then terminates.
Routing failures

Routing problems are usually the result of outages in a network and a lack of alternative routing paths available for recovery. See “Steps for verifying IP routing to a destination when not using policy-based routing” on page 28 and “Steps for diagnosing problems with IP routing to a destination when using policy-based routing” on page 30 for help with diagnosing routing failures.

Table 65 on page 690 describes command terms used in this section.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NETSTAT ROUTE</td>
<td>Refers to the Netstat ROUTE/-r command and the netstat route commands used on other platforms.</td>
</tr>
<tr>
<td>OMPROUTE RTTABLE</td>
<td>Refers to the D TCPIP,tcpijobname,OMPROUTE,RTTABLE command for displaying OMPROUTE IPv4 route tables.</td>
</tr>
<tr>
<td>OMPROUTE RT6TABLE</td>
<td>Refers to the D TCPIP,tcpijobname,OMPROUTE,RT6TABLE command for displaying OMPROUTE IPv6 route tables.</td>
</tr>
<tr>
<td>PING</td>
<td>Refers to z/OS UNIX ping, TSO PING, and the ping commands used on other platforms.</td>
</tr>
<tr>
<td>Traceroute</td>
<td>Refers to z/OS UNIX traceroute, TSO TRACERTE, and the traceroute commands used on other platforms.</td>
</tr>
</tbody>
</table>

Analyzing routing failures

Guidelines: When analyzing routing failures, follow these guidelines:

- Make sure that the address used in attempting to contact the remote host is a valid IP address.
- Make sure routing is possible in both directions. For most TCP/IP communication, two-way routing is required. The origin must have routes to reach the destination, and the destination must have routes to reach the origin. If NETSTAT ROUTE at the origin shows correct routing, you must also use NETSTAT ROUTE at the destination to verify that it can send replies back to the origin. If there are intermediate hops between the source and destination, all routing tables must have routing information. For example, if the origin node routing table indicates that the first hop to reach the destination is router A, then the router A routing table must also have a valid, active route to the destination, and so on. This also applies to the return route.
- Also, this is affected by SOURCEVIPA. If SOURCEVIPA is enabled at the origin of the communication, then the destination and all intermediate hops must be able to route back to the VIPA.
- If the NETSTAT ROUTE output on the source, the destination, or an intermediate hop does not show the expected routes, do one or more of the following:
  - Make sure that the routers involved in providing routing information are operational and participating in the correct routing protocol.
  - Make sure that the necessary physical connections are active.
  - Use the OMPROUTE DISPLAY commands described in z/OS Communications Server: IP System Administrator’s Commands to determine whether anything in the configuration or current state of OMPROUTE has caused the unexpected NETSTAT ROUTE information.
Documenting routing failures
You should gather documentation described in “Documentation for the IBM Support Center” on page 39 for initial diagnosis of all routing failures. If dynamic routing is being provided by OMPROUTE and the expected dynamic routes have not been installed in the stack route table, the following documentation should also be available:

- MVS system log
- SYSLOGD
- The data set containing OMPROUTE trace and debug information. If OMPROUTE trace and debug information is being redirected to the OMPROUTE CTRACE internal buffer, this buffer is included in a dump of the OMPROUTE address space. For details, see “OMPROUTE traces and debug information” on page 701 and “TCP/IP services component trace for OMPROUTE” on page 712.
- Output from OMPROUTE RTTABLE or RT6TABLE commands. If using policy-based routing, collect output for the appropriate route tables.
- Output from any other OMPROUTE DISPLAY commands used.

Adjacency failures
OMPROUTE adjacency failures are reported when OMPROUTE is unable to establish adjacency with a neighboring router, or loses an established adjacency, over one of its network interfaces. The following error messages are used to report adjacency failures:

For IPv4:

`EZZ7921I OSPF Adjacency Failure, neighbor neighbor, old state state, new state state, event event`

For IPv6:

`EZZ7954I IPv6 OSPF Adjacency Failure, neighbor neighbor, old state ostate, new state nstate, event event`

In addition to the adjacency failure message, if the futile neighbor state loop detection is enabled in OMPROUTE (Max_Adj_Attempt parameter on OSPF and IPV6OSPF statements), the following error messages will be issued to report futile neighbor state loops for the adjacency attempts:

For IPv4:

`EZZ8157I jobname IPv4 OSPF detected futile neighbor state loop with neighbor neighbor on interface interface after threshold_value adjacency attempts`

For IPv6:

`EZZ8157I jobname IPv6 OSPF detected futile neighbor state loop with neighbor neighbor on interface interface after threshold_value adjacency attempts`

If OMPROUTE is configured with redundant parallel interfaces (primary and backup) attached to the same LAN segment, OMPROUTE will try to form adjacency with a neighboring designated router over the alternate redundant interface when the futile neighbor state loop has been detected on the problematic interface. The following informational messages will be issued to report the interface changes:

For IPv4:

`EZZ8158I jobname IPv4 OSPF could not establish adjacency on interface interface1 - attempting to establish adjacency on interface interface2`

For IPv6:

`EZZ8158I jobname IPv6 OSPF could not establish adjacency on interface interface1 - attempting to establish adjacency on interface interface2`
For information about the Max_Adj_Attempt parameter, see the OMPROUTE topic in z/OS Communications Server: IP Configuration Reference.

For information about futile neighbor state loops, see the topic about network design considerations with z/OS Communications Server in z/OS Communications Server: IP Configuration Guide.

OMPROUTE adjacency failures can also occur during the processing of received OSPF packets that are malformed or unexpected. For example, a neighboring router can be sending an incorrectly built Link State Advertisement (LSA) or sending an unexpected AS External LSA for a stub area to OMPROUTE. For more information, see “Malformed and unexpected packets” on page 699.

Analyzing adjacency failures

An adjacency failure is reported by the neighbor event code in the OMPROUTE informational message provided. The events that are associated with adjacency failures are indicated by codes 7 – 15:

Table 66. Neighbor event codes

<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hello received</td>
<td>OMPROUTE received hello packets from a neighbor.</td>
</tr>
<tr>
<td>2</td>
<td>Start sending hellos</td>
<td>OMPROUTE is ready to start sending hello packets to a neighbor.</td>
</tr>
<tr>
<td>3</td>
<td>Two-way communication</td>
<td>OMPROUTE reached bidirectional communication with a neighbor. The neighbor and OMPROUTE received and acknowledged hello packets from each other.</td>
</tr>
<tr>
<td>4</td>
<td>Ready to form adjacency</td>
<td>OMPROUTE is ready to establish adjacency with a neighbor.</td>
</tr>
<tr>
<td>5</td>
<td>Master/slave role negotiation is done</td>
<td>OMPROUTE completed negotiating the master and slave roles with a neighbor. This signals the start of sending and receiving of database descriptor packets.</td>
</tr>
<tr>
<td>6</td>
<td>Database exchange is done</td>
<td>OMPROUTE completed exchanging the database descriptor packets for the network topology information. Each router now knows which part of its link state database (LSDB) is outdated.</td>
</tr>
<tr>
<td>7</td>
<td>Sequence number mismatch</td>
<td>OMPROUTE received a sequence number mismatch in a database descriptor packet. A neighbor might be attempting to restart the adjacency for some reason, resulting in sequence number mismatches. This event indicates that the neighbor was not receiving hello packets from OMPROUTE, experienced event 12 on its side, and is trying to restart.</td>
</tr>
<tr>
<td>8</td>
<td>Bad link state request</td>
<td>OMPROUTE received a bad Link State request (LSA) packet from a neighbor. A subverted router in the network possibly modified the contents of an LSA to result in maximum sequence number or maximum age attacks. From the LSA floods, the neighbors replace the good LSA with the bad LSA as newer in their databases until they naturally age out in a maximum of 1 hour.</td>
</tr>
<tr>
<td>Event</td>
<td>Description</td>
<td>Explanation</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>9</td>
<td>Loading is done</td>
<td>OMPROUTE completed the loading of the link state information for the link state database, which is based on the link state request packets from a neighbor.</td>
</tr>
<tr>
<td>10</td>
<td>One-way communication only</td>
<td>OMPROUTE does not see its router ID in the hello packets that are received by a neighbor. If a neighbor is not receiving the hello packets with the OMPROUTE router ID, it assumes that OMPROUTE is down and removes the OMPROUTE router ID from its list of neighbors. The neighbor does not include the OMPROUTE router ID in the hello packets sent to OMPROUTE.</td>
</tr>
<tr>
<td>11</td>
<td>Neighbor is down</td>
<td>Because the OMPROUTE routing interface is down, it is unable to communicate with a neighbor over that interface. The neighbor is set to down state.</td>
</tr>
<tr>
<td>12</td>
<td>No hellos were seen recently</td>
<td>OMPROUTE did not receive hello packets from a neighbor for a full DEAD_ROUTER_INTERVAL and as a consequence, OMPROUTE assumes that the neighbor is down.</td>
</tr>
<tr>
<td>14</td>
<td>Start adjacency establishment</td>
<td>OMPROUTE starts to establish an adjacency with a neighbor after it reaches bidirectional communication with the neighbor. OMPROUTE sends database descriptor packets to negotiate master or slave status with the neighbor to establish an adjacency.</td>
</tr>
<tr>
<td>15</td>
<td>Failure to thrive</td>
<td>OMPROUTE was trying to establish adjacency with a neighbor but failed to complete within the DB_EXCHANGE_INTERVAL.</td>
</tr>
<tr>
<td>16</td>
<td>Adjacency attempts threshold is reached</td>
<td>OMPROUTE has reached the futile neighbor state loop threshold (DR_MAX_ADJ_ATTEMPT) for adjacency attempts with a neighbor. For more information about the actions to be taken, see Preventing futile neighbor state loops during adjacency formation in z/OS Communications Server: IP Configuration Guide.</td>
</tr>
</tbody>
</table>

With the neighbor event code, the old neighbor state indicates the highest neighbor state that OMPROUTE reached for the adjacency attempt and the new neighbor state indicates the changed state. When OMPROUTE cannot reach the two-way state (8) or loses the bidirectional communication with a neighboring router, OMPROUTE reverts to the lesser neighbor states 1-4. On non-multiaccess networks such as point-to-point links, OMPROUTE attempts to reach full adjacency with all neighboring routers. On multiaccess networks such as LANs (including HiperSockets LANs), OMPROUTE attempts to reach full adjacency only with neighbors that are designated routers or backup designated routers. If OMPROUTE is the designated router or the backup designated router on a multiaccess network, it attempts to reach full adjacency with all neighbors.

**Guideline:** OMPROUTE is not intended to be a designated router or a backup designated router on multiaccess networks that include dedicated routers. The dedicated routers can provide the designated router function. Configure OMPROUTE to assume the designated router role only when no dedicated routers are available, such as in a HiperSockets LAN in which all the neighbors are z/OS LPARs.
Starting at the two-way state for bidirectional communication, the neighbor states 8 – 128 are used by OMPROUTE in attempts to reach full adjacency with a neighboring router, as shown in the following table:

Table 67. Neighbor states

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 1     | Neighbor is down or unreachable | No hello packets are received by the neighbor. Possible causes are as follows:  
• The routing interface in OMPROUTE is down  
• The neighbor is inactive  
• The neighbor is not OSPF-enabled  
• The neighbor is not sending hello packets with its unique router ID and matching attributes (hello interval, dead router interval, subnet mask, area ID, and security scheme)  
• Hello packets were dropped between OMPROUTE and the neighbor  
• Hello packets are corrupted |
| 2     | Attempting to contact neighbor    | OMPROUTE sent hello packets to the network but no hello packets were received from a neighbor. This state is valid only for manually configured neighbors in a non-broadcast multiaccess (NBMA) environment. For possible causes, see state 1. |
| 4     | One-way communication           | OMPROUTE received hello packets from a neighbor with the router ID of the neighbor. If OMPROUTE remained in this state, acknowledgments to hello packets that contain the OMPROUTE router ID were not received from the neighbor. Possible causes are as follows:  
• The neighbor did not receive the hello packets from OMPROUTE that contain its router ID  
• The neighbor is not including the OMPROUTE router ID in its hello packets that are sent to OMPROUTE  
• Hello packets were dropped between OMPROUTE and the neighbor  
• Hello packets are corrupted  
• New designated router must be reelected after lost communications with designated router and backup designated router |
<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 8     | Two-way communication         | The neighbor and OMPROUTE received and acknowledged hello packets from each other. In the list of neighbors, OMPROUTE has the neighbor router ID and the neighbor has the OMPROUTE router ID as learned from the hello packets. If OMPROUTE remained in or reverted to this state during the adjacency formation, possible causes are as follows:  
  • Neither OMPROUTE or the neighbor is the designated router or backup designated router for the network. On a multiaccess network, full adjacencies are established only with the designated router and its backup.  
  • A database descriptor packet is received with:  
    – Mismatched sequence number  
    – Unexpected init bit set  
    – Options field differs from the last Options field received  
  • Acknowledgments to database descriptor packets were dropped between OMPROUTE and the neighbor. |
| 16    | Database exchange start       | OMPROUTE is negotiating master and slave roles with a neighbor. Designated routers and backup designated routers establish a master-slave relationship and choose the initial sequence number for the adjacency formation. The neighbor with the higher router ID becomes the master and starts the exchange. The master is also responsible for the sequence number increment. If OMPROUTE remained in this state, possible causes are as follows:  
  • Mismatched interface maximum transmission unit (MTU) values between OMPROUTE and the neighbor result in packet losses  
  • Duplicate router IDs on neighbors  
  • Access list is blocking the unicasts  
  • NAT translating the unicasts |
Table 67. Neighbor states (continued)

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 32    | Database exchange | OMPROUTE is exchanging database information with a neighbor in the form of database descriptor packets. These packets contain LSA headers only and describe the contents of the entire link state database (LSDB). Each database descriptor packet has a sequence number that only the master can increment and that the slave explicitly acknowledges. The packet contents that are received are compared with the information contained in the LSDB for new or more current link state information. Routers also send link state request packets and link state update packets that contain the entire LSA. If OMPROUTE remained in this state, possible causes are as follows:  
  • Corrupted database descriptor packets that are sent by a neighbor or by a network switch  
  • See state 16 for other possible causes |
| 64    | Loading           | OMPROUTE is requesting newer pieces from a neighbor database that are more up-to-date in the form of link state request packets. Based on the information that the database descriptor packets provide, routers send link state request packets. The neighbor then provides the requested link state information in link state update packets. During the adjacency formation, if a router receives an outdated or missing LSA, it requests that LSA by sending a link state request packet. All link state update packets are acknowledged. If OMPROUTE remained in this state, possible causes are as follows:  
  • Corrupted link state request packets that are sent by a neighbor or by a network switch  
  • See state 16 for other possible causes |
| 128   | Full              | OMPROUTE established full adjacency with a neighbor. Routers achieve the full state with their designated router and backup designated router only, and neighbors always see each other as two-way state (8). |

The order of the neighbor transit states for establishing adjacency is 8, 16, 32, 64, and 128. Whenever a problem is detected for some reason between those states before full adjacency is reached, OMPROUTE resets the neighbor state to two ways (8) and repeats the process on a continuous basis even to the point where it becomes futile. A futile neighbor state loop is seen as a successive repetitive pattern of transit states and ones that do not seem to reach full adjacency. For example, typical patterns are: 8-16, 8-16 or 8-16-32, and 8-16-32. After each adjacency failure, OMPROUTE continues to attempt to establish adjacency with a neighbor over the same network interface. If futile neighbor state loop detection is enabled and if there are redundant parallel interfaces (primary or backup) attached to the same LAN segment available, OMPROUTE suspends the problematic interface and tries the adjacency attempt over the alternative interface again. The other option is to use the MODIFY OMPROUTE commands to manually suspend and activate an alternative redundant parallel OSPF interface so that adjacency with the neighbor is attempted over that interface.
For information about futile neighbor state loops, see the topic about network design considerations with z/OS Communications Server in z/OS Communications Server: IP Configuration Guide. For details about MODIFY OMPROUTE commands, see z/OS Communications Server: IP System Administrator’s Commands.

OMPROUTE can drop adjacencies under the following conditions:

- Other workloads on the z/OS system keep OMPROUTE from dispatching enough processor cycles:
  - Dumps are being taken while OMPROUTE is running. All address spaces are marked non-dispatchable during a dump processing. If the dump takes longer than a DEAD_ROUTER_INTERVAL, the adjacencies fail.
  - There are too many other address spaces that are running at a higher priority than OMPROUTE. Because OMPROUTE is a time-sensitive application and manages the TCP/IP routing table, set the OMPROUTE priority to be one less than the TCP/IP dispatching priority. If you are using WLM goal modes, place OMPROUTE in the same service class as TCP/IP.

- Not enough dispatching for OMPROUTE:
  - The dispatching priority for OMPROUTE is too low. Either increase the OMPROUTE dispatching priority or increase the DEAD_ROUTER_INTERVAL values.
  - OMPROUTE is running as a BPXBATCH program. Because there are other applications that are using the BPXBATCH program, they might steal processor cycles from OMPROUTE. Change OMPROUTE not to use the BPXBATCH program.

- Increased workload in OMPROUTE:
  - OMPROUTE is a designated router or a backup designated router, and link state database management-related tasks can contribute to high workloads. These tasks can affect OMPROUTE in processing of inbound hello packets necessary to maintain adjacencies with its neighbors. Either increase the DEAD_ROUTER_INTERVAL values or change the ROUTER_PRIORITY values to reduce the likelihood of OMPROUTE becoming elected as a designated router. A z/OS system is not designed to be a full-fledged router and it is best to offload this work of link state database management to the neighboring network routers. That is, configure the network routers on the attached LAN segment to be elected as designated routers when possible.
  - OMPROUTE is running with too much tracing. OMPROUTE debug trace with file I/O can contribute to adjacency failures (for example, missed hello packets). Use the OMPROUTE CTRACE method when possible.
  - OMPROUTE routing table is large. After OMPROUTE has more than 1000-2000 routes, adjacency failures (for example, missed hello packets) might occur because of the increased workload from processing routing table and link state updates. Configure OMPROUTE to use stub areas when possible and try to keep z/OS out of backbone areas.
  - OMPROUTE has too many adjacencies. Too many adjacencies might be notable when you are using XCF in a sysplex environment. Because of increased workload from adjacency communications, adjacency failures (for example, missed hello packets) might occur. Determine whether it is necessary for XCF interfaces to be configured to use OSPF.

- Network hardware problem:
  - Attached switch or router not functioning correctly.
  - Poor or faulty network cable connections.

A network hardware problem that is beyond detection by TCP/IP or OMPROUTE can contribute to adjacency failures and futile neighbor state loops. If futile neighbor state loop detection is enabled and if there are redundant parallel interfaces that are attached to the same LAN segment, OMPROUTE attempts adjacency with the neighbor over an alternative interface. When necessary, use the MODIFY OMPROUTE commands to manually suspend and activate an alternative redundant parallel OSPF interface so that adjacency with the neighbor is attempted over that interface. OMPROUTE might circumvent the network hardware problem by using the alternative interface.
For the symptom of missed inbound or outbound hello packets, the TCP/IP stack might not be getting dispatched often enough to forward the hello packets to or from OMPROUTE. In this case, ensure that appropriate dispatching priorities are assigned to the TCP/IP stack and OMPROUTE.

To track adjacency problems, take the following steps:

• Issue the command to display the OSPF interfaces and analyze the following fields from the report:
  – STATE for the current interface state
  – #NBRS for the total number of neighbors whose hellos were received, plus those that were configured.
  – #ADJS for the total number of neighbors in state exchange or greater. These neighbors are the neighbors with whom the router is synchronized or is in the process of synchronization.

• Issue the command to display a detailed OSPF interface and analyze the following fields from the report:
  – DESIGNATED ROUTER to determine whether OMPROUTE is a designated router or not.
  – BACKUP DR to determine whether OMPROUTE is a backup designated router or not.
  – DR PRIORITY to determine the interface router priority. A higher value indicates that this OMPROUTE is more likely to become the designated router. A value of 0 indicates that OMPROUTE can never become the designated router.
  – #NEIGHBORS for total number of neighbors whose hellos were received, plus those that were configured.
  – #ADJACENCIES for total number of neighbors in state Exchange or greater. These neighbors are the neighbors with whom the router is synchronized or is in the process of synchronization.
  – #FULL ADJS for total number of full adjacencies. This number is the number of neighbors whose state is Full (and therefore with which the router synchronized databases).
  – #MCAST FLOODS for the total number of link state updates that flooded the interface (not counting retransmissions).

• Issue the command to display the OSPF neighbors and analyze the following field from the report:
  – STATE for the current neighbor state.

• Issue the command to display a detailed OSPF neighbor and analyze the following fields from the report:
  – NEIGHBOR STATE for the current neighbor state.
  – DR PRIORITY to determine the neighbor router priority.
  – #ADJ RESETS for the total number of transitions to state ExStart from a higher state.
  – #NBR LOSSES for total number of times the neighbor made the transition to the down state.

Documenting adjacency failures

The following documentation should be available for initial diagnosis of adjacency failures:

• MVS system log
• SYSLOGD

• The data set containing OMPROUTE trace and debug information, unless trace and debug information is being redirected to the OMPROUTE CTRACE internal buffer, which is automatically included in a dump of the OMPROUTE address space. For details, see “OMPROUTE traces and debug information” on page 701.

• TCP/IP and OMPROUTE CTRACE. For information about generating an OMPROUTE Component Trace, see “TCP/IP services component trace for OMPROUTE” on page 712.

• Output from appropriate OMPROUTE DISPLAY commands as described in z/OS Communications Server: IP System Administrator’s Commands.

Use the DISPLAY TCPIP,,OMROUTE,OPTIONS command to display the global configuration options.
If using IPv4, use the following commands to display OSPF configuration, interfaces, neighbors, and routing table:

- DISPLAY TCPIP,OMPROUTE,OSPF,LIST,ALL
- DISPLAY TCPIP,OMPROUTE,OSPF, INTERFACES
- DISPLAY TCPIP,OMPROUTE,OSPF, INTERFACE,NAME=if_name
- DISPLAY TCPIP,OMPROUTE,OSPF,NEIGHBOR
- DISPLAY TCPIP,OMPROUTE,OSPF,NEIGHBOR,IPADDR=ip-addr
- DISPLAY TCPIP,OMPROUTE,RTTABLE

If using IPv6, use the following commands to display OSPF configuration, interfaces, and neighbors, and routing table:

- DISPLAY TCPIP,OMPROUTE,IPV6OSPF,ALL
- DISPLAY TCPIP,OMPROUTE,IPV6OSPF, INTERFACES
- DISPLAY TCPIP,OMPROUTE,IPV6OSPF, INTERFACE,NAME=if_name [Note: ID=if-id can be used instead of NAME parameter]
- DISPLAY TCPIP,OMPROUTE,IPV6OSPF,NEIGHBOR
- DISPLAY TCPIP,OMPROUTE,IPV6,NEIGHBOR,ID=router-id [Note: IFNAME=if_name can be used instead of ID parameter]
- DISPLAY TCPIP,OMPROUTE,RT6TABLE

- When applicable, the dumps of TCPIP and VTAM address spaces. A SLIP on OMPROUTE adjacency failing message (for example, EZZ7921I) may be used to capture the OMPROUTE trace and debug information as well as the dumps of TCPIP and VTAM address spaces at the time of the error.

**Malformed and unexpected packets**

An OSPF packet is considered malformed and is discarded if any of the following are present in the packet:

- Incorrect version in the OSPF packet header.
- Incorrect packet type in the OSPF header.
- Incorrect length value in the OSPF packet header.
- Incorrect checksum in the OSPF packet header.
- Incorrect LSA type in an LSA header.
- Incorrect length value in an LSA header.
- Incorrect checksum in an LSA header.
- Incorrect LSA age field in an LSA header.
- Incorrect LSA scope value in an LSA header.
- Incorrect prefix length value in an LSA that includes address prefixes.
- Incorrect value for the number of entries in a packet or LSA. For example, a bad number of LSAs value in a Link State Update packet, a bad number of links value in a Router LSA, or a bad number of prefixes value in a Link LSA or Intra-Area Prefix LSA.

An OSPF packet is considered unexpected and is discarded if any of the following are present in the packet:

- Unexpected AS External LSA received over an interface that is attached to an OSPF stub area.
- Unexpected AS External LSA received over a virtual link.
- Unexpected AS Scope LSA received over an interface that is attached to an OSPF stub area.
Analyzing malformed and unexpected packets

OMPROUTE issues console messages to report errors in the received OSPF packets. In addition, OMPROUTE tracks the number of malformed and unexpected packets that are received for the OSPF packet statistics. If such packets are being received, contact the manufacturer of the routing application that is sending them. The malformed packets are viewable for analysis from the following documentation:

- Network sniffer trace
- IP packet trace
- OMPROUTE trace and debug output

An IP packet trace (SYSTCPDA) can be used to obtain traces of IPv4 and IPv6 OSPF packets flowing from and into TCP/IP on a z/OS Communications Server host. The PKTTRACE statement or command enable you to trace IP packets as they enter or leave TCP/IP. The IP packets can be filtered to the OSPF protocol number by using the PROT option on the PKTTRACE statement or command.

To track the number of malformed and unexpected packets that are received, take the following steps:

- Issue the command to display detailed information about an OSPF interface and analyze the # ERR PKTS RCVD field in the report to see the total number of packets received on the interface that contained errors.
- Issue the command to display detailed information about an OSPF neighbor and analyze the # ERR LS RVCD field in the report to see the total number of advertisements received from the neighbor that were unexpected or contained errors.

Documenting malformed and unexpected packets

If the manufacturer of the routing application cannot provide documentation that indicates that it is sending the malformed or unexpected packets that are being received by OMPROUTE, the following documentation is available for initial diagnosis.

- A network sniffer trace.
- The data set that contains the IP packet trace (SYSTCPDA), unless the packet trace is being redirected to the TCP/IP address space. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for more information.
- The data set that contains OMPROUTE trace and debug information. If OMPROUTE trace and debug information is being redirected to the OMPROUTE CTRACE internal buffer, this buffer is included in a dump of the OMPROUTE address space. See “OMPROUTE traces and debug information” on page 701 for more information.
- Output from the appropriate OMPROUTE DISPLAY commands as described in z/OS Communications Server: IP System Administrator’s Commands.

If the malformed or unexpected packets that are being received are IPv4 OSPF packets, use the following commands to display your IPV4 OSPF interfaces and neighbors:

- DISPLAY TCPIP,,OMPROUTE,OSPF, INTERFACES
- DISPLAY TCPIP,,OMPROUTE,OSPF, INTERFACE,NAME=if_name
- DISPLAY TCPIP,,OMPROUTE,OSPF,NEIGHBOR
- DISPLAY TCPIP,,OMPROUTE,OSPF,NEIGHBOR,IPADDR=ip-addr

If the malformed or unexpected packets that are being received are IPv6 OSPF packets, use the following commands to display your IPv6 OSPF interfaces and neighbors:

- DISPLAY TCPIP,,OMPROUTE,IPV6OSPF, INTERFACES
- DISPLAY TCPIP,,OMPROUTE,IPV6OSPF, INTERFACE,NAME=if_name

Note: ID=if-id can be used instead of NAME=if_name

- DISPLAY TCPIP,,OMPROUTE,IPV6OSPF,NEIGHBOR
- DISPLAY TCPIP,,OMPROUTE,IPV6OSPF,NEIGHBOR,ID=router-id
**Note:** Specify IFNAME=if_name if the neighbor that is specified by the ID parameter has more than one neighbor relationship with OMPROUTE (for example if there are multiple IPv6 OSPF interfaces that connect OMPROUTE to the neighbor).

When applicable, you can use a SLIP on the OMPROUTE error message that is reporting the receipt of the malformed or unexpected packet to capture the OMPROUTE trace and debug information and the dump of the TCP/IP address space that contains the IP packet trace at the time of the error.

### OMPROUTE traces and debug information

There are many TCP/IP traces that can be useful in identifying the cause of OMPROUTE problems. OMPROUTE's use of the MVS Component Trace support is also useful (see “TCP/IP services component trace for OMPROUTE” on page 712). This section describes the OMPROUTE internal traces. OMPROUTE internal tracing and debugging can be started when OMPROUTE is started. Also, the MODIFY command can be used to start, stop, or alter OMPROUTE tracing and debugging after OMPROUTE has been started. This topic describes each of these methods.

### Starting OMPROUTE tracing and debugging from the z/OS UNIX System Services shell

If OMPROUTE is started from the z/OS UNIX System Services shell command line (using the `omproute` command), you can specify the following parameters to indicate the level of tracing or debugging that you want.

- **-tn and -6tn (where n is a supported trace level)**
  
  These options specify the OMPROUTE external tracing levels, with -tn covering both OMPROUTE initialization and IPv4 routing protocols and -6tn covering IPv6 routing protocols. These options provide information about the operation of the routing application and can be used for many purposes, such as debugging a configuration, education on the operation of the routing application, verification of test cases, and so on. The following trace levels are supported:
  
  - 1 = Informational messages
  - 2 = Formatted packet trace

- **-sn (where n is a supported debug level)**

  This option specifies the internal debugging level for the OMPROUTE subagent. It provides internal debugging information needed for debugging problems. The following level is supported:
  
  - 1 = Internal debugging messages. This turns on DPIdebug(2).

- **-dn and -6dn (where n is a supported debug level)**

  These options specify the OMPROUTE internal debugging levels, with -dn covering both OMPROUTE initialization and IPv4 routing protocols and -6dn covering IPv6 routing protocols. These options provide internal debugging information needed for debugging problems. The following levels are supported:
  
  - 1 = Internal debugging messages.
  - 2 = Unformatted hexadecimal packet trace
  - 3 = Function entry or exit trace
  - 4 = Task add or run

**Guidelines:**

- The -tn, -6tn, -dn, and -6dn options affect OMPROUTE performance. As a result, you might have to increase the Dead Router Interval on OSPF and IPv6 OSPF interfaces to prevent neighbor adjacencies from collapsing.

- The trace and debug levels are cumulative; each level includes all lower levels. For example, -t2 provides formatted packet trace and informational messages. You can enter more than one parameter
by inserting a space after each parameter, for example, `omproute -t1 -d2`, which is the trace level most often requested by support. For more information, see APAR II12026.

- Parameters can be specified in mixed case.

**Starting OMPROUTE tracing and debugging from an MVS cataloged procedure or AUTOLOG**

The OMPROUTE tracing and debugging are controlled by parameters on PARM= when OMPROUTE is started from an MVS cataloged procedure or AUTOLOG. For example:

```bash
//OMPROUTE EXEC PGM=OMPROUTE,REGION=10M,TIME=NOLIMIT,
// PARM=('POSIX(ON) ENVAR("_CEE_ENVFILE=DD:STDENV")/-t2 -d1')
```

For a description of the parameters that can be specified, see “Starting OMPROUTE tracing and debugging from the z/OS UNIX System Services shell” on page 701.

**Starting OMPROUTE tracing and debugging using the MODIFY command**

Whether you start OMPROUTE from the z/OS UNIX System Services shell or from an MVS cataloged procedure, you can use the MODIFY command to start logging or tracing, to stop logging or tracing, and to change the level of logging or tracing.

The syntax for these MODIFY commands follows:

- **MODIFY procname,TRACE=trace-level**
  Use the TRACE command to change the trace level for OMPROUTE initialization as well as IPv4 routing protocols.
  - `TRACE=0` turns off OMPROUTE tracing.
  - `TRACE=1` gives all the informational messages.
  - `TRACE=2` gives the informational messages plus formatted packet tracing.

- **MODIFY procname,TRACE6=trace-level**
  Use the TRACE6 command to change the trace level for IPv6 routing protocols.
  - `TRACE6=0` turns off OMPROUTE tracing.
  - `TRACE6=1` gives all the informational messages.
  - `TRACE6=2` gives the informational messages plus formatted packet tracing.

- **MODIFY procname,DEBUG=debug-level**
  Use the DEBUG command to change the debug level for OMPROUTE initialization as well as IPv4 routing protocols.
  - `DEBUG=0` turns off OMPROUTE debugging.
  - `DEBUG=1` gives internal debug messages.
  - `DEBUG=2` gives the same as DEBUG=1 plus hexadecimal packet tracing.
  - `DEBUG=3` gives the same as DEBUG=2 plus module entry and exit.
  - `DEBUG=4` gives the same as DEBUG=3 plus task add and run.

- **MODIFY procname,DEBUG6=debug-level**
  Use the DEBUG6 command to change the debug level for IPv6 routing protocols.
  - `DEBUG6=0` turns off OMPROUTE debugging.
  - `DEBUG6=1` gives internal debug messages.
  - `DEBUG6=2` gives the same as DEBUG6=1 plus hexadecimal packet tracing.
  - `DEBUG6=3` gives the same as DEBUG6=2 plus module entry and exit.
  - `DEBUG6=4` gives the same as DEBUG6=3 plus task add and run.
• MODIFY proname,SADEBUG=trace-level
  Use the SADEBUG command to start and stop message logging for the OMPROUTE subagent and to stop DPI tracing:
  – SADEBUG=0 stops message logging for the OMPROUTE subagent and issues DPIdebug(0) to stop DPI tracing.
  – SADEBUG=1 generates all messages by the OMPROUTE subagent and DPIdebug(2).

**Destination of OMPROUTE trace and debug output**

If the OMPROUTE CTRACE with option DEBUGTRC (or option ALL) is not enabled, then output from OMPROUTE tracing and debugging is written to the debug output destination. The debug output destination is based on the OMPROUTE_DEBUG_FILE and OMPROUTE_IPV6_DEBUG_FILE environment variables. If OMPROUTE was started without tracing enabled and OMPROUTE_DEBUG_FILE/OMPROUTE_IPV6_DEBUG_FILE is not defined and tracing is started later using the MODIFY command, the trace output destination is $TMP/omproute_debug, where $TMP is the value of the TMP environment variable.

When OMPROUTE_DEBUG_FILE is defined, the first trace file created for OMPROUTE initialization and IPv4 routing protocol tracing is named using the value coded on OMPROUTE_DEBUG_FILE. When OMPROUTE_IPV6_DEBUG_FILE is defined, the first trace file created for IPv6 routing protocol tracing is named using the value coded on OMPROUTE_IPV6_DEBUG_FILE. When either of these first files is full, the extensions are changed to 00N, where N is in the range of 1 to the number of files specified in the OMPROUTE_DEBUG_FILE_CONTROL environment variable (default 4). The current file is always the file named using the value coded on OMPROUTE_DEBUG_FILE/OMPROUTE_IPV6_DEBUG_FILE and the oldest file is the highest N value. This eliminates the danger of OMPROUTE filling the z/OS UNIX file system when tracing is active for a long time.

The size and number of debug files created can be controlled by the OMPROUTE_DEBUG_FILE_CONTROL environment variable. This allows you to adjust how much OMPROUTE trace data is saved. You tailor this parameter to your network complexity or available z/OS UNIX file system storage capacity. See z/OS Communications Server: IP Configuration Guide for details on this environment variable.

If the OMPROUTE CTRACE with option DEBUGTRC (or option ALL) is enabled, then output from OMPROUTE tracing and debugging is sent to the CTRACE facility. The OMPROUTE CTRACE facility can write trace records to an internal buffer or to an external writer. When the OMPROUTE CTRACE with option DEBUGTRC (or option ALL) is active, the normal debug output destinations are ignored. If the CTRACE is disabled, and a trace level is modified, then OMPROUTE once again follows the above rules for determining the debug output destination.

**Sample OMPROUTE trace output**

Figure 96 on page 704 is a sample OMPROUTE initialization and IPv4 routing protocol trace with descriptions for some of the trace entries:
EZZ78001 OMPROUTE starting
- EZZ7845I Established affinity with TCPCS8
- EZZ7817I Using defined OSPF protocol 89
- EZZ7838I Using configuration file: /u/user146/omproute/omproute.conf
- EZZ7883I Processing interface from stack, address 9.169.100.18, name CTC2,index 2,flags 451
- EZZ7883I Processing interface from stack, address 9.67.100.8, name CTC1,index 1,flags 451
- EZZ8023I The RIP routing protocol is Enabled
- EZZ8036I The IPv6 RIP routing protocol is Enabled
- EZZ7937I The OSPF routing protocol is Enabled
- EZZ8050I Updating BSD Route Parms for link CTC1, MTU 1024, metric 1, subnet 255.255.255.0, destination 0.0.0.0
- EZZ8057I Added network 9.67.100.0 to interface 9.67.100.8 on net 0 interface CTC1, table EZBMAIN
- EZZ8057I Added network 9.67.100.7 to interface 9.67.100.8 on net 0 interface CTC1, table EZBMAIN
- EZZ7879I No IPv4 Default Route Installed for table EZBMAIN
- EZZ81001 OMPROUTE subagent Starting
- EZZ7898I OMPROUTE Initialization Complete
- EZZ81011 OMPROUTE subagent Initialization Completed
- EZZ8011I send request to address 9.67.100.7
- EZZ8015I sending packet to 9.67.100.7
- EZZ8011I send request to address 9.169.100.14
- EZZ8015I sending packet to 9.169.100.14
- EZZ8015I sending packet to 9.67.100.7
- EZZ8012I sending broadcast response to address 9.67.100.255 in 1 packets with 1 routes
- EZZ8015I sending packet to 9.169.100.14
- EZZ8012I sending broadcast response to address 9.169.100.255 in 1 packets with 1 routes
- EZZ7908I Received packet type 1 from 9.67.100.13
- EZZ7908I Received packet type 2 from 9.67.100.13
- EZZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.67.100.0 org 9.67.100.8
- EZZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.169.100.0 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 1 id 9.67.100.8 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 5 id 9.67.100.7 org 9.67.100.8
- EZZ7879I No IPv4 Default Route Installed for table EZBMAIN
- EZZ7908I Received packet type 1 from 9.67.100.13
- EZZ7908I Received packet type 2 from 9.67.100.13
- EZZ7908I Received packet type 4 from 9.67.100.7
- EZZ7908I Received packet type 2 from 9.67.100.7
- EZZ7908I Received packet type 4 from 9.67.100.7
- EZZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.67.100.7 org 9.67.100.8
- EZZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.67.100.8 org 9.67.100.8
- EZZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.167.100.13 org 9.169.100.13
- EZZ7928I from 9.67.100.7, new LS advertisement: typ 5 id 9.67.100.0 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 5 id 9.67.100.0 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 5 id 9.169.100.0 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 5 id 9.169.100.0 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 5 id 9.169.100.0 org 9.67.100.8
- EZZ7927I from 9.67.100.7, self update: typ 5 id 9.169.100.0 org 9.67.100.8
EZZ7934I Originating LS advertisement: typ 1 id 9.67.100.8 org 9.67.100.8
EZZ7910I Sending multicast, type 4, destination 224.0.0.5 net 0 interface CTC1
EZZ7910I Sending multicast, type 3, destination 224.0.0.5 net 0 interface CTC1
EZZ7908I Received packet type 4 from 9.67.100.7
EZZ7928I from 9.67.100.7, new LS advertisement: typ 5 id 9.169.100.14 org 9.67.100.8
EZZ7927I from 9.67.100.7, self update: typ 5 id 9.169.100.14 org 9.67.100.8
EZZ7910I Sending multicast, type 2, destination 224.0.0.5 net 0 interface CTC1
EZZ7908I Received packet type 2 from 9.67.100.7
EZZ7949I Dijkstra calculation performed, on 2 area(s), table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.67.100.7, type SPF cost 1, table EZBMAIN
EZZ7934I Originating LS advertisement: typ 3 id 9.67.100.7 org 9.67.100.8
EZZ7908I Received packet type 5 from 9.67.100.7
EZZ7908I Received packet type 5 from 9.67.100.7
EZZ7910I Sending multicast, type 5, destination 224.0.0.5 net 0 interface CTC1
EZZ7934I Originating LS advertisement: typ 5 id 9.169.100.14 org 9.67.100.8
EZZ7934I Originating LS advertisement: typ 5 id 9.169.100.0 org 9.67.100.8
EZZ7934I Originating LS advertisement: typ 5 id 9.67.100.0 org 9.67.100.8
EZZ7910I Sending multicast, type 4, destination 224.0.0.5 net 0 interface CTC1
EZZ7908I Received packet type 4 from 9.67.100.7
EZZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.67.100.7 org 9.67.100.7
EZZ7910I Sending multicast, type 5, destination 224.0.0.5 net 0 interface CTC1
EZZ7934I Originating LS advertisement: typ 5 id 9.169.100.14 org 9.67.100.8
EZZ7934I Originating LS advertisement: typ 5 id 9.169.100.0 org 9.67.100.8
EZZ7934I Originating LS advertisement: typ 5 id 9.67.100.0 org 9.67.100.8
EZZ7910I Sending multicast, type 4, destination 224.0.0.5 net 0 interface CTC1
EZZ7908I Received packet type 4 from 9.67.100.7
EZZ7928I from 9.67.100.7, new LS advertisement: typ 4 id 9.67.100.8 org 9.67.100.8
EZZ7910I Sending multicast, type 2, destination 224.0.0.5 net 0 interface CTC1
EZZ7908I Received packet type 2 from 9.67.100.7
EZZ7949I Dijkstra calculation performed, on 2 area(s), table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.67.100.7, type SPF cost 1, table EZBMAIN
EZZ7934I Originating LS advertisement: typ 3 id 9.67.100.7 org 9.67.100.8
EZZ7908I Received packet type 5 from 9.67.100.7
EZZ7934I Originating LS advertisement: typ 5 id 9.169.100.13 org 9.167.100.13
EZZ7934I Originating LS advertisement: typ 5 id 9.167.100.13 org 9.167.100.13
EZZ7934I Originating LS advertisement: typ 5 id 9.167.100.13 org 9.167.100.13
EZZ7934I Originating LS advertisement: typ 5 id 9.167.100.13 org 9.167.100.13
EZZ7934I Originating LS advertisement: typ 5 id 9.167.100.13 org 9.167.100.13
EZZ7908I Received packet type 5 from 9.67.100.7
EZZ7910I Sending multicast, type 5, destination 224.0.0.5 net 0 interface CTC1
EZZ7949I Dijkstra calculation performed, on 2 area(s), table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.167.100.13, mask 255.255.255.255 via 9.67.100.7, link CTC1, metric 2, type 129, table EZBMAIN
EZZ7827I Adding stack route to 9.167.100.13, mask 255.255.255.255 via 9.67.100.7, link CTC1, metric 2, type 129, table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.167.100.13, type SPF cost 2, table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.67.100.8, type SPF cost 2, table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.67.100.8, type SPF cost 2, table EZBMAIN
EZZ7913I State change, interface 9.67.100.8, new state 16, event 1
EZZ7935I New OMPROUTE route to destination BR 9.167.100.13, type SPF cost 2, table EZBMAIN
EZZ7827I Adding stack route to 9.167.100.17, mask 255.255.255.255 via 9.67.100.7, link CTC1, metric 3, type 129, table EZBMAIN
EZZ7935I New OMPROUTE route to destination Net 9.167.100.17, type SPF cost 3, table EZBMAIN
EZ7934I Originating LS advertisement: typ 3 id 9.167.100.13 org 9.67.100.8
EZ7934I Originating LS advertisement: typ 3 id 9.167.100.8 org 9.67.100.8
EZ7934I Originating LS advertisement: typ 3 id 9.167.100.17 org 9.67.100.8

EZ7909I Sending unicast type 1 dst 9.167.100.13
EZ7910I Sending multicast, type 1, destination 224.0.0.5 net 0 interface CTC1
EZ7908I Received packet type 1 from 9.167.100.13
EZ7919I State change, neighbor 9.167.100.13, new state 4, event 1
EZ7919I State change, neighbor 9.167.100.13, new state 8, event 3
EZ7999I Sending unicast type 2 dst 9.167.100.13
EZ7908I Received packet type 2 from 9.167.100.7
EZ7928I from 9.67.100.7, new LS advertisement: typ 4 id 9.67.100.8 org 9.167.100.13
EZ7928I from 9.67.100.7, new LS advertisement: typ 3 id 9.67.100.7 org 9.167.100.13
EZ7908I Received packet type 2 from 9.167.100.13
EZ7919I State change, neighbor 9.167.100.13, new state 32, event 5
EZ7999I Sending unicast type 2 dst 9.167.100.13
EZ7910I Sending multicast, type 5, destination 224.0.0.5 net 0 interface CTC1
EZ7908I Received packet type 2 from 9.167.100.13
EZ7909I Sending unicast type 4 dst 9.167.100.13
EZ7909I Sending unicast type 5 dst 9.167.100.13
EZ7909I Sending unicast type 3 dst 9.167.100.13
EZ7909I Sending unicast type 4 dst 9.167.100.13
EZ7910I Sending multicast, type 4, destination 224.0.0.5 net 0 interface CTC1
EZ7933I Flushing advertisement: typ 3 id 9.67.100.8 org 9.67.100.8
EZ7933I Flushing advertisement: typ 4 id 9.67.100.8 org 9.67.100.8

EZ7910I Sending multicast, type 1, destination 224.0.0.5 net 1 interface CTC2
EZ7928I from 9.167.100.13, new LS advertisement: typ 1 id 9.67.100.8 org 9.67.100.8
EZ7927I from 9.167.100.13, self update: typ 1 id 9.67.100.8 org 9.67.100.8

EZ7909I Sending unicast type 4 dst 9.167.100.13
EZ7919I State change, neighbor 9.167.100.13, new state 128, event 6
EZ7999I Sending unicast type 2 dst 9.167.100.13
EZ7999I Originating LS advertisement: typ 1 id 9.67.100.8 org 9.67.100.8
EZ7910I Sending multicast, type 4, destination 224.0.0.5 net 0 interface CTC1
EZ7933I Flushing advertisement: typ 3 id 9.67.100.7 org 9.167.100.13
EZ7933I Flushing advertisement: typ 4 id 9.67.100.8 org 9.167.100.13
EZ7908I Received packet type 5 from 9.167.100.13
EZ7908I Received packet type 2 from 9.67.100.7
EZ8012I sending broadcast response to address 9.67.100.255 in 1 packets with 1 routes
EZ7908I Received packet type 5 from 9.67.100.7
EZ7908I Received packet type 1 from 9.67.100.7
EZ8004I response received from host 9.67.100.7
EZ7908I Received packet type 5 from 9.167.100.13
EZ7949I Dijkstra calculation performed, on 2 area(s), table EZBMAIN
EZ8015I sending packet to 9.169.100.14
EZ8012I sending broadcast response to address 9.169.100.255 in 1 packets with 1 routes
EZ7908I Received packet type 4 from 9.167.100.13
EZ7928I from 9.167.100.13, new LS advertisement: typ 1 id 9.167.100.13 org 9.167.100.13
EZ7908I Received packet type 4 from 9.67.100.7
EZ7928I from 9.67.100.7, new LS advertisement: typ 1 id 9.167.100.13 org 9.167.100.13
EZ7910I Sending multicast, type 5, destination 224.0.0.5 net 0 interface CTC1
EZ7999I Sending unicast type 5 dst 9.167.100.13
EZ7999I Originating LS advertisement: typ 1 id 9.67.100.8 org 9.67.100.8

EZ7895I Processing DISPLAY command - OSPF,LIST,INTERFACES
EZ7809I INTERFACE CONFIGURATION
EZ7809I IP ADDRESS AREA COST RTRNS TRNSDLY PRI HELLO DEAD
EZ7809I 9.169.100.18 0.0.0.0 1 10 1 1 20 80
EZ7809I 9.167.100.8 2.2.2.2 1 10 1 1 20 80
Diagnosing OMPROUTE problems
Figure 96. Sample OMPROUTE Trace Output

Following are brief explanations of numbered items in the trace:

1. OMPROUTE initializing (trace level 1 was specified at startup: -t1).

2. OMPROUTE learns of TCP/IP stack IPv4 interfaces.

2.5 IPv6 tracing is in the file pointed to by the OMPROUTE_IPV6_DEBUG_FILE environment variable

3. Direct routes are added for each TCP/IP stack IPv4 interface.

4. OSPF Hello packet sent out OSPF interface.

5. OSPF Interface transitions to state “point-to-point.”

6. RIP Requests & Responses begin being sent out RIP interface.

7. OSPF Hello packet received from OSPF neighbor.
OSPF neighbor transitions to state “Init.”

OSPF neighbor transitions to state “2-Way.”

OSPF neighbor transitions to state “ExStart.”

OSPF Database Description packet sent out OSPF interface.

OSPF Database Description received from OSPF neighbor.

OSPF neighbor transitions to state “Exchange.”

OSPF Link State Request packet sent out OSPF interface.

OSPF Link State Update packet received from OSPF neighbor.

Link State Advertisements from received Update packet are processed.

OSPF Link State Update packet sent out OSPF interface.

OSPF neighbor transitions to state “Full.”

OSPF Link State Acknowledgment packet received from OSPF neighbor.

OSPF Link State Acknowledgment packet sent out OSPF interface.

OSPF Dijkstra calculation is performed.

Learned route is added to TCP/IP stack IPv4 route table.

Adjacency establishment begins with router at other end of OSPF Virtual Link.

Request received to display OSPF Interface configuration information.

Request received to change IPv4 tracing level to 2 (adds formatted packets).

Request received to change IPv6 tracing level to 2 (adds formatted packets to trace output in the file pointed to by the OMPROUTE_IPV6_DEBUG_FILE environment variable).

Formatted OSPF packet.

Formatted RIP packet.

Request received to change tracing level back to 1 (-t1).

OMPROUTE learns of stopped TCP/IP IPv4 interface.

Routes over stopped interface are deleted.
Neighbor over stopped interface transitions to state “Down.”

Stopped interface transitions to state “Down.”

The following sample shows OMPROUTE IPv6 routing protocol trace with descriptions for some of the trace entries:

1. EZZ7977I Processing IPv6 interface from stack, address 1977::7, name MPCPTPV67, index 16, flags 811, flags2
2. EZZ7977I Processing IPv6 interface from stack, address fe80::542c:ed1e:1362:4d26, name MPCPTPV67, index 16, flags 811, flags2
3. EZZ78057I Added network 1977::7 to interface fe80::542c:ed1e:1362:4d26 on net 16 interface MPCPTPV67, table EZBMAIN
4. EZZ78004I response received from host fe80::846e:70a6:8ca6:48b7
5. EZZ78011I send request to address ff02::9
6. -- IPv6 RIP Packet Sent (MPCPTPV67) -- Type: Response
   Destination_Addr: ::
Following are brief explanations of numbered items in the trace:
OMPROUTE learns of TCP/IP stack IPv6 interface addresses. Each home address on an IPv6 interface is described separately; OMPROUTE uses the interface name to assign addresses to a specific interface.

Direct routes are added for each non-link-local TCP/IP stack IPv6 home address. When an interface’s home address is needed in a message, its link-local address is used unless it is a VIPA that does not have a link-local address.

IPv6 RIP Requests and Responses begin being sent out IPv6 RIP interface. Note use of link-local address when interface is being identified by address only.

IPv6 RIP Response received and associated routes added to IPv6 route table. Source address is always link-local.

Request received to change IPv6 tracing level to 2 (adds formatted packets). The operator command to set the tracing level appears in the IPv4 trace, because modify commands run on the IPv4 thread.

Formatted IPv6 RIP packet.

TCP/IP services component trace for OMPROUTE

z/OS Communications Server provides Component Trace support for the OMPROUTE application. This section describes how to specify OMPROUTE trace and formatting options. For short descriptions of other tracing procedures, such as displaying trace status, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43. Also, see “Commands to enable, disable, and display the status of the OMPROUTE CTRACE” on page 715.

For detailed descriptions, see the following information:
- z/OS MVS Diagnosis: Tools and Service Aids for information about Component Trace procedures
- z/OS MVS Initialization and Tuning Reference for information about the SYS1.PARMLIB member
- z/OS MVS System Commands for information about trace commands
- z/OS MVS Programming: Authorized Assembler Services Guide for information about procedures and return codes for CTRACE macros
- z/OS MVS IPCS Commands
- z/OS MVS IPCS User’s Guide

Specifying trace options

You can specify Component Trace options at OMPROUTE initialization or after OMPROUTE has initialized.

Specifying options at initialization

A default minimum Component Trace is always started during OMPROUTE initialization. A parmlib member can be used to customize the parameters used to initialize the trace. The default OMPROUTE Component Trace parmlib member is the SYS1.PARMLIB member CTIORA00. The parmlib member name can be changed by use of the OMPROUTE_CTRACE_MEMBER environment variable.

Tip: Besides specifying the trace options, you can also change the OMPROUTE trace buffer size. The buffer size can be changed only at OMPROUTE initialization.

The maximum OMPROUTE trace buffer size is 100 MB.

Guideline: Use of a large internal CTRACE buffer or an external writer is recommended when using the DEBUGTRC option.
Requirement: The OMPROUTE REGION size in the OMPROUTE catalog procedure must be large enough to accommodate a large buffer size.

If the CTIORA00 member is not found when starting OMPROUTE, the following message is issued:

```
IEE5381 CTIORA00 MEMBER NOT FOUND in SYS1.PARMLIB
```

When this occurs, the OMPROUTE component trace is started with a buffer size of 1 MB and the MINIMUM tracing option.

The following figure shows the SYS1.PARMLIB member CTIORA00.

```
/*******************************************************************************/
/*                                                                      */
/*  IBM Communications Server for z/OS                                   */
/*  SMP/E Distribution Name: CTIORA00                                    */
/*                                                                      */
/*  PART Name:  CTIORA00                                                  */
/*                                                                      */
/*                                                                      */
/*  Copyright:                                                          */
/*                Licensed Materials - Property of IBM                     */
/*                5694-A01                                               */
/*                (C) Copyright IBM Corp. 1998,2003                       */
/*                                                                      */
/*                                                                      */
/*  Status:       CSV1R5                                                */
/*                                                                      */
/*                                                                      */
/*  DESCRIPTION = This parmlib member causes component trace for        */
/*                the TCP/IP OMPROUTE application to be initialized      */
/*                with a trace buffer size of 1M                          */
/*                This parmlib member only lists those TRACEOPTS          */
/*                values specific to OMPROUTE.  For a complete list       */
/*                of TRACEOPTS keywords and their values see             */
/*                z/OS MVS INITIALIZATION AND TUNING REFERENCE.          */
/*                                                                      */
/*                                                                      */
/* $MAC(CTIORA00),COMP(OSPF ),PROD(TCPIP ):  Component Trace            */
/* SYS1.PARMLIB member                                                  */
/*                                                                      */
/*******************************************************************************/

TRACEOPTS
/* ---------------------------------------------------------------- */
/*   Optionally start external writer in this file (use both         */
/*   WTRSTART and WTR with same wtr_procedure)                       */
/* ---------------------------------------------------------------- */
/*   WTRSTART(wtr_procedure)                                          */
/* ---------------------------------------------------------------- */
/*   OPTIONS: NAMES OF FUNCTIONS TO BE TRACED, OR "ALL"               */
/* ---------------------------------------------------------------- */
/*        OPTIONS(                                                    */
/*                'ALL'                                              */
/*                'MINIMUM'                                           */
/*                'ROUTE'                                             */
/*                'PACKET'                                            */
/*                'OPACKET'                                           */
/*                'RPACKET'                                           */
/*                'IPACKET'                                           */
/*                'SPACKET'                                           */
/*                'DEBUGTRC'                                          */
/*        )                                                       */

Figure 98. SYS1.PARMLIB member CTIORA00
Table 68 on page 714 describes the available trace options.

<table>
<thead>
<tr>
<th>Trace event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>Select all types of records. Be aware that this option slows performance.</td>
</tr>
<tr>
<td>MINIMUM</td>
<td>Select OMPROUTE’s minimum level of tracing. Specifying MINIMUM is the same as specifying ROUTE.</td>
</tr>
<tr>
<td>ROUTE</td>
<td>Select information exchange and routing updates between the OMPROUTE application and the z/OS TCP/IP Services stack.</td>
</tr>
<tr>
<td>PACKET</td>
<td>Select all inbound and outbound packet flows. This is the same as specifying OPACKET, RPACKET, and IPACKET.</td>
</tr>
<tr>
<td>RPACKET</td>
<td>Select inbound and outbound packet flows for the IPv4 RIP and IPv6 RIP protocols.</td>
</tr>
<tr>
<td>OPACKET</td>
<td>Select inbound and outbound packet flows for the IPv4 OSPF and IPv6 OSPF protocols.</td>
</tr>
<tr>
<td>IPACKET</td>
<td>Select inbound packets sent from z/OS TCP/IP with information regarding route or interface changes.</td>
</tr>
<tr>
<td>SPACKET</td>
<td>Trace inbound and outbound packets sent between the SNMP agent and the OMPROUTE subagent.</td>
</tr>
<tr>
<td>DEBUGTRC</td>
<td>Redirects IPv4 trace (-t), IPv4 debug (-d), IPv6 trace (-6t) and IPv6 debug (-6d) output to the CTRACE facility.</td>
</tr>
</tbody>
</table>

**Guideline:** Use of a large internal CTRACE buffer or an external writer is recommended when using the DEBUGTRC option.

**Specifying options after initialization**

After OMPROUTE initialization, you must use the TRACE CT command to change the component trace options. Each time a new Component Trace is initiated, all prior trace options are turned OFF and the new options are put into effect.

You can specify the trace options with or without the PARMLIB member. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

**Formatting OMPROUTE trace records**

You can format component trace records using IPCS panels or a combination of the IPCS panels and the CTRACE command, either from a dump or from external-writer files. (For details, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.) Any combination of the following values can be entered as options to filter the CTRACE entries. The options must be entered using the format:

```
TYPE(option[,option]...)
```

- ROUTE
- OPACKET
- RPACKET
- IPACKET
• SPACKET
• DEBUGTRC

You cannot use the following as options when formatting OMPROUTE component traces:

• ALL
• MINIMUM
• PACKET

Commands to enable, disable, and display the status of the OMPROUTE CTRACE

Steps for enabling the CTRACE at OMPROUTE startup
Edit the CTIORA00 parmlib member as appropriate and start OMPROUTE with a trace level enabled.

Procedure

To enable the CTRACE at OMPROUTE startup, take the following steps:

Restriction: OMPROUTE must have READ access to the SYS1.PARMLIB data sets.

1. Edit CTIORA00 parmlib member (or the member specified in OMPROUTE_CTRACE_MEMBER environment variable) and specify TRACEOPTS ON, the desired buffer size by way of the BUFSIZE() parameter, and the desired CTRACE options.
   
   To direct the CTRACE to an external writer, also specify the name of the writer JCL procedure in the WTR() parameter. See the example CTIORA00 member.

2. Start OMPROUTE with a trace level enabled.

Steps for disabling the CTRACE at OMPROUTE startup

To disable the CTRACE at OMPROUTE startup, edit CTIORA00 or the member specified in OMPROUTE_CTRACE_MEMBER environment variable and specify TRACEOPTS OFF.

Steps for enabling the CTRACE after OMPROUTE is started

Enable the CTRACE after OMPROUTE is started.

Procedure

Perform the following steps:

1. Do one of the following:

   • Issue the following console commands to enable a CTRACE to an internal buffer:

   ```
   TRACE CT,ON,COMP=SYSTCPRT,SUB=(omproute_jobname)
   R xx,OPTIONS=(ctrace options),END
   ```

   • Issue the following console commands to enable a CTRACE to an external writer:

   ```
   TRACE CT,WTRSTART=writer_proc
   TRACE CT,ON,COMP=SYSTCPRT,SUB=(omproute_jobname)
   R xx,OPTIONS=(ctrace options),WTR=writer_proc,END
   ```

2. If DEBUGTRC or ALL is included in the CTRACE options, issue one of the following commands to modify the trace level:

   ```
   F,omproute_jobname,TRACE=x
   F,omproute_jobname,DEBUG=x
   F,omproute_jobname,TRACE6=x
   ```

   or
Requirement: This is required even if the OMPROUTE trace is already active.

Steps for disabling the CTRACE after OMPROUTE is started
Disable the CTRACE after OMPROUTE is started.

Procedure
Perform the following steps:

1. Issue the following console commands to disable a CTRACE to an internal buffer:

   TRACE CT,OFF,COMP=SYSTCPRT,SUB=(omproute_jobname)

   or

   Issue the following console commands to disable a CTRACE to an external writer:

   TRACE CT,OFF,COMP=SYSTCPRT,SUB=(omproute_jobname)
   TRACE CT,WTRSTOP=writer_proc

2. If DEBUGTRC or ALL is included in the CTRACE options, issue one of the following commands to modify the trace level:

   F,omproute_jobname,TRACE=x
   F,omproute_jobname,DEBUG=x
   F,omproute_jobname,TRACE6=x
   F,omproute_jobname,DEBUG6=x

Step for displaying the CTRACE status
To display the CTRACE status, issue the following console command:

D TRACE,COMP=SYSTCPRT,SUB=(omproute_jobname)
Chapter 31. Diagnosing X.25 NPSI problems

This topic discusses how to diagnose X.25 NPSI problems and includes the following subtopics:

- “Operation” on page 718
- “Configuration requirements” on page 719
- “Sources of diagnostic information” on page 720
- “X.25 trace examples” on page 720
- “Steps for diagnosing logon problems” on page 723
- “Session hangs” on page 724

The X.25 NPSI server uses an X.25 network or point-to-point X.25 line to transfer TCP/IP traffic. The X.25 NPSI server is a VTAM application running as a started task. Either the NPSI Generalized Access to X.25 Transport Extension (GATE) or Dedicated Access to X.25 Transport Extension (DATE) can be used. GATE is recommended because it allows NPSI to handle more details of error recovery and allows an X.25 physical link to be shared with other functions.

Details of the GATE and DATE programming interfaces are in *X.25 NPSI Host Programming*, and further diagnostic information is in *X.25 NPSI Diagnosis, Customization, and Tuning*.

Specifications for carriage of IP traffic on X.25 networks can be found in:

- **RFC 877**
  - A Standard for the Transmission of IP Datagrams Over Public Data Networks
- **X25.DOC**
  - Old DDN X.25 specifications from BBN (available by anonymous FTP from nic.ddn.mil in directory netinfo)
- **RFC 1236**
  - IP to X.121 Address Mapping for DDN
- **RFC 1356**
  - Multiprotocol Interconnect on X.25 and ISDN in the Packet Mode

Figure 99 on page 718 shows the X.25 NPSI environment.
Operation

The X.25 NPSI server uses NPSI to set up X.25 virtual circuits as needed to carry traffic to and from remote X.25 equipment. The three main functional areas shown in Figure 99 on page 718 are:

- TCP/IP interface
- NPSI interface
- IP/X.25 address mapping

IP datagrams are transferred between TCP/IP and the X.25 NPSI server on a DLC path established when a TCPIP X25NPSI device is started. The transfer protocol is similar to that used with SNALINK, with the addition of a first-hop IP address passed by TCP/IP from the relevant BEGINROUTES statement. The X.25 NPSI server uses the first hop IP address to look up an X.25 address in its destination table.

Communication with NPSI is by way of several SNA sessions. One control session is established at initialization for each MCH LU defined in a LINK statement in the X.25 NPSI server configuration data set. Commands to establish and terminate X.25 virtual circuit connections pass between the X.25 NPSI server and NPSI on the control session. See X.25 NPSI Host Programming for details of the control commands.
As new virtual circuits are established, NPSI initiates new SNA sessions with the X.25 NPSI server application by means of VTAM LOGON. IP datagrams are then exchanged with the remote equipment over the VC session until an idle timeout occurs or the VC is taken for another destination.

IP addresses are mapped to X.25 addresses by table lookup, or in the case of the DDN network, by a calculation described in RFC 1236. The X.25 NPSI server performs the lookup with the first-hop IP address on each datagram it receives from TCP/IP. The LINK and DEST entries defined in the X.25 NPSI server configuration data set are scanned in order from top to bottom to find a DEST with a matching IP address. After the DEST is found, the link it applies to is selected to carry the datagram, and the active virtual circuits on that link are scanned to find one with an X.25 address that matches the DEST. If such a VC is found, the datagram is queued for transmission on that VC; if none is found and there is a free VC, a new X.25 call is initiated; if all VCs on the link are in use, the least recently used connection is cleared, as long as it has been open for at least the minimum open time, and a new call is initiated. If no VC matches these conditions, the datagram is discarded.

**Configuration requirements**

The next two topics describe configuration considerations.

**RACF/Security Manager requirement**

The user ID assigned to the X.25 NPSI start procedure needs an OMVS Segment assigned to it.

**VTAM considerations**

- **APPL definition**
  
  The X.25 NPSI server requires AUTH=(ACQ) and PARSESS=YES in the VTAM APPL definition.

- **SWNET definition for switched circuits**
  
  - The value that is specified for MAXDATA for the PU must be at least 10 bytes greater than the value specified for the maximum packet size on the BUFFERS statement in the X.25 NPSI server configuration data set.
  
  - SSCPFSM=USSNTO and DISCNT=(YES,F) are necessary.

**NPSI considerations**

- **BUILD definition**
  
  The value specified for X25.MAXPIU must be at least 10 bytes greater than the value specified for the maximum packet size on the BUFFERS statement in the X.25 NPSI server configuration data set.

- **X25.MCH definition**
  
  - LOGAPPL can be coded for recovery.
  
  - TRAN=NO is required with GATE=DEDICAT.

- **X25.VC definition**
  
  - Permanent virtual circuits (PVCs) are not supported.
  
  - Do not code LOGAPPL except with CONNECT=YES (Fast connect).
  
  - Do not code MAXDATA except with CONNECT=YES (Fast connect).

- **X25.OUFT definition**
  
  X.25 facilities specified with X25.OUFT are not used by the X.25 NPSI server.
Sources of diagnostic information

Many problems with the X.25 NPSI server are the result of configuration faults. Check the following configuration files:

- BEGINROUTES statements, DEVICE and LINK in PROFILE.TCPIP
- The X.25 NPSI server configuration data set
- VTAM APPL definition for the X.25 NPSI server
- NPSI definitions
- VTAM SWNET definitions for NPSI

The primary diagnostic information source is the activity log produced by the X.25 NPSI server. Messages appear in the MVS system log, and can also be captured into a separate data set by including a SYSPRINT DD statement in the X.25 NPSI cataloged procedure. Normal logging records virtual circuit establishment and termination.

Additional information can be recorded about VC activity by setting the TRACE CONTROL option in the X.25 NPSI server configuration data set. This level is sufficient for almost all problem situations; interpretation of the data requires knowledge of X.25 NPSI packet formats. Tracing of the contents of IP datagrams sent to and received from NPSI is provided by the MVS CTRACE option. For details on using the CTRACE option, see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43.

VTAM buffer traces and NPSI X.25 line traces can also be useful in diagnosing difficult problem situations.

You can perform traces on the X.25 LINKNAME using the TCPIP PKTTRACE command or on the SNA LU name using the VTAM buffer trace command. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43, for details about how to use the IP packet trace facility.

X.25 trace examples

The message severity codes (last position of the message ID) are:

- **I** Information (including trace)
- **W** Warning
- **E** Recoverable error
- **S** Recoverable error
- **T** Unrecoverable error

The following example shows normal initialization:

```
EZB2111I VTAM ACB X25IP1 opened successfully
EZB2210I MCH XU038 packet level ready
EZB2451I IP AS path accepted for job name TCPIPTES
```

Initialization has four main steps:

1. The configuration file is read and processed.
2. VTAM control blocks are initialized (EZB2111I).
3. NPSI physical links (MCHs) configured by LINK statements are initialized (EZB2210I).
4. TCP/IP establishes a DLC path to the X.25 NPSI server (EZB2451I).
Normal incoming call, TRACE OFF

The following example illustrates a normal incoming call with TRACE OFF:

```
EZB2301I VC F001XU038  incoming call from 00000039 user data CC
EZB2325I VC F001XU038  facilities: pkt1024.
EZB2320I VC F001XU038  NPSI logon LU VL038001
EZB2330I VC F001XU038  call complete

...some time later...

EZB2350I VC F001XU038  call cleared, cause=00 diagnostic=C5
EZB2351I VC F001XU038  connection terminated for 00000039: sent 1 received 1 dropped 0
EZB2352I VC 010 closed
```

Notes:

1. The VC identifier F001XU038 ties together the events associated with a single virtual circuit. Messages for one VC are intermixed with messages for other VCs.
2. The X.25 address originating the call (00000039) is reported in the EZB2301I message.
3. X.25 calls can optionally request facilities to be applied, such as window size, packet size, throughput class, and reverse charging. These are reported in the EZB2325I message.
4. EZB2330I "call complete" indicates the virtual circuit is ready for transferring TCP/IP data.
5. An X.25 call can be closed by the originator, the acceptor, or the X.25 network. The cause and diagnostic codes in the EZB2350I message indicate the reason. In the example, cause=00 indicates the originator has closed the connection. Lists of cause and diagnostic codes can be found in `X.25 NPSI Diagnosis, Customization, and Tuning`.
6. EZB2351I reports the number of IP datagrams transferred on the virtual circuit.
7. After the EZB2352I "closed" message is issued, the virtual circuit is ready for reuse by another incoming call or to originate a new call.

Normal incoming call, TRACE DATA

The following example illustrates a normal incoming call with TRACE DATA:

```
EZB2230I MCH XU038  packet received (length=17)
EZB2000I 0000 .0................... 0BF00188 00000030 00000039 03420A0A
EZB2000I 0010 . CC
EZB2325I VC F001XU038  facilities: pkt1024.
EZB2302I VC F001XU038  call accept packet sent (length=6)
EZB2000I 0000 .0....           0FF00102 0400
EZB2320I VC F001XU038  NPSI logon LU VL038001
EZB2330I VC F001XU038  call complete

EZB2332I VC F001XU038  data received (length=276)
EZB2000I 0000 E........<.....}& 45000114 00100000 3C017F82 B20FFD6
EZB2000I 0010 .}.....k:.wrx-. (. 820FFD11 0800AA6B 080AF77B 72ADABBE
EZB2000I 0020 0}.f9kq.,.PF;._n 3078D6C66 B96BF118 AC85046 3B83DF6E
....data omitted for brevity...
EZB2000I 0110 =_3.            BD5F339D
EZB2333I VC F001XU038  data sent (length=277)
EZB2000I 0000 E........<.....}& 00450001 14001000 063C017F 8280FFD6
EZB2000I 0010 .}.....2.k:.wrx-. ( 1180FFFD 260000B2 6B90BAF7 7872ADAB
EZB2000I 0020 0}.f9kq.,.PF;._n B3078D0C 6B90BF12 18AC0E50 463B83DF
....data omitted for brevity...
EZB2000I 0110 =_3.            5FB5D339D

EZB2336I VC F001XU038  inactivity timer expired
EZB2337I VC F001XU038  clear request packet sent (length=5)
EZB2000I 0000 0000.00     00011300 00
EZB2365I VC F001XU038  clear sent
EZB2333I VC F001XU038  packet received (length=1)
EZB2000I 0000 0000.17     08230700 6600B8F1 18AC0E50 463B83DF
EZB2351I VC F001XU038  connection terminated for 00000039: sent 1 received 1 dropped 0
EZB2352I VC 010 closed
```
TRACE DATA can be used to record the full contents of IP datagrams as they pass through the X.25 NPSI server. The IP header begins at byte 45 (X'2D') within the IP packet. A reduced trace given by TRACE CONTROL shows only the X.25 control packets (call request, call accept, clear request, and clear confirm). See X.25 NPSI Host Programming for the detailed packet formats.

Normal outgoing call, TRACE CONTROL

The following example illustrates a normal outgoing call with TRACE CONTROL:

```
EZB2310I VC F810XU038    outgoing call to 00000039
EZB2311I VC F810XU038    call request packet sent (length=20)
EZB2000I 0000 ......h........ 0B081002 04008800 0003900 00003803
EZB2200I 0010 ...420A0ACC
EZB2230I MCH XU038    packet received (length=5)
EZB2000I 0000 ......0.          0F0810F0 01
EZB2314I VC 0810XU038    call accepted by user data
EZB2320I VC 0810XU038    NPSI logon LU VL038001
EZB2330I VC 0810XU038    call complete
EZB2336I VC 0810XU038    inactivity timer expired
EZB2353I VC 0810XU038    clear request packet sent (length=5)
EZB2000I 0000 ......0.          00011300 00
EZB2365I VC 0810XU038    clear sent
EZB2333I VC 0810XU038    packet received (length=1)
EZB2000I 0000 .                17
EZB2358I VC 0810XU038    clear confirmed
EZB2351I VC 0810XU038    connection terminated for 00000039: sent 5
received 5 dropped 0
EZB2352I VC 010 closed
```

The steps involved in outgoing and incoming calls are similar. One important difference is that the virtual circuit identifier changes when the call is accepted (compare the EZB2311I and EZB2314I messages). This is related to the details of the NPSI programming interface.

X.25 experts should note that some X.25 packets do not appear in the trace because they are generated by NPSI without the direct involvement of the host application. Clear confirm is one example. Also, the sequence of events during closing can vary slightly in normal operation, and in some instances, benign VTAM request failures can be reported with message EZB2411E.

Results of LIST command

The following example illustrates the results of the LIST command:

```
EZB2020R MCH XU038    state 1050
EZB2021R VC 010 LU VL038001 DTE 00000039    state 4050
EZB2021R VC 00F LU          DTE                 state 1010
...  
EZB2021R VC 001 LU          DTE                 state 1010
EZB2022R IP AS TCPIPTES state 80
```

The LIST command is useful to get a snapshot of virtual circuit status. This example shows a normal status with one active VC (state 4050). VC state 1010 indicates ready but not in use. With the NPSI fast connect feature, the normal idle state is 1050. Other intermediate states can appear while an X.25 call or clear is in progress. The codes are listed in z/OS Communications Server: IP Messages Volume 1 (EZA).

The status of the path to TCP/IP is shown in the last line:
- 80 is normal
- 00 indicates that the TCPIP X25 NPSI device has not been started

Termination by TCPIP STOP device

The following example illustrates termination using the TCPIP STOP device:

```
EZB2091I HALT notice accepted, type 0
EZB2250I MCH XU038    terminating
EZB2352I VC 010 closed
EZB2352I VC 00F closed
```
Steps for diagnosing logon problems

Several steps must take place successfully to establish an X.25 virtual circuit for TCP/IP activity:

1. An X.25 call request is received by the X.25 NPSI server from the X.25 network (incoming call) or is sent by the X.25 NPSI server to establish a connection to a new destination (outgoing call).

2. An X.25 call accept confirms the X.25 call request. Call accept is sent by TCPIPX25 for an incoming call, or received from the X.25 network for an outgoing call.

3. NPSI initiates an SNA session with the X.25 NPSI server application by using a VTAM LOGON.

Each of these steps is reported in the activity log, shown in the “X.25 trace examples” on page 720. Problems fall into two main areas: failure of the X.25 call itself, indicated by either a refusal or an immediate clear, or failure of the NPSI LOGON. Call failures are reported with X.25 cause and diagnostic codes. Standardized cause codes include:

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>DTE clearing. The remote system cleared the call.</td>
</tr>
<tr>
<td>01</td>
<td>Number busy. The called number cannot accept another call.</td>
</tr>
<tr>
<td>03</td>
<td>Invalid facility request. A facility that is requested by the caller is not subscribed or conflicts with a subscribed option.</td>
</tr>
<tr>
<td>05</td>
<td>Network congestion. Congestion conditions or some other problem within the network temporarily prevent the requested virtual circuit from being established.</td>
</tr>
<tr>
<td>09</td>
<td>Out of order. The called number is out of order.</td>
</tr>
<tr>
<td>0B</td>
<td>Access barred. The caller is not permitted to obtain a connection to the called number.</td>
</tr>
<tr>
<td>0D</td>
<td>Not obtainable. The called number is not assigned or is no longer assigned.</td>
</tr>
<tr>
<td>11</td>
<td>Remote procedure error. An X.25 protocol error at the remote equipment.</td>
</tr>
<tr>
<td>13</td>
<td>Local procedure error. An X.25 protocol error.</td>
</tr>
</tbody>
</table>

See X.25 NPSI Diagnosis, Customization, and Tuning for a list of diagnostic codes. X.25 networks can also have special diagnostic codes in the range 80–FF.

VC LOGON can fail for various reasons. Among the most common reasons are:

- Incorrect VTAM switched circuit definitions. IDNUM entries are error prone; SSCP FM=USSNTO and DISCNT=(YES,F) are necessary.
- A default VTAM USS table IST INC DT that is modified to include text in the message 10 entry.
- Coding LOGAPPL on the NPSI X25.VC definitions. Use LOGAPPL only on the X25.MCH and on the X25.VC with the Fast Connect feature.
- Insufficient number of type 1 LUs configured on the NCP LUDPOOL statement.
A VTAM buffer trace with ID=VTAM helps diagnose the first problem. Collect the following configuration documentation before you contact the IBM Software Support Center: X.25 NPSI server configuration data set, VTAM APPL definition for the NPSI X.25 server, NPSI definitions, and VTAM SWNET definitions for NPSI.

Session hangs

In diagnosing session hang or timeout problems, remember that TCPIPX25 does not track individual TCP sessions; it transfers only IP datagrams. One X.25 virtual circuit can carry datagrams from several TCP sessions. A VC can also be closed and reestablished several times during a TCP session with long periods of inactivity. Failure of an X.25 connection is not directly reflected in TCP sessions it might be carrying, only indirectly by TCP timeouts.

Opening a TCP session, such as a Telnet connection, can fail for reasons not specific to X.25, such as a TCP/IP routing problem caused by an incorrect BEGINROUTES definition, or an IP routing problem in the remote device. Symptoms suggesting these problems include:

- No X.25 call is made when a TCP connection is requested.
- No traffic is received from the remote equipment, indicated by a received count of zero in the EZB2351I connection terminated message.

An established TCP connection can hang because the X.25 network or remote device is down. This is indicated by a clear cause and diagnostic, as described in “Steps for diagnosing logon problems” on page 723.

Helpful hints

PING fails but Telnet and FTP connect. Setting up a new X.25 connection might take longer than the default PING timeout on a busy system. Use the PING TIMEOUT or COUNT parameters to extend the waiting time. Use the NPSI GATE Fast Connect feature to reduce connection setup time.

PING succeeds but Telnet or FTP data transfer times out. Full-screen Telnet and FTP data transfers create large IP datagrams, while PING uses smaller ones. If the small datagrams go through but large ones do not, there might be a problem with MAXDATA on the VTAM switched circuit definitions; see “Configuration requirements” on page 719 for details. Attempting to pass a datagram larger than MAXDATA on a virtual circuit hangs the VC for all subsequent traffic.

A load-dependent hang can be due to an insufficient number of virtual circuits.

The TRAFFIC command can be used to observe virtual circuit data transfer activity.

Documentation requirements

If IBM Support Center help is needed, collect the following configuration documentation before contacting IBM:

- X.25 NSPI server console log showing X.25 connections related to the problem
- X.25 NPSI server configuration data set
- PROFILE.TCPIP data set
- NPSI definitions
- VTAM SWNET definitions for NPSI
Chapter 32. Diagnosing IMS problems

This topic describes how to diagnose IMS problems, and contains the following subtopics:

- “Steps for setting up the IMS TCP/IP services socket interface system” on page 726
- “Common configuration mistakes” on page 727
- “Quick checklist for common problems” on page 728
- “Documentation references for problem diagnosis” on page 740

The IMS TCP/IP Services socket interface allows TCP/IP clients to access IMS using a TCP/IP network. This access is fully described in z/OS Communications Server: IP IMS Sockets Guide. A sockets program-to-program connection is established between a client (TCP/IP socket) program and a server (IMS application) program. TCP/IP and the Listener are agents in the connection establishment. The components of the IMS TCP/IP socket interface system are shown in Figure 100 on page 725.

Figure 100. Components of the IMS TCP/IP services socket interface system
The following list is a brief description of the component interaction and data flow that occurs when a client program requests an IMS transaction.

1. The client program starts and sends the transaction request message (TRM) to the Listener port.

2. The Listener reads the TRM and accepts the socket connection between the client program and the Listener from TCP/IP.

3. The Listener validates the TRM, prepares to give the socket connection to the IMS transaction, builds the transaction initiation message (TIM) containing the socket connection information, and sends the TIM to the IMS transaction manager message queue. For implicit IMS transactions, the Listener also reads the input data from the client program and sends it to the message queue.

4. The IMS transaction manager schedules the requested transaction.

5. IMS Transaction. This can be one of the following:

   **Implicit**
   The IMS assist module receives the TIM on behalf of the implicit IMS transaction and takes the socket connection from the Listener. The input data is read and the IMS transaction performs the required database access. The IMS assist module, on behalf of the implicit IMS transaction, writes the output data to the client program, through the socket connection, followed by the commit status message (CSM). The socket connection then closes.

   **Explicit**
   The explicit IMS transaction receives the TIM and takes the socket connection from the Listener. Input and output data is read and written as defined by the protocol, and the required database access is performed. The explicit IMS transaction writes the CSM to the client program and closes the socket connection.

   The IMS transaction and the client program terminate.

---

**Steps for setting up the IMS TCP/IP services socket interface system**

This list of steps can be used to diagnose problems in starting components by identifying the prerequisites.

**About this task**
The steps immediately preceding a step in which you are told to start a component are required to give definitions and configuration information that must be completed correctly before that component can be started. The reference keys in the steps refer to the components as shown in Figure 100 on page 725. All components except the client sockets program belong to the server host.

**Procedure**
Perform the following steps to establish the system that is described in Figure 100 on page 725.

1. **Configure TCP/IP to reserve the Listener port number.**
   A TCP/IP port should be reserved for the Listener to connect to when it starts. The following is a sample profile statement to reserve the Listener port.

   ```
   PORT 4096 TCP EZAIMSLN
   ```

   See z/OS Communications Server: IP IMS Sockets Guide for details about the PORT statement.

   2. **Configure the TCP/IP network from the server host to the client host.**

---

726 z/OS Communications Server: IP Diagnosis Guide
For the client program to issue IMS transaction requests across a socket connection, there must be a TCP/IP network defined between the client and server hosts. Any physical network supported by IBM MVS TCP/IP can be used to establish this socket connection.

See the appropriate information in z/OS Communications Server: IP Configuration Reference for details about how to configure the required network to the server host TCP/IP.

3. Start the TCP/IP address space on the server host

4. Establish and verify the network connection from the client host to the server host.

   Depending on the network connection, start or activate the required device drivers and network nodes required to establish a TCP/IP network connection.

   To verify the TCP/IP network connection, use the PING command on the client host, using the server host destination IP address or network name.

5. Define the Listener to the IMS transaction manager.

   The IMS transaction manager must be defined to expect message queue input from the Listener. For information about how to define the Listener to IMS, see the Listener IMS definitions in z/OS Communications Server: IP IMS Sockets Guide.

6. If the IMS transaction that is requested by the client program is not already written, write it.

   See z/OS Communications Server: IP IMS Sockets Guide for specific details about writing IMS transactions that can be requested by a TCP/IP client program.

7. Define the IMS transaction that is requested by the client program to the IMS transaction manager.

   The IMS transaction must be defined to IMS before the Listener can request it to be scheduled on behalf of the client program. See z/OS Communications Server: IP IMS Sockets Guide for important restrictions when defining IMS transactions.

8. Start the IMS transaction manager and the IMS database manager.

9. Complete the Listener configuration data set.

   The Listener configuration data set is read when the Listener is started. The procedure used to start the Listener (usually EZAIMSLN) uses the ddname LSTNCFG to specify the Listener configuration data set. Following is an example statement that specifies TCPIP.LISTENER.DATA as the configuration data set.

   ```
   LSTNCFG DD DSN=TCPIP.LISTENER.DATA,DISP=SHR
   ```

   This data set must contain a minimum set of required statements to specify the environment the Listener is started in and the list of IMS transactions available to client programs.

   See z/OS Communications Server: IP IMS Sockets Guide for details about the format and contents of this data set.

10. Start the Listener address space.

    The Listener is started as an MVS address space as described in z/OS Communications Server: IP IMS Sockets Guide. The JCL procedure required for starting the address space is also listed in z/OS Communications Server: IP IMS Sockets Guide.

11. Write the client program, if not already written.

    See z/OS Communications Server: IP IMS Sockets Guide for programming details about client programs that can request IMS transactions over a TCP/IP network.

12. Start the client program.

**Common configuration mistakes**

The following is a list of common configuration mistakes:

- The IMS transaction has not been defined in the Listener configuration data set.
• The Implicit or Explicit parameter in the Listener configuration data set does not match the protocol used by the IMS transaction.
• The program specification block (PSB) for the Listener does not include the ALTPCB label.
• The IMS transaction invoked by the Listener does not specify the MODE=SNGL parameter on the IMS TRANSACT macro in the IMS database manager definition. See the z/OS Communications Server: IP IMS Sockets Guide for information about restrictions on application programs.
• The IMS transaction invoked by the Listener was not defined to the IMS transaction manager as a multisegment transaction.
• The IMS transaction invoked by the Listener is an IMS conversational transaction or executes in a remote Multiple Systems Coupling (MSC) environment.

Quick checklist for common problems

The following list summarizes some initial checks that can be made quickly and are helpful in identifying the problem area.

1. Is the TCP/IP network active?
   To verify that the network to the server host is active, use the PING command on the client host, using the same IP address or host name as specified in the client program.

2. Is the Listener started and active on the server host?
   Check that the Listener address space is active and running. The MVS SDSF facility can be used to view the active address space list. Also see “Using NETSTAT” on page 741 for details about how to determine whether the Listener TCP/IP port is active.

3. Did the Listener program list any configuration errors to the SYSPRINT data set?
   Check the JCL DD statement in the Listener start procedure to identify the destination of the SYSPRINT output. See “Where to find error message documentation” on page 743 to determine the reason for any errors. The Listener address space might need to be stopped to flush any error messages to the destination.

4. Have you completed all of the required definitions. See “Steps for setting up the IMS TCP/IP services socket interface system” on page 726 for the list of required definitions and configurations.

5. Is the client program connecting to the same TCP/IP port as the Listener? See “Using NETSTAT” on page 741 for details about how to use the NETSTAT command to identify which port the Listener is connected to and which port the client program is establishing a socket connection on.

Component problems

Table 69 on page 729 lists some of the problems related to starting or stopping one of the components in the IMS TCP/IP Services socket interface system.
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| The Listener terminates on startup | 1. Incorrect configuration data set.  
2. The prerequisites for starting the Listener have not been completed.  
3. Incorrect method of starting. | 1. Check for configuration error messages written to the SYSPRINT data set and correct the problems (if any).  
2. Complete the required steps listed in “Steps for setting up the IMS TCP/IP services socket interface system” on page 726.  
3. Ensure the Listener is being started as an MVS address space as described in z/OS Communications Server: IP IMS Sockets Guide. The JCL procedure required for starting the address space is also listed in z/OS Communications Server: IP IMS Sockets Guide. |
| The Listener does not terminate | The Listener waits for all of the currently open socket connections to close before it responds to the user termination request. If any of the socket connections have hung, the Listener needs to be forcibly terminated. | Force the Listener to terminate using the command specified in the section about stopping the IMS Listener in z/OS Communications Server: IP IMS Sockets Guide.  
See “Connection problems” on page 730 for a description of how socket connections can hang. |
| As the Listener is starting, messages are written to the system console asking if IMS should be started | The IMS system should be started before the Listener. If the Listener is started first, the operator is prompted to start the IMS system. | Reply to the console messages to start IMS. |
| An implicit IMS transaction written in C is experiencing unexpected problems at startup | If IMS transaction programs written in C are not built correctly, the IMS interface fails on startup. | Build the C program correctly as specified in the section about writing an IMS TCP/IP Services server program in z/OS Communications Server: IP IMS Sockets Guide. |
| The Listener is abending while accepting the TRM | If a user-defined security exit has been linked into the Listener, it might be causing the problem. The security exit is called when validating the TRM. If the security exit has not been written to accept the required linkage and parameters, the Listener abends because the exit runs in the same address space. | Check that the security exit has been written to accept the linkage and parameters as specified in the section on the IMS security exit in z/OS Communications Server: IP IMS Sockets Guide. |
### Connection problems

Table 70 on page 730 lists some problems related to the TCP/IP socket connection. They include problems with establishing the connection, transferring data over the connection, and unexpected loss of the connection.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The client program is experiencing intermittent reject connect responses from TCP/IP</td>
<td>The TCP/IP sockets facility has a connection request backlog queue. While this queue is full, further connection attempts are rejected by TCP/IP. Under load, this queue can temporarily fill, causing some client program requests to be silently ignored.</td>
<td>To reduce the frequency of this problem, increase the size of the backlog queue. The size of the queue is controlled by a parameter in the Listener configuration data set and is limited by the SOMAXCONN statement in the TCPIP PROFILE.</td>
</tr>
<tr>
<td>The TCP/IP socket connection to the client program is being broken immediately after the implicit IMS transaction is scheduled</td>
<td>The Listener configuration data set might incorrectly define the implicit IMS transaction as explicit. In this case, the Listener does not pass the input data to the IMS transaction through the message queue as expected. The transaction starts, and upon detecting no data, immediately close the TCP/IP socket connection and terminate.</td>
<td>Verify that the TRANSACTION statements in the Listener configuration data set specify the TYPE parameter correctly.</td>
</tr>
<tr>
<td>Connection lockup for an implicit IMS transaction</td>
<td>A connection lockup occurs when both the implicit IMS transaction and the client program are waiting for data from the other end of the socket connection.</td>
<td>Use the IP packet trace facility to determine whether the client program is sending a valid EOM segment. See “Using IP packet trace” on page 740 for details about the IP packet trace facility. See the information about implicit-mode application data in z/OS Communications Server: IP IMS Sockets Guide for the format of the EOM segment.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Resolution</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>Connection lockup for an explicit IMS transaction</td>
<td>A connection lockup occurs when both the explicit IMS transaction and the client program are waiting for data from the other end of the socket connection. 1. Because the explicit IMS transaction protocol is user-defined, programming errors can easily lead to connection deadlocks. That is, the server is waiting for more data while the client is waiting for a response, and both wait indefinitely. 2. The Listener configuration data set might incorrectly define the explicit IMS transaction as implicit. In this case the Listener waits for valid implicit data from the client program, or if valid data is received, the explicit IMS transaction waits for data from the client program because the Listener has already read the data and written it to the message queue.</td>
<td>1. Use the IP packet trace facility to identify which part of the protocol is failing. See “Using IP packet trace” on page 740 for details about the IP packet trace facility. 2. Verify that the TRANSACTION statements in the Listener configuration data set specify the TYPE parameter correctly. Timeouts, especially in the client program, are recommended when issuing socket READs to avoid deadlocks and allow easy diagnosis. See the information about SELECT calls in z/OS Communications Server: IP IMS Sockets Guide for more information about specifying timeouts for READs.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Resolution</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>------------</td>
</tr>
</tbody>
</table>
| Connection lockup for either an explicit or implicit IMS transaction | 1. If the TRM sent by the client program is incomplete, the Listener waits indefinitely for the rest of the message.  
2. If the IMS transaction does not successfully issue the takesocket to gain the connection from the Listener, the Listener waits for this event indefinitely. The takesocket might not be issued successfully due to one of the following reasons:  
• The IMS transaction is defined to run in a message processing region that is not started. In this case, the IMS transaction is never scheduled and, therefore, never issue the takesocket.  
• One of the several TCP/IP socket calls, up to and including the takesocket, might fail and terminate the IMS transaction.  
• An IMS error can stop the transaction from being successfully scheduled, or, especially in the explicit case, can cause the IMS transaction to terminate before the takesocket is issued. | 1. Check the length and format of the TRM by using the IP packet trace facility as described in “Using IP packet trace” on page 740.  
2. Check that the IMS transaction is being successfully scheduled by the IMS transaction manager and ensure that any IMS and socket calls issued by the IMS transaction are checked for unsuccessful return codes. |
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The takesocket call issued by the IMS transaction fails</td>
<td>1. IMS can, for recovery reasons, abend a transaction and start it again. If the transaction is abended after it has gained the socket connection (through a takesocket call), the TCP/IP socket connection is lost. Although IMS restores the message queue when it restarts the transaction, the takesocket issued by the transaction fails as the socket connection has already been taken from the Listener. &lt;br&gt;2. An IMS transaction not defined as multisegment to the IMS transaction manager is scheduled as soon as the TIM is added to the message queue. This gives the IMS transaction an opportunity to issue the takesocket before the givesocket is issued by the Listener. The takesocket fails with an error return code.</td>
<td>1. Restart the client program. To reduce the frequency of this problem, determine why IMS is restarting the IMS transaction by using the IMS trace facility. See “IMS traces” on page 741. &lt;br&gt;2. Make certain the IMS transaction is defined as multisegment.</td>
</tr>
<tr>
<td>The client program is always receiving reject connect responses from TCP/IP</td>
<td>The maximum number of active sockets might have been reached, with all the currently active socket connections unable to complete. An increasing number of socket connections eventually reduces the available socket connections to zero when the number of socket connections equals the MaxActiveSockets configured for the Listener. When this happens, TRMs are not processed by the Listener, and they are left on the TCP/IP backlog queue. When the backlog queue fills, TCP/IP silently ignores a client program connection attempt.</td>
<td>Identify the client programs causing the problem using the NETSTAT command as specified in “Using NETSTAT” on page 741; then continue diagnosis to determine why these connections are locking up. &lt;br&gt;The Listener must be restarted to clear the active socket list. Because there are active socket connections, the Listener must be forced to terminate using the command specified in z/OS Communications Server: IP IMS Sockets Guide.</td>
</tr>
</tbody>
</table>
### Table 70. Connection problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection lockup or loss when passing a socket connection from one explicit IMS transaction to another</td>
<td>To pass a socket connection from the first IMS transaction to the second, the first IMS transaction must wait after it issues the givesocket until the second IMS transaction issues a takesocket; otherwise, the connection is lost. A connection lockup can occur when the first IMS transaction waits for the takesocket to be issued, but both IMS transactions are defined to run in the same message processing region. In this case, they cannot both be scheduled to run at the same time, and the first IMS transaction waits indefinitely for the takesocket from the second IMS transaction, which is never scheduled.</td>
<td>When passing a socket connection between IMS transactions, make sure the first transaction waits for the second to issue the takesocket and that both IMS transactions can be scheduled to run at the same time.</td>
</tr>
</tbody>
</table>

### Error message and return code problems

Table 71 on page 734 lists problems related to error responses.

**Table 71. Error message and return code problems**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The client program is receiving a request status message (RSM)</td>
<td>The Listener sends this message to the client program when it detects an error condition.</td>
<td>Use the return and reason codes from the message to look up the explanation. See “Where to find return code documentation” on page 742.</td>
</tr>
<tr>
<td>The implicit IMS transaction is receiving return codes in the I/O program communication block (PCB) that are not defined in the section on status codes in IMS/ESA® V6 Diagnosis Guide and Reference, LY37-3731.</td>
<td>The IMS assist module performs several socket-related functions on behalf of the implicit IMS transaction in response to IMS transaction manager requests. When errors are detected that are not related to the IMS transaction manager request, the IMS assist module sets special return codes in the PCB.</td>
<td>Look up the meaning of the special return codes. See “Where to find return code documentation” on page 742.</td>
</tr>
<tr>
<td>The Listener error messages are written to the MVS system console instead of the SYSPRINT data set</td>
<td>If the Listener experiences data set I/O errors, it redirects the error messages to the MVS system console.</td>
<td>Check the MVS system console log for I/O errors on the data set to identify the problem. The SYSPRINT DD statement in the JCL procedure to start the Listener specifies the destination data set for the error messages.</td>
</tr>
</tbody>
</table>
## Socket data protocol problems

Table 72 on page 735 lists problems related to data transfer over the socket connection. They include incorrect data sent, not enough or too much data sent, and data corruption.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Listener is not responding to the client program</td>
<td>1. If the TRM sent by the client program is incomplete, the Listener waits indefinitely for the rest of the message. &lt;br&gt;2. If the port specified by the client program is not the port that is attached to the Listener, and the socket connection is established, the other end of the connection does not communicate with the client program as required.</td>
<td>1. Check the length and format of the TRM by using the IP packet trace facility as described in “Using IP packet trace” on page 740. &lt;br&gt;2. Check that the Listener is attached to the port used by the client program to establish the socket connection. Use the command specified in “Using NETSTAT” on page 741.</td>
</tr>
<tr>
<td>All the input data sent from the client program is not being passed to the implicit IMS transaction from the Listener</td>
<td>Any input data written after the first EOM segment is ignored by the Listener.</td>
<td>Check for EOM segments being sent by the client program by using the IP packet trace facility described in “Using IP packet trace” on page 740. &lt;br&gt;See the information about the implicit-mode application data in z/OS Communications Server: IP IMS Sockets Guide for the format of the EOM segment.</td>
</tr>
<tr>
<td>Explicit IMS transaction is receiving garbled data from or sending garbled data to the client program</td>
<td>The data might need translation when the client program does not exist on an EBCDIC host. For explicit data transfer, the client program, or the IMS transaction, or both, must provide ASCII to EBCDIC translation and byte-order translation of fixed-point binary integers, if required. The Listener automatically translates the TRM when creating the TIM.</td>
<td>Code the client program or the IMS transaction or both to provide the necessary translation when the client program is not on an EBCDIC host.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Resolution</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Implicit IMS transaction is receiving garbled data from or sending</td>
<td>The automatic data translation when the client program does not exist on an EBCDIC host can be causing the problem. For implicit data transfer, the Listener automatically translates input data from ASCII to EBCDIC, based on the TRM contents. The IMS assist module also automatically translates output data from EBCDIC to ASCII when sending to an ASCII client program, as determined by the TRM. If the TRM sent by the client program is not either ASCII or EBCDIC as required, then the automatic translations fail. The client program is also responsible for any required byte-order translation of fixed-point binary integers.</td>
<td>Code the client program to provide the necessary translation when the client program is not on an EBCDIC host and the automatic data translation cannot be used.</td>
</tr>
<tr>
<td>receiving garbled data to the client program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. If the data translated between ASCII and EBCDIC contains any</td>
<td></td>
<td></td>
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<tr>
<td>nonprintable data, such as integers, flags, or reserved fields, the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>data is corrupted. In this case, the client program must provide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBCDIC data (including the TRM) for the IMS transaction and expect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBCDIC data from the IMS transaction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. If the data is translated between ASCII and EBCDIC and contains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>characters that are not common to both the ASCII and EBCDIC tables,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the nontranslatable characters are translated to spaces.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The security exit does not validate user data from the client program</td>
<td>The security exit might not be successfully linked into the Listener. The exit must be compiled and assembled and then linked into the Listener for it to be called.</td>
<td>Check that the security exit has been coded and built correctly as specified in z/OS Communications Server: IP IMS Sockets Guide.</td>
</tr>
</tbody>
</table>

---

**Table 72. Socket data protocol problems (continued)**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The security exit does not validate user data from the client program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The security exit might not be successfully linked into the Listener.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check that the security exit has been coded and built correctly as</td>
<td></td>
<td></td>
</tr>
<tr>
<td>specified in z/OS Communications Server: IP IMS Sockets Guide.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 72. Socket data protocol problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data is corrupted after an implicit IMS transaction issues a GU</td>
<td>The I/O area declared might be too small. When using the IMS assist module, the I/O area provided for the GU call must be large enough to hold the TIM, even though the data eventually returned in the I/O area can be smaller.</td>
<td>Make certain the implicit IMS transaction has enough storage declared to hold the TIM. The size of this message is specified in z/OS Communications Server: IP IMS Sockets Guide.</td>
</tr>
</tbody>
</table>
| The PL/I IMS transaction is receiving or sending message segments that are not valid | The message segments might be declared incorrectly. The PL/I API interface to the IMS transaction manager defines the message segments with a four-byte length field, but the length value must include only two of those bytes plus the rest of the segment. | Use the following rules to avoid problems:  
- The IMS assist module PL/I API routines mimic the interface used by the PL/I API routines. Code PL/I implicit transaction message segments in exactly the same manner as for this interface.  
- Code the client program in exactly the same manner as for all the IMS transaction API interfaces. The IMS assist module routines automatically converts the message segments from the PL/I API to the standard format.  
- Explicit transactions do not use the IMS assist module. The message segment format, if required, must match on both the client program and the IMS transaction sides. It is recommended that the standard message segment format be used.  
See the information about programming considerations for the implicit-mode server and the explicit-mode server in z/OS Communications Server: IP IMS Sockets Guide for more details about the PL/I API issues. |

### IMS transaction build problems

Table 73 on page 738 lists some problems related to building a component in the IMS TCP/IP Services socket interface system.
Table 73. IMS transaction build problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
</table>
| Unresolved external reference errors are causing the linker to fail when linking an IMS transaction | 1. The implicit IMS transaction link JCL is not including the IMS assist module and the MVS TCP/IP Services sockets library to resolve external references.  
2. The explicit IMS transaction link JCL is not including the MVS TCP/IP Services sockets library to resolve external references. | 1. Compare the link JCL to the sample provided in the section about JCL for linking an implicit-mode server in z/OS Communications Server: IP IMS Sockets Guide.  
2. Compare the link JCL to the sample provided in the section about JCL for linking an explicit-mode server in z/OS Communications Server: IP IMS Sockets Guide. |

**IMS database problems**

Table 74 on page 738 lists some problems related to unexpected IMS database actions or failures. They include changes not made or requests for changes that fail.

Table 74. IMS database problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The IMS transaction is terminating without performing the required function and without issuing any error messages</td>
<td>The IMS transaction might not be checking for interface errors.</td>
<td>It is the responsibility of the IMS transaction programmer to identify and issue error messages if the IMS database manager, IMS transaction manager, or TCP/IP socket interfaces fail.</td>
</tr>
<tr>
<td>The client program is not receiving any data from the implicit IMS transaction, but is receiving a successful CSM</td>
<td>The IMS transaction might be issuing an IMS database rollback (ROLB) call. If the IMS transaction issues a ROLB call, all output accumulated by the IMS assist module is discarded as part of the ROLB function. Depending on how the IMS transaction is coded, it might complete without further output (ISRT calls).</td>
<td>Use caution in issuing ROLB calls in implicit IMS transactions using the IMS assist module. Make certain you understand the details about implicit-mode support for ROLB processing in z/OS Communications Server: IP IMS Sockets Guide.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Resolution</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Local IMS transaction manager ISRT/GU/GN calls are failing when issued in IMS transactions | Local calls assume a terminal has requested the IMS transaction. The input and output of data, however, is sent across the socket connection for IMS transactions started by the Listener. The following is a list of specific causes of the problem:  
  - The ISRT call has no terminal associated with the IMS transaction for the output.  
  - There is no data on the message queue for explicit IMS transactions to get with the GU or GN calls.  
  - An implicit IMS transaction receives an unexpected TIM in response to a GU call. | Do not issue local IMS transaction manager calls from transactions started by the Listener. An implicit IMS transaction must use the IMS assist module calls, which accesses either a terminal or socket connection, as required. An explicit IMS transaction must interface directly to the socket connection. |
| The ISRT call fails for an implicit IMS transaction if a large amount of data is output | The IMS assist module restricts the total output for a single IMS transaction execution to 32KB.                                                                                                         | Limit the output for an implicit IMS transaction using the IMS assist module to a total of 32KB.                                                                                                               |
| The IMS database manager commits the changes made by an IMS transaction, but the client program receives an error | 1. The implicit IMS transaction does not issue a second GU. The IMS database commits the changes either when the IMS transaction ends or when another GU is issued. For implicit IMS transactions, the IMS assist module routines send the output data and CSM to the client program and closes the socket connection when the second GU is issued. If the implicit IMS transaction does not issue another GU, the changes are committed when the transaction ends, but the client program assumes failure when the CSM is not received.  
2. The socket connection might have been broken after the changes were committed but before the CSM was sent. In this case, the client program assumes failure, but the changes have been committed. | 1. Implicit IMS transactions that are started by the Listener must issue GU calls to get the next transaction request until the GU call returns with no requests to process.  
2. Where possible, the client program should be coded to automatically restart the IMS transaction and handle the condition where the IMS transaction is duplicated. For explicit IMS transactions, a more rigorous protocol can be implemented.  
**Guideline:** This should be considered as an uncommon case. |
Table 74. IMS database problems (continued)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The client program does not receive a valid CSM from an implicit IMS transaction</td>
<td>The client program might not have completed the response protocol correctly. The client program must read the response data until it reads an EOM segment. The CSM immediately follows the EOM.</td>
<td>Use the IP packet trace facility to determine whether the IMS transaction is sending a valid EOM segment followed by a valid CSM segment. See “Using IP packet trace” on page 740 for details about the IP packet trace facility. If the correct message segments are being sent, correct the client program to receive the response data. See z/OS Communications Server: IP IMS Sockets Guide for the format of the EOM and CSM segments.</td>
</tr>
</tbody>
</table>

Documentation references for problem diagnosis

This topic contains the information and documentation references required to gather and decode diagnostic information about the IMS TCP/IP Services socket interface system.

The two main tools used for problem diagnosis are the IP packet trace facility and the NETSTAT utility. The use of these tools is explained in following sections and example statements and commands are provided. An explanation of how to interpret the output from each of these tools is also provided.

For TCP/IP or IMS-specific tracing, reference is made to the appropriate diagnosis documentation.

Two cross-reference sections, which list all the types of return codes and error messages that can be issued from the IMS TCP/IP Services socket interface system, are provided at the end of this section. For each type of return code and error message, a reference is made to existing documentation that provides a complete description.

Traces

The following traces can be used to gain information about data flows and actions of the IMS TCP/IP Services socket interface system. The IP packet trace facility is the most helpful trace facility when writing and debugging your own client programs and IMS transactions. The TCP/IP internal traces are mainly used to diagnose problems with the TCP/IP network and socket-specific problems. The IMS traces are mainly used to diagnose IMS-specific problems, such as IMS transaction scheduling and database commit and rollback errors. The IMS assist module trace is used to determine problems with the IMS Assist module. This trace can be enabled by adding a sysdebug dd card to the IMS region procedure where the IMS transaction using the Assist Module is running.

Using IP packet trace

Use IP packet trace to identify the flow of data between the client program and the Listener and IMS transaction servers. TCP packets can be traced on the socket connections established through the Listener-reserved port. If the IP address of the client program is specified, only packets originating from or destined to the client program are traced. Specifying this parameter is recommended to avoid tracing a large number of unrelated TCP packets.

Restriction: When using X.25 devices to provide the network to the client program, the IP packet trace facility must be activated from the individual device address spaces. The previous example only activates tracing in the TCP/IP address space.
See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for details about how to use the IP packet trace facility.

The packets that contain data display the data in hexadecimal digits and, in this case, their EBCDIC characters. The numeric fields in the message segments can be verified from the hexadecimal representation, while any alphabetic data can be verified from the EBCDIC display.

**TCP/IP internal traces**

The TCP/IP internal traces are sent to CTRACE. This is a key trace used to determine the success or failure of the socket calls made by the IMS Listener and the IMS transactions. These traces provide information about the internals of the TCP/IP address space. This information can be used to diagnose problems in establishing the network between the client program and the server host or in establishing the socket connections. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43, for details about how to use the TCP/IP internal tracing facility.

**IMS traces**

The IMS traces provide information about the internals of the IMS database system. You can use this information to diagnose IMS transaction scheduling problems, IMS transaction manager message queue problems, and database change problems that cause rollbacks or commit errors. For more information about IMS traces, see the IMS knowledge center at http://www.ibm.com/support/knowledgecenter/SSEPH2/welcome.

**Using NETSTAT**

This section details how to use NETSTAT to query TCP/IP port usage and the state of socket connections. This command can be used to verify that the Listener is active and has opened the correct port and to diagnose problems with the socket connection between the client program and the Listener or IMS transaction.

**Restriction:** The client program must have the socket connection open for NETSTAT to query the connection status.

The NETSTAT SOCKETS command displays which ports are open to which address spaces and displays active socket connections and their status. Following is sample output from this command (the output shown is valid for V2R10 and V1R2):
READY
netstat sockets

MVS TCP/IP NETSTAT CS V2R10  TCPIP Name: TCPCS  12:34:56
Sockets interface status:
Type  Bound to            Connected to          State    Conn
====  ===========            ===========          =====    ====
Name: INETD1 Subtask: 006DB5B8
  Dgram  0.0.0.0..37  *.*  UDP  00000058
  Dgram  0.0.0.0..13  *.*  UDP  00000057
  Dgram  0.0.0.0..19  *.*  UDP  00000056
  Dgram  0.0.0.0..9   *.*  UDP  00000055
  Dgram  0.0.0.0..7   *.*  UDP  00000054
Name: OSNMPD Subtask: 006DBA70
  Dgram  0.0.0.0..161 *.*  UDP  00000013
Name: TCPCS Subtask: 00000000
  Stream 127.0.0.1..23  127.0.0.1..1033 Establsh  00000045
  Stream 9.67.113.27..23  9.37.81.207..1096 ClosWait  00000039
Name: TCPCS Subtask: 006C57B0
  Stream 0.0.0.0..23  0.0.0.0.0  Listen  00000012
Name: TCPCS Subtask: 006D56F0
  Stream 127.0.0.1..1026  127.0.0.1..1025 Establsh  0000000F
Name: TCPCS Subtask: 006D5C0F
  Stream 0.0.0.0..1025  0.0.0.0.0  Listen  0000000C
  Stream 127.0.0.1..1025  127.0.0.1..1026 Establsh  00000010
Name: USER18 Subtask: 006A3400
  Stream 127.0.0.1..1033  127.0.0.1..23 Establsh  00000044

See z/OS Communications Server: IP User's Guide and Commands for more details about the usage, parameters, and output of NETSTAT.

Where to find return code documentation

The following list refers to the appropriate return code documentation for all return codes that are expected in the IMS TCP/IP Services socket interface system.

- To the client from the Listener (request status message).

  See the information about the request status message (RSM) segment in z/OS Communications Server: IP IMS Sockets Guide for the format of the RSM and a description of the return codes.

  **Guideline:** The RSM with the "IMS transaction unavailable to be started" return code, is returned when the IMS transaction previously abended or failed and the IMS transaction manager marked it as not able to be scheduled.

- To the client from an IMS transaction (CSM).

  The CSM is received by the client program when the transaction is successful. This message implies a successful return code. If this message is not received, the client program must assume that the IMS transaction did not complete successfully.

- To the implicit IMS transaction from the IMS assist module (I/O program communication block).

  See the information about the I/O PCB implicit-mode server in z/OS Communications Server: IP IMS Sockets Guide for the format of the I/O PCB and return code explanations.

- To an implicit or explicit IMS transaction from TCP/IP.

  See the information about error messages and return codes for IMS sockets calls in z/OS Communications Server: IP IMS Sockets Guide.

- To an implicit or explicit IMS transaction from the IMS transaction manager.
For information about DL/I status codes, return codes, and reason codes, see the IMS knowledge center at http://www.ibm.com/support/knowledgecenter/SSEPH2/welcome.

- To an implicit or explicit IMS transaction from the IMS database manager.

For information about DL/I status codes, return codes, and reason codes, see the IMS knowledge center at http://www.ibm.com/support/knowledgecenter/SSEPH2/welcome.

**Where to find error message documentation**

The following list refers to the appropriate error message documentation for all error messages expected in the IMS TCP/IP Services socket interface system.

- Error messages from the Listener are written to the SYSPRINT ddname data set. See the information about the IMS Listener error messages in z/OS Communications Server: IP IMS Sockets Guide for descriptions of the error messages in this data set.

- Error messages from TCP/IP are written to the SYSERROR and SYSDEBUG data sets. See z/OS Communications Server: IP IMS Sockets Guide for descriptions of the error messages in these data sets.
Chapter 33. Diagnosing VMCF/TNF/IUCV problems

This topic describes how to diagnose VMCF/IUCV problems and restartable VMCF/TNF problems.

Diagnosing restartable VMCF/TNF problems

This topic describes how to diagnose restartable VMCF/TNF problems and contains the following subtopics:

- “VMCF or TNF fail to initialize” on page 745
- “Abends” on page 303
- “Steps for diagnosing no response to commands” on page 745
- “VMCF or TNF does not stop” on page 745

You can configure virtual machine communication facility (VMCF) and termination notification facility (TNF) in two different ways: as restartable subsystems or as nonrestartable subsystems. For details about configuration, see z/OS Communications Server: IP Configuration Reference.

If you choose restartable VMCF and TNF, you might encounter the problems described in this topic.

Note: For information about common VMCF and TNF problems, see z/OS Communications Server: IP Configuration Guide.

VMCF or TNF fail to initialize

If VMCF or TNF fail to initialize with an OC4 abend, there is probably an installation problem. Check the PPT entries for errors. Some levels of MVS do not flag PPT syntax errors properly.

Abends 0D5 and 0D6

If, after removing a user, the system crashes with abends 0D5 and 0D6, the application is probably still running and using VMCF. Users should not be removed from VMCF or TNF without first terminating the affected user.

Steps for diagnosing no response to commands

If VMCF and TNF do not respond to commands, one or both of the nonrestartable versions of VMCF or TNF are still active.

Procedure

Perform the following steps to stop and restart the subsystems:

1. Stop all VMCF and TNF users.
2. Stop the subsystems using the commands FORCE ARM VMCF and FORCE ARM TNF.
3. Restart using EZAZSSI.

VMCF or TNF does not stop

If you are unable to stop VMCF or TNF, users probably still exist in the VMCF and TNF lists. Use the F VMCF,DISPLAY,NAME=* and the F TNF,DISPLAY,NAME=* commands to identify those users who are still active; then either cancel those users or remove them from the lists, using the F VMCF,REMOVE and the F TNF,REMOVE commands.
Diagnosing VMCF/IUCV problems with the TSO MVPXDISP command

The TSO MVPXDISP command is used as a debugging aid to display the state of the connections from some address spaces to the VMCF address space. In addition, the command is used to obtain information about storage utilization for VMCF and IUCV-related buffers, as well as routines supporting the underlying PC functions. This information can be used by the IBM Software Support Center to analyze the state of the VMCF address space.

The TSO MVPXDISP command is used to display information about a connection for a single user ID or started task to the VMCF address space, or all connections can be displayed. The command is also used to obtain information about the storage utilization. MVPXDISP must be an Authorized Program Facility (APF) command.

If you have a user application that is hung, issue the TSO MVPXDISP command and keep the output for help in diagnosing the problem.

```
mvpxdisp smtp
EZY2053I MVPXDISP: User SMTP Asid 002C.  *****
EZY2054I MVPXDISP: Data @ 15B20AD8 Sm=FF Cr0=000008E1 Flags=04.
EZY2055I MVPXDISP: Client of the VMCF address space.
EZY2055I MVPXDISP: Client of SMSG.
EZY2055I MVPXDISP: Client of VMCF.
EZY2056I MVPXDISP: IUCV mask=F8F8, Pending Ctl=0000, Appl=0000.
EZY2057I MVPXDISP: VMCF: Buf=00182BA0, Len=00000118, Flgs=00 User=  Key= 80.
EZY2059I MVPXDISP: VMCF: Pending count=0 Flags=00000000.
EZY2065I MVPXDISP: IUCV: Connections=0, Max=255.
EZY2065I MVPXDISP: IUCV: Ctl flags=00000000 Appl flags=00000000.
```

Figure 101 on page 746 shows a sample of the output received from issuing the TSO MVPXDISP command with the `userid` parameter. The messages in this sample are only displayed if the PROFILE MSGID option is in effect for the TSO user ID.

```
mvpxdisp smtp
EZY2053I MVPXDISP: User SMTP Asid 002C.  *****
EZY2054I MVPXDISP: Data @ 15B20AD8 Sm=FF Cr0=000008E1 Flags=04.
EZY2055I MVPXDISP: Client of the VMCF address space.
EZY2055I MVPXDISP: Client of SMSG.
EZY2055I MVPXDISP: Client of VMCF.
EZY2056I MVPXDISP: IUCV mask=F8F8, Pending Ctl=0000, Appl=0000.
EZY2057I MVPXDISP: VMCF: Buf=00182BA0, Len=00000118, Flgs=00 User=  Key= 80.
EZY2059I MVPXDISP: VMCF: Pending count=0 Flags=00000000.
EZY2065I MVPXDISP: IUCV: Connections=0, Max=255.
EZY2065I MVPXDISP: IUCV: Ctl flags=00000000 Appl flags=00000000.
```

Figure 101. MVPXDISP sample output using the `userid` parameter

The output from the MVPXDISP command, when it is issued with the `userid` parameter, contains the following information:

**User**

User ID associated with the address space control block (ASCB) owning the connection to the VMCF address space.

**Asid**

Address space ID (ASID) for the user ID.

**Data**

Address of the control block containing extended information about the user ID.
Sm=
Saved system mask of the user's address space.

Cr0=
Control register 0 of the user's address space.

Flags
Control flags describing the state of the connection. The meaning of the flag bits is as follows:

X'80'
  SMSG is allowed.

X'40'
  User ID is a client of VMCF.

X'20'
  User ID is a client of IUCV.

X'10'
  User ID is a client of the VMCF address space.

X'08'
  Reserved.

X'04'
  User had the TRANSWAP field specified when initially made a client of VMCF.

X'02'
  Reserved.

X'01'
  Reserved.

Client of text string
Up to 4 lines of text that describe the settings of the bit fields from the Flags variable that concern the client status of the connection. Possible values for text string are:

- VMCF address space
- SMSG
- VMCF
- IUCV

IUCV mask=
Enable mask used with IUCV communications.

Pending Ctl=
Control pending interrupt mask used with IUCV communications.

Appl=
Application pending interrupt mask used with IUCV communications.

Buf=
Address of the VMCF user external interrupt buffer.

Len=
Length of the VMCF user external interrupt buffer.

Flgs=
Control flags associated with the VMCF connection. The meaning of the flag bits is as follows:

X'80'
  Specific AUTHORIZE was performed.

X'40'
  Priority messages are allowed.

X'20'
  Connection is in a quiesced state.

X'1F'
  Reserved.
User=  
If a specific AUTHORIZE was performed, the name of the user ID with whom the restricted connection was established; otherwise, a blank field.

Key=  
User key at the time the connection was initialized.

Pending count=  
Count of pending VMCF requests that have been sent.

Flags=  
Control flags associated with pending VMCF requests. Only byte 0 contains defined bit fields. All bit positions in bytes 1 through 3 are reserved. The meaning of the defined flag bits is as follows:
- X'80'  
  IRB is scheduled or running.
- X'40'  
  VMCF interrupt might be pending.
- X'3F'  
  Reserved.

Connections=  
Count of active IUCV connections.

Max=  
Maximum number of IUCV connections allowed.

Ctl flags=  
Control flags associated with pending IUCV requests on the control path. Only byte 0 contains defined bit fields. All bit positions in bytes 1 through 3 are reserved. The meaning of the defined flag bits is as follows:
- X'80'  
  IRB is scheduled or running.
- X'40'  
  IUCV interrupt might be pending.
- X'3F'  
  Reserved.

Appl flags=  
Control flags associated with pending IUCV requests on the application path. Only byte 0 contains defined bit fields. All bit positions in bytes 1 through 3 are reserved. The meaning of the defined flag bits is as follows:
- X'80'  
  IRB is scheduled or running.
- X'40'  
  IUCV interrupt might be pending.
- X'3F'  
  Reserved.

Figure 102 on page 749 shows a sample of the output received from issuing the MVPXDISP command with the ISAQ parameter. The messages in this sample are only displayed if the PROFILE MSGID option is in effect for the TSO user ID.
Figure 102. MVPXDISP sample output using the ISAQ parameter

The output from the MVPXDISP command, when it is issued with the ISAQ parameter contains the following information:

**VMCF_Dsa Header at**
Address of the anchor block for the dynamic storage areas used by the routines supporting the program call (PC) function.

**XI_Dsa Header at**
Address of the anchor block for the dynamic storage areas used by the VMCF address space while it services cross-memory calls.

**Subpool**
Subpool number from which the storage frames are allocated.

**1st Getmain count**
Count of the number of times a request was made for storage from the pool and none was available. It can be viewed as the maximum number of concurrent requests.

**2nd Getmain count**
Count of the number of times a storage request was made for an area that exceeded the frame size. This value should never be other than zero, since the frame sizes were chosen based on the maximum storage request size that should be made by the various routines.

**Frame size**
Number of bytes (decimal) allocated by a GETMAIN request.

**Max asked**
Largest area in bytes (decimal) that has been obtained from the storage pool to satisfy a request by the routines that exploit the storage pool.
Chapter 34. Diagnosing problems with IP CICS sockets

This information describes how to diagnose IP CICS Sockets problems with the Customer Information Control System (CICS) and contains the following subtopics:

• “Diagnostic data” on page 751
• “Initialization problems” on page 752
• “CICS sockets application problems” on page 753
• “CICS sockets control blocks” on page 754
• “CICS trace” on page 755

CICS is an IBM licensed program that enables transactions that are entered at remote terminals to be processed concurrently by user-written application programs.

For more information about CICS and solving problems with CICS, see the following information:

• z/OS Communications Server: IP CICS Sockets Guide
• CICS information at http://www.ibm.com/software/htp/cics/library/
• z/OS MVS Diagnosis: Tools and Service Aids

Diagnostic data

To diagnose problems with IP CICS Sockets, some or all of the following data might be required:

• Message logs
  – System log
  – Message log at the transient-data destination specified by the ERRORTD IP CICS Sockets TYPE=CICS configuration option
• CICS external-trace data set (auxtrace)

**Tip:** Using the CICS Trace Control Facility transaction, CETR, ensure the following CICS trace flags are set to obtain the CICS auxiliary trace:

– Set the CICS Master User Trace Flag to the value of ON to generate IP CICS Sockets CICS trace records
– Set the Master System Trace Flag to the value of ON to generate CICS trace records
– Set the AP component trace level to the value of 1

**Rule:** Ensure that CICS tracing is enabled for the IP CICS Socket Interface. If the IP CICS Sockets TYPE=CICS TRACE configuration option is NO then no IP CICS Sockets CICS tracing occurs. Either change the configuration option to enable IP CICS Sockets CICS tracing and then stop and restart the IP CICS Socket Interface or dynamically enable the CICS trace by using the EZAO,START,TRACE command or with the EZAO,SET,CICS transaction specifying TRACE=YES.

• Component trace
  – Engine
  – Physical file system (PFS)
  – Socket
  – Socket (SOCKAPI)
  – Transmission control protocol (TCP)
Initialization problems

This topic describes some problems you might encounter when attempting to initialize CICS configured to use IP CICS Sockets.

Steps for diagnosing CICS socket interface not initialized

Determine why the CICS socket interface did not initialize.

Procedure

Follow these steps:

1. Issue the EZAO,START,CICS command, and then check that the interface initializes.
   a. If the interface initializes, check that EZACIC20 is in the Program Load Table (DFHPLT).
      Putting EZACIC20 into the PLT allows the CICS Socket Interface to initialize on CICS address startup. See z/OS Communications Server: IP CICS Sockets Guide for more information.
   b. If EZACIC20 is defined in the DFHPLT, check the message logs for failures.
   c. If there are no messages, then start CICS with an auxiliary trace active, IP CICS Sockets CICS tracing enabled, and then request an SVC dump of CICS.
   d. Call the Support Center.

2. Verify that the socket Resource Definition Online (RDO) definitions have been properly installed and that the correct data sets are in the STEPLIB and DFHRPL concatenations.

Steps for diagnosing CICS listener not initialized

Determine why the CICS Listener did not initialize.

Procedure

Perform the following steps:

1. Use the EZAC transaction to verify that the listener is defined in the configuration file.
2. In the configuration-file record for that listener, verify that IMMEDIATE is set to YES, and then verify that the correct APPLID and port number are specified.
3. Verify that the listener is properly defined in a CICS RDO group and that the RDO group is in the proper group list.
4. Check the message logs for failures.
   a. If there are no messages, start CICS with auxtrace active IP CICS Sockets CICS tracing enabled, and then request an SVC dump of CICS.
b. If there are messages, call the Support Center.

5. If an EZY1292E message was issued, investigate why the CICS socket interface did not initialize. See “Steps for diagnosing CICS socket interface not initialized” on page 752.

6. If an EZY1369E message was issued, investigate why the TCP/IP stack as specified on the IP CICS Sockets interface TCPADDR configuration option did not initialize. See “Steps for diagnosing problems” on page 3 for steps on diagnosing TCP/IP problems.

No CICS sockets messages issued

If no CICS sockets messages (error or informational) were issued, verify that the correct CICS transient-data queue is specified in the EZACICD TYPE=CICS ERRORTD field in the configuration record for the CICS region. A region is the CICS address space.

Steps for diagnosing TCP/IP clients unable to connect

Determine why TCP/IP clients are unable to connect.

Procedure

Perform the following steps:

1. Verify that the listener is active by logging on to CICS, and then issue a CEMT I TASK command. Make sure that the listener name appears in the task list.

2. Verify that the listener is listening on the correct port number by issuing a NETSTAT CONN command, and then check that the listener has the correct port in listen status. Verify that clients are trying to connect to this port and to the correct IP address.

3. Check the ERRORTD log and verify that the EZY1291I message has been issued. If it has not been issued, look for messages that indicate a failure.

4. If message EZY1365E is issued, then ensure that the value specified for the MAXFILEPROC is larger than the listener's NUMSOCK value. Also, ensure that the client's user ID FILEPROCMAX setting is appropriately specified.

For more information about how MAXFILEPROC affects tuning applications, see z/OS UNIX System Services Planning.

For more information about the FILEPROCMAX specification, see the documentation provided for the SAF product in use on your system. If using RACF, this can be found in z/OS Security Server RACF Security Administrator's Guide.

Steps for diagnosing child-server transactions not starting

Child-server transactions are transactions that are started by the listener.

Procedure

If child-server transactions are not starting, perform the following steps:

1. Issue a CEMT I TRANSACTION command to verify that the transaction is installed. If it is not installed, a NOT FND message is displayed.

2. Issue a CEMT I PROGRAM command to verify that the child-server program is installed.

3. If the transaction or program is not installed, define it in the proper RDO group.

4. Check the message logs for failures.

CICS sockets application problems

This topic describes some of the problems you might encounter with CICS sockets applications.
Steps for diagnosing hung CICS tasks
Determine why CICS application tasks hang.

Procedure
Perform the following steps:
1. While a task is hung, request an SVC dump of CICS and TCP/IP.
2. If the problem can be re-created, re-create with CICS auxtrace and component trace turned on.
3. Issue a NETSTAT SOCKET command to determine whether the task is waiting for a particular socket call to be posted. If it is waiting, you can issue the NETSTAT DROP command to end it.
4. If the application is hung while waiting for the completion of a READ command, consider issuing a SELECT or SELECTEX command prior to the READ command. The SELECT command returns either the number of sockets that are ready to be read or 0 if it times out. The SELECTEX command also returns either the number of sockets that are ready to be read or 0 if it times out and it also returns an ECB or a list of ECBs.

Hung CICS region
If a CICS sockets application program using the Call Instruction API (EZASOKET) is erroneously link-edited without the EZACICAL stub, the entire CICS region might hang while waiting for socket calls to complete. Ensure that EZACICAL is explicitly link-edited with the application.

An EZASOKET call should generate a static call to the EZASOKET entry point within the EZACICAL stub. If the application is not compiled and link edited correctly, the EZASOKET call generates a dynamic call to program EZASOKET, which calls the socket API directly.

Errors on socket calls
If you receive errors on socket calls, note the ERRNO that is received, and then look it up in the portion of z/OS Communications Server: IP CICS Sockets Guide that describes return codes.

A SOCKAPI CTRACE can also help diagnose problems with EZASOKET calls.

CICS shutdown hangs
If an EZY1342I message has been issued, there is a CICS task that has at least one socket open and that is not terminating. You can fix this problem by executing an immediate termination of the CICS socket interface rather than a deferred termination. To execute an immediate termination, issue an EZAO,STOP,CICS command, and then specify YES at the IMMEDIATE prompt.

If you do not add EZACIC20 to the shutdown DFHPLT, CICS cannot terminate because the socket subtasks are still attached to the CICS region. To terminate CICS without EZACIC20, manually shut down the CICS socket interface using the EZAO transaction.

If you have added EZACIC20 to the shutdown DFHPLT then set the IP CICS socket interface PLTSDI configuration option to the value YES to force an immediate shutdown.

CICS sockets control blocks
This section describes some problems you might encounter with the task interface element (TIE) and global work area (GWA). For information about the layout of GWA, TIE, and other control blocks, see the section in the z/OS Communications Server: IP CICS Sockets Guide that describes external data structures.

Task interface element
A Task interface element (TIE) represents a CICS task that issued at least one call to the CICS sockets API. You can locate TIEs in a dump of the CICS region by issuing the IPCS VERBX CICSxxx ‘UEH=3’ command. CICSxxx is the name of the VERBEXIT used to format a CICS TS dump and is specific to the
release of CICS TS that produced the dump. After the CICSxxx VERBEXIT returns, then search for
EZACIC01.TIE. The CICSxxx EZACIC01 prefix identifies it as a TIE for CICS sockets. For more information
about the CICS TS VERBEXITs, see the CICS information at http://www.ibm.com/software/htp/cics/
library/.

The IPCS VERBX CICSxxx 'UEH=3' command output shows a CICS image of the TIE. The TCP/IP TIE is
embedded within the CICS image of the TIE and starts at offset +X'80'.
The IPCS VERBX CICSxxx 'UEH=3' command output contains TIEs for other interfaces as well.

Global work area
The GWA is the main anchor point for the CICS socket interface. It contains general status data, work
areas, and pointers to other control-block chains. You can locate the GWA in a dump of the CICS region by
issuing the IPCS VERBX CICSxxx 'UEH=3' command, and searching for EZACIC01.GWA. The EZACIC01
prefix identifies it as the GWA for CICS sockets.

CICS trace
The CICS sockets task-related user exit (TRUE), EZACIC01, issues CICS trace entries at the following four
points of execution:
• When the TRUE receives a socket call from an application
• When the TRUE is passing the socket call to the subtask
• When the TRUE receives the response from the subtask
• When the TRUE is ready to return its response to the application

The trace point ID is AP 00C7. Trace records are self-explanatory. They show the type of call, the point of
execution, the ERRNO, and the RETCODE.

Steps for displaying the internal trace
Trace records can be written either to a CICS internal trace table or to its external-trace data set
(auxtrace).

Procedure
Perform the following steps to display the internal trace:
1. Request a dump of the CICS region by using the RGN SDATA=(option 1,option 2...option n) parameter
   on a DUMP command. Examples of options are CSA, PSA, NVC, RGN, TRT, SQA, LSQA, and LPA. For a
   complete list of options, see z/OS MVS Diagnosis: Tools and Service Aids.
2. Display the trace by using the IPCS VERBX CICSxxx 'UEH=3' command.
   Tip: CICS trace can also be directed to the GTF trace data set.

What to do next
For more information about the auxtrace, see the CICS information at http://www.ibm.com/software/htp/
cics/library/.
Chapter 35. Diagnosing problems with Shared Memory Communications

Shared Memory Communications (SMC) problems are often related to switch configuration, VLAN connectivity, physical network ID (PNetID) configuration, and other configuration issues.

Common problems with using SMC include the following categories:

- “SMC-R switch configuration issues” on page 757
- “SMC-R VLAN configuration issues” on page 758
- “SMC-D VLAN connectivity issues” on page 758
- “Physical network ID configuration issues” on page 759
- “No associated subnet mask” on page 760
- “PFID status remains STARTING” on page 760
- “Problem with SMC interaction with security function” on page 761
- VTAM message IST2444I seen during PFID activation

The SMCRReason field of the Netstat ALL/-A report and the SMCR or SMCD field of the Netstat DEvlinks/-d report provide information that is related to SMC problems. The SMCR field applies to Shared Memory Communications over Remote Direct Memory Access (SMC-R) processing, and the SMCD field applies to Shared Memory Communications - Direct Memory Access (SMC-D) processing.

For a complete list of SMCRReason codes in the Netstat ALL/-A report and the SMCR or SMCD Disabled reasons in the Netstat DEvlinks/-d report, see z/OS Communications Server: IP System Administrator’s Commands.

SMC-R switch configuration issues

Remote Direct Memory Access (RDMA) processing requires standard 10 GbE switch support, and distance limitations might exist. Enable the global pause frame (a standard Ethernet switch feature for Ethernet flow control that is described in the IEEE 802.3x standard) on the switch.

When the SMCRReason field of the Netstat ALL/-A report is 00005013 - RDMA CONNECTIVITY FAILURE, VTAM was not able to complete the SMC-R Link Confirm flow, which usually indicates a switch configuration issue. The Link Confirm message is the first data sent over the RDMA over Converged Ethernet (RoCE) fabric. Check for the following issues:

- If you are using VLANs, verify that the VLAN configuration on the RoCE switch ports is consistent with the VLAN configuration on the OSD switch ports.

For example, the OSD switch ports might be configured properly, with no VLAN ID or the default VLAN ID, but the RoCE switch ports have a different VLAN ID configured, such as trunk mode with VLAN IDs 400 and 500.

For more information about configuring VLANs with SMC-R, see “SMC-R VLAN configuration issues” on page 758.

- Verify that your cable is plugged into the correct port on the "RoCE Express" feature and into the correct port on the switch.

For example, the cable might be plugged into the correct port on the "RoCE Express" feature but into the wrong port on the switch, or the cable might be plugged into the correct port on the switch but into the wrong port on the "RoCE Express" feature.

- Verify that the MTU value configured on the switch is large enough to support your configured MTU size on GLOBALTTCPIP SMCR MTU for this interface.
Enable jumbo frame support on the RoCE switch ports.

- Multiple switches are in use but the switch uplinks are not configured properly.
- For some switches (for example the IBM RackSwitch G8264), you might need to configure the RoCE switch ports as edge ports. This places the port in the forwarding state as soon as the link is up, reducing delays due to Spanning Tree Protocol processing.

Verify that you have Ethernet flow control enabled on your switch. Ethernet flow control is implemented by using pause frames. If the control is not enabled, this can cause the switch to be overrun leading to packet loss.

**SMC-R VLAN configuration issues**

The SMC-R VLAN configuration checklist is provided for you to verify that your VLAN environment for RoCE, and therefore for SMC-R, is correctly configured.

1. Verify the consistency of the VLAN mode settings for your Ethernet switch port.

   The VLAN mode setting for an Ethernet switch port can be access mode or trunk mode. The VLAN mode for the Ethernet switch port for an OSA Express port must be the same VLAN mode for the Ethernet switch port for the associated "RoCE Express" ports. For example, if the Ethernet switch ports for the OSA Express are configured in access mode, the Ethernet switch ports for their associated "RoCE Express" ports must also be configured in access mode.

2. Verify the consistency of the VLAN access that is available to Ethernet switch ports that "RoCE Express" features use.

   All "RoCE Express" ports for a specific physical network ID (PNetID) must have access to the same VLANID value:
   - If you use access mode, only a single VLANID can be used, and all Ethernet switch ports that serve the "RoCE Express" ports for a specific PNetID must be configured with this single VLANID. This VLANID is not required to match any of the VLANIDs that are configured for the Ethernet switch ports that serve the associated OSA Express features.
   - If you use trunk mode, all Ethernet switch ports that serve the "RoCE Express" ports for a specific PNetID must be configured with the same set of VLANID values as the Ethernet switch ports that serve the associated OSA Express features.

3. Verify VLAN mode consistency across all z/OS hosts that use SMC-R for a specific PNetID.

   All z/OS hosts that connect to the same PNetID for SMC-R communication must use the same VLAN mode, either access mode or trunk mode. You cannot mix access mode and trunk mode among the z/OS hosts for the same PNetID.

   **Guideline:** The "RoCE Express" feature inherits the VLANID from the OSA interfaces within the same physical network. You do not specifically configure a VLANID for the "RoCE Express" feature.

For more information about configuring VLANs with SMC-R, see SMC-R VLAN configuration considerations in Shared Memory Communications over RDMA Reference Information (http://www.ibm.com/software/network/commsserver/SMCR/).

For more information about VLAN support with SMC, see VLANID considerations in z/OS Communications Server: IP Configuration Guide.

**SMC-D VLAN connectivity issues**

Internal shared memory (ISM) processing does not require network switches. However, VLANs are supported over ISM devices to allow for separation of traffic. The OSD or HiperSockets VLAN attributes propagate to the associated ISM interfaces that use the same physical network ID (PNetID).

No additional HCD definition is required to identify VLANID values that an ISM device can use. During activation processing, VTAM registers with the ISM device the VLANIDs that the ISM interfaces use.
If you are using VLANs, ensure the compatibility of VLANID values on the OSD or HiperSockets interfaces that are used to establish the TCP connection. If a mismatch between VLANID values occurs, the SMReason field of the Netstat ALL/-A report indicates 00005806 – VLAN ID NOT FOUND.

For more information about configuring VLANs with SMC-D, see VLANID considerations in z/OS Communications Server: IP Configuration Guide.

**Physical network ID configuration issues**

The TCP/IP stack must be able to determine which physical network is connected to a particular "RoCE Express" or internal shared memory (ISM) interface, so that the "RoCE Express" or ISM interface can be associated with the SMC capable interfaces that connect to that same physical network.

- For Shared Memory Communications over Remote Direct Memory Access (SMC-R), SMC capable interfaces include IPAQENET and IPAQENET6 interfaces.
- For Shared Memory Communications - Direct Memory Access (SMC-D), SMC capable interfaces include IPAQENET, IPAQENET6, IPAQIDIO, and IPAQIDIO6 interfaces.

In the HCD definitions, the same PNetID values have different meaning for different types of devices.

<table>
<thead>
<tr>
<th>Device type</th>
<th>PNetID 1</th>
<th>PNetID 2</th>
<th>PNetID 3</th>
<th>PNetID 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>HiperSockets device</td>
<td>Represents the device</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>ISM device</td>
<td>Represents the device</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>OSD adapter</td>
<td>Represents port 0</td>
<td>Represents port 1</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>RoCE Express</td>
<td>Represents port 1</td>
<td>Represents port 2</td>
<td>Not used</td>
<td>Not used</td>
</tr>
<tr>
<td>RoCE Express2</td>
<td>Represents the device</td>
<td>Not used</td>
<td>Not used</td>
<td>Not used</td>
</tr>
</tbody>
</table>

**SMC-R physical network ID configuration issues**

Use the Netstat DEvlinks/-d and D NET,TRL,TRLE=xxxx commands to verify the physical network ID (PNetID) value on the OSD interfaces and the "RoCE Express" interfaces.

- If the Netstat DEvlinks/-d report for your OSD interface indicates SMCR: DISABLED (NO PNETID), ensure that you configured the PNetID value on the correct OSD port in the HCD definitions.
- If you receive message EZD2028I with reason PNETID IS NOT CONFIGURED during "RoCE Express" interface activation, ensure that you configured the PNetID value on the correct "RoCE Express" port in the HCD definitions.
- If the Netstat DEvlinks/-d report for your OSD interface indicates SMCR: Yes and your "RoCE Express" interfaces initialized successfully, verify that the PNetID value of the OSD interface matches that of the intended "RoCE Express" interfaces.

For more information about configuring PNetIDs, see Physical network considerations in z/OS Communications Server: IP Configuration Guide.

**SMC-D physical network ID configuration issues**

Use the Netstat DEvlinks/-d and D NET,TRL,TRLE=xxxx commands to verify the physical network ID (PNetID) value on the OSD or HiperSockets interfaces and the ISM interfaces.

- If the Netstat DEvlinks/-d report for your OSD or HiperSockets interface indicates SMCD: DISABLED (NO PNETID), ensure that you configured the PNetID value on the correct OSD port or HiperSockets CHPID in the HCD definitions.
• During ISM interface activation, if you receive message EZD2028I with reason PNETID IS NOT CONFIGURED or message IST2422I, ensure that you configured the PNetID value on the correct ISM device in the HCD definitions.

• During ISM interface activation, if you receive message IST2423I, ensure that you configured sufficient Peripheral Component Interconnect Express (PCIe) function ID (PFID) values for the PNetID value in the HCD definitions.

• If the Netstat DEVlinks/-d report for your OSD or HiperSockets interface indicates SMCD: Yes and your ISM interfaces initialized successfully, verify that the PNetID value of the OSD or HiperSockets interface matches the PNetID of the intended ISM interfaces.

For more information about configuring PNetIDs, see Physical network considerations in z/OS Communications Server: IP Configuration Guide.

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No associated subnet mask

Shared Memory Communications (SMC) is used only between peers whose IPv4 interfaces have the same subnet value or whose IPv6 interfaces have at least one prefix in common.

• For IPv4, if the SMCR or SMCD field of the Netstat DEVlinks/-d report for an OSD interface is DISABLED (NO SUBNET MASK), it means no subnet mask value is configured for the OSD interface.

• For IPv4, if the SMCD field of the Netstat DEVlinks/-d report for a HiperSockets interface is DISABLED (NO SUBNET MASK), it means no subnet mask value is configured for the HiperSockets interface.

• For IPv4, if the SMCreason code in the Netstat ALL/-A report is 521E PEER SUBNET/PREFIX MISMATCH, the interfaces on the peer stacks use different subnets.

• For IPv6, if the SMCreason code in the Netstat ALL/-A report is 521E PEER SUBNET/PREFIX MISMATCH, the interfaces on the peer stacks do not have a prefix in common.

For information about associating your interfaces with the appropriate subnet or prefix, see Configuring Shared Memory Communications over RDMA and Configuring Shared Memory Communications - Direct Memory Access in z/OS Communications Server: IP Configuration Guide.

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PFID status remains STARTING

The PFIDSTATUS field is the Peripheral Component Interconnect Express (PCIe) function ID (PFID) status for the RNIC or the internal shared memory (ISM) interface.

The following list describes the possible status values:

• READY
  
  READY indicates that the initialization sequence with the PFID is complete and the PFID is ready.

• NOT ACTIVE
  
  NOT ACTIVE indicates that the PFID was never started or was stopped after it was started.

• STARTING
  
  STARTING indicates that a START of the PFID was issued and TCP/IP sent an activation request to the Data Link Control (DLC) layer.

  For an ISM interface, this should be a transitory state.

  For an RNIC interface, if the PFIDSTATUS remains STARTING, this means z/OS Communications Server did not receive a port state change event that indicates the port is active from the “RoCE Express” feature. Until the port state change event is received, the PFIDSTATUS remains in STARTING state.

  Take the following actions if the PFIDSTATUS field does not change from STARTING to READY for an RNIC interface:
  
  – Check that your cables are connected properly.
– Verify that the switch ports are enabled.
– If the RoCE adapters are hard-wired to each other, the STARTING status is expected until the partner side has started the RNIC interface.
– Verify that the optical cable used for the RNIC adapter is not damaged.

### Problem with SMC interaction with security function

Generally, security functions that require TCP/IP to examine TCP packets cannot be used with SMC communications because data that is sent over SMC links is not converted into TCP packets.

For more information, see Security functions in z/OS Communications Server: IP Configuration Guide.

### VTAM message IST2444I seen during PFID activation

You should not code the PORTNUM operand on the GLOBALCONFIG SMCR statement when the PFID represents a RoCE Express2 feature. The correct port number is configured in the Hardware Configuration Definition (HCD) and is learned by VTAM and the TCP/IP stack during PFID activation.

If you code a value for PORTNUM on GLOBALCONFIG, and it is not the same as the HCD port number value, VTAM issues message IST2444I during PFID activation. For instance, if you configured GLOBALCONFIG SMCR PFID 51 PORTNUM 2, but the correct port number is port 1, the following message is generated when VTAM activates PFID 51:

IST2444I PORTNUM 2 IGNORED FOR SMC-R PFID 0051, ACTIVATION CONTINUES

This is just an informational message, so you do not have to take any action. If you want to avoid getting this message during any subsequent PFID activation attempts, you can remove the PORTNUM value from the GLOBALCONFIG SMCR statement.

Any VARY OBEYFILE processing involving PFID 51 should work regardless of whether you correct the incorrect PORTNUM value.
Chapter 36. Diagnosing problems with Express Logon

The Express Logon feature in Communications Server for z/OS allows a user on a workstation, with a TN3270E client and an X.509 certificate, to log on to an SNA application without entering an ID or password.

This topic describes how to diagnose problems using Express Logon for the z/OS Communications Server Express Logon feature, including the Digital Certificate Access Server (DCAS). It contains the following sections:

• “Analyzing start problems with the DCAS” on page 764
• “Analyzing client interface problems” on page 765

For complete information about Express Logon, see the following:

• z/OS Communications Server: IP Configuration Guide
• z/OS Security Server RACF Security Administrator’s Guide

For most situations in which the DCAS does not start, a message to the console is displayed. If the explanation in z/OS Communications Server: IP and SNA Codes does not help, you should turn on debugging and logging. You can specify debugging and logging as startup parameters from the z/OS UNIX shell or from the MVS console as a started procedure:

• If the DCAS is started from the z/OS UNIX shell, you can specify the following:

  `dcas -d <debugging_level> -l <logtype>`

• If the DCAS is started from the MVS console, you can specify debugging and logging on the PARM statement after the final slash, as shown in the following example:

  ```
  //DCAS   PROC
  //*
  //DCAS   EXEC PGM=EZADCDMN,REGION=4096K,TIME=NOLIMIT,
  // PARM='POSIX(ON) ALL31(ON)/-d -1 SYSLOGD'
  ```

The following optional parameters can be used with both DCAS UNIX commands and MVS started procedures:

-d or -D

Indicates debugging. The following levels apply:

1

  Specifies log error and warning messages.

2

  Specifies log error, warning, and informational messages.

3

  Specifies log error, warning, informational, and debug messages.

The default level is 3.

-l or -L

Indicates logging to SYSLOGD or to a designated log file. If you do not specify this parameter, logging defaults to /tmp/dcas.log.

If you specify a debug level, but not logging, the DCAS attempts to open the default log file /tmp/dcas.log. If this fails, debugging is turned off.

For SYSLOGD, the DCAS uses the log facility local0.

If DCAS has already been started you can issue a MODIFY DCAS,DEBUG=debug_level from the MVS console to enable, disable, or switch the level of debugging. See z/OS Communications Server: IP System Administrator's Commands for more information about this command.
An accent mark (´) is used in the definition above, not a single quotation mark.

For further aid in diagnosing errors, see the error logs of the TN3270E middle-tier servers. Also, examine the HOD client security message panel.

The following netstat commands, issued from the middle-tier server, are useful in determining connectivity problems between z/OS Communications Server and DCAS.

For AIX, the netstat command is:

```bash
netstat -an | grep port#
```

For CS/2, the netstat command is:

```bash
netstat -sn | grep port#
```

For NT, the netstat command is:

```bash
netstat -an | more port#
```

In the netstat commands, port# is the listening port of DCAS. The default DCAS port is 8990.

## Analyzing start problems with the DCAS

When analyzing problems that occur when starting the DCAS, consider the following:

- The DCAS must run from an APF Authorized library.
- The DCAS uses z/OS Language Environment C runtime services. Make sure that the Language Environment C runtime library is compatible with the current level of z/OS Communications Server.
- If DCAS uses IBM System SSL (TLSMECHANISM DCAS):
  - The DCAS calls SSL cryptographic services runtime library. Verify that hlq.SYS1.SIEALNKE is accessible at run time. If certificates are authenticated using the X.500 host, SSL uses LDAP services to access the X.500 host. If running from the z/OS UNIX shell, verify that the LIBPATH environment variable includes /usr/lib.
  - The DCAS attempts to initialize SSL services. If you are using key rings that reside in the z/OS UNIX file system, verify that the KEYRING and STASHFILE keywords in the DCAS configuration file point to valid z/OS UNIX file system file names. Names are case-sensitive. If using key rings that reside in RACF, verify that the SAFKEYRING keyword in the DCAS configuration file references a valid RACF key ring.
- If DCAS uses AT-TLS policies (TLSMECHANISM ATTLS), see the following topics for more information:
  - Customizing DCAS for TLS/SSL in z/OS Communications Server: IP Configuration Guide
  - Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637
- The DCAS must be associated with a valid user ID using z/OS UNIX services. It must run with the POSIX(ON) C runtime option. Use the following RACF command:

```plaintext
ADDUSER dcasid DFLTGRP(OMVSGRP) OMVS(UID(0) HOME('/'))
```

- If the DCAS is started as an MVS started procedure, verify that the following RACF commands have been issued:

```plaintext
RDEFINE STARTED DCAS.* STDATA(USER(dcasid))
RDEFINE OPERCMDS (MVS.SERVMGR.DCAS) UACC(NONE)
PERMIT MVS.SERVMGR.DCAS CLASS(OPERCMDS) ACCESS(CONTROL) ID(dcasid)
SETROPTS RACLIST(OPERCMDS) REFRESH
```

- The DCAS uses the TCP/IP protocol to communicate with clients in the network. Verify that the z/OS Communications Server products VTAM and TCP/IP have been started and are active.
Analyzing client interface problems

When analyzing problems with client interfaces, consider the following:

- DCAS uses the TCP/IP protocol to communicate with its clients, the TN3270 middle-tier servers. Verify that the z/OS Communications Server products VTAM and TCP/IP have been started and are active. To verify network connectivity to a client, try pinging that client.
- The DCAS uses RACF services to obtain a user ID given a digital certificate.
  - Verify the certificate has been defined properly to RACF. Use the following commands:
    ```
    SETROPTS CLASSACT(DIGTCERT)
    SETROPTS RACLST(DIGTCERT) REFRESH
    PERMIT IRR.DIGTCERT.function CLASS(FACILITY) ID(dcasid) ACCESS(CONTROL)
    RACDCERT ID(userid) ADD('certificate dataset name') TRUST
    ```
  - Verify that the user ID associated with the DCAS has permission to access certificates. Use the following RACF commands:
    ```
    SETROPTS CLASSACT(DIGTCERT)
    SETROPTS RACLST(DIGTCERT) REFRESH
    PERMIT IRR.DIGTCERT.LIST CLASS(FACILITY) ID(dcasid) ACCESS(CONTROL)
    ```
  - The DCAS uses RACF services to obtain a PassTicket for an associated application ID. Verify that the RACF PTKTDATA profile for the application ID has been defined properly. The ID must match the ID specified on the workstation client. For HOD V5, this is the name specified in the Express Logon Application ID pop-up window. It might not be the same name specified on the USSMSG10. For applications such as TSO, specifying the application ID can be difficult since the profile name has special RACF considerations. See the z/OS Security Server RACF Security Administrator's Guide.

Use these commands to verify the RACF PTKTDATA profile:

```
SETROPTS CLASSACT(PTKTDATA)
RDEFINE profile PTKTDATA SSIGNON() 
SETROPTS RACLST(PTKTDATA) REFRESH
```
Chapter 37. Diagnosing resolver problems

This topic describes how to diagnose resolver problems and contains the following subtopics:

- “Steps for resolving the hostname” on page 767
- “Steps for resolving caching problems” on page 770
- “Steps for responding to message EZZ9308E” on page 772
- “Steps for responding to message EZZ9311E” on page 778
- “TRACE RESOLVER” on page 783
- “CTRACE - RESOLVER” on page 803

The resolver provides two kinds of tracing plus an IPCS subcommand to help analyze resolver problems in dumps. The resolver provides TRACE RESOLVER information that can be helpful in debugging problems an application program could have with using resolver facilities (for example, GetAddrInfo or GetNameInfo). Component Trace is used for tracing the RESOLVER component (SYSTCPRE) for diagnosing resolver problems that cannot be isolated to one particular application. Use the IPCS RESOLVER subcommand to format and summarize resolver control blocks (see “RESOLVER command” on page 264).

See z/OS Communications Server: IP Configuration Reference for additional information.

Steps for resolving the hostname

Determine why a hostname failed to resolve.

Before you begin
You need to know the exact hostname that failed to resolve and the environment in which the application was running (for example, TSO, UNIX, or batch).

Procedure
1. Diagnose why the hostname failed to resolve by pinging the hostname. Base your next course of action on the following conditions:

<table>
<thead>
<tr>
<th>If ping for the hostname...</th>
<th>Then...</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succeeds, but another application fails when resolving the same hostname</td>
<td>One or more of the following may be the problem:</td>
<td>Use the Trace Resolver to solve the problem.</td>
</tr>
<tr>
<td></td>
<td>• The resolver configuration for the application in the users environment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The resolver cache has information about the hostname, and one application is able to access the resolver cache and the other is not.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The resolver cache has saved different information about the hostname as provided by different name servers, and the applications are using different cached information.</td>
<td></td>
</tr>
</tbody>
</table>
### If ping for the hostname...

<table>
<thead>
<tr>
<th>If ping for the hostname...</th>
<th>Then...</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fails, but the hostname is converted to an IP address</td>
<td>The resolution is successful but the host is not reachable or active.</td>
<td>See Chapter 4, “Diagnosing network connectivity problems,” on page 25 to continue researching the problem.</td>
</tr>
<tr>
<td>Fails to convert the name to an IP address</td>
<td>The problem might be with the resolver configuration, querying the resolver cache, searching local host files, or using DNS.</td>
<td>Use Trace Resolver to solve the problem. <strong>Note:</strong> You can use the LOOKUP option in TCPIP.DATA to specify local searching before or instead of asking DNS.</td>
</tr>
</tbody>
</table>

2. Determine whether the name or address being queried is known to DNS if you expect to resolve the hostname using DNS.

The following example looks for the name www.johndoe.com from the DNS at IP address 1.2.3.4:

```bash
dig @1.2.3.4 www.johndoe.com -t any
```

The command should return all resource records of any type from the DNS at 1.2.3.4 for www.johndoe.com. For more information about dig, see [z/OS Communications Server: IP System Administrator's Commands](https://www.ibm.com/support/knowledgecenter/SSEQ4Q_9.1.0/com.ibm.net.doc/tz_osccomer_tdicommands.html).

3. If dig does not return all resource records, base your next course of action on the following conditions:

<table>
<thead>
<tr>
<th>If dig...</th>
<th>Then...</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fails because it cannot contact DNS</td>
<td>You need to check your link to the DNS IP address.</td>
<td>See Chapter 4, “Diagnosing network connectivity problems,” on page 25 to continue researching the problem.</td>
</tr>
<tr>
<td>Fails because DNS reports that the resource was not found</td>
<td><a href="http://www.johndoe.com">www.johndoe.com</a> is not a resource record known to DNS.</td>
<td>See the DNS administrator to add the name. As a temporary work-around, you might want to add the name to a local host file that the resolver searches. See <a href="https://www.ibm.com/support/knowledgecenter/SSEQ4Q_9.1.0/com.ibm.net.doc/zos/zoconfig.html">z/OS Communications Server: IP Configuration Guide</a> for information about local host files.</td>
</tr>
</tbody>
</table>
If dig... | Then... | Solution
---|---|---
Succeeds | The problem in resolving the hostname using ping or another application might be in configuring the resolver, or might involve the contents of the resolver cache, or might result from the resolver treating the name server as unresponsive. | The `dig` command bypasses the resolver cache, search orders, local host files, and domain names that are appended by the resolver. The best way to check the configuration is to start the Trace Resolver. It is important to use the Trace Resolver in the environment where the application is failing because the application might be using a different TCPIP.DATA file, environment variables, or search order than the environment where the `dig` command was issued.

The application might also be accessing the resolver cache, which might have inaccurate or outdated information. See “Steps for resolving caching problems” on page 770 for more cache information.

The resolver might not be sending DNS queries generated by applications because the name server is considered to be unresponsive. See “Steps for responding to message EZZ9311E” on page 778 for more information.

4. If the Trace Resolver output indicates errors in the resolver configuration, issue the MODIFY RESOLVER,DISPLAY command and base your course of action on the following conditions:

<table>
<thead>
<tr>
<th>If MODIFY RESOLVER,DISPLAY output...</th>
<th>Then...</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes message EZD2039I WARNINGS ISSUED DURING RESOLVER INITIALIZATION</td>
<td>The resolver detected syntax errors or unrecognized setup statements when it was processing the resolver setup file statements during address space initialization. These errors might cause the resolver to use different settings than you intended.</td>
<td>Correct the errors in the resolver setup file. Issue the MODIFY RESOLVER,REFRESH,SETUP command to correct the resolver configuration.</td>
</tr>
</tbody>
</table>

| Does not include message EZD2039I. | No syntax errors were in the resolver setup file. The configuration error might still be a value that is incorrectly specified on a resolver setup statement, or it might be an error in the application TCPIP.DATA file. | Correct the errors in the resolver setup file or application TCPIP.DATA file. Issue the MODIFY RESOLVER,REFRESH command to correct the configuration errors. |
Results
You know that you are done when the application that previously failed to resolve the host name can now resolve it.

Steps for resolving caching problems
Determine whether a hostname contains inaccurate information in the resolver cache.

Before you begin
You need to know the exact hostname that is suspected to have inaccurate information in the resolver cache, and the environment in which the application was running (for example, TSO, UNIX, or batch).

Procedure
1. Determine whether the resolver cache contains any information about the host name, using the Netstat RESCache/-q report. The following command can be used to display information about the host name (which in this example is www.johndoe.com):

   netstat -q DETAIL -H www.john.doe

   The command should display all entries that exist in the resolver cache because of hostname-to-IP address resolution requests for www.johndoe.com. For more information about the Netstat RESCache/-q report, see z/OS Communications Server: IP System Administrator's Commands.

2. Determine, using the **dig** command, if the name or address being queried is known to the DNS name server if you expect to resolve the hostname using DNS.

   The following example looks for the name www.johndoe.com from the DNS at IP address 1.2.3.4:

   dig@1.2.3.4 www.johndoe.com -t any

   The command should return all resource records of any type from the DNS at 1.2.3.4 for www.johndoe.com. For more information about dig, see z/OS Communications Server: IP System Administrator's Commands. The DNS name server to use for this search is the first name server listed in the NSINTERADDR list of name servers in the TCPIP.DATA data set used by the application experiencing the problems. For more information about NSINTERADDR, see z/OS Communications Server: IP Configuration Reference.

3. Base your next course of action on the results of the **dig** command:

<table>
<thead>
<tr>
<th>If . . .</th>
<th>Then . . .</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dig fails because it cannot contact DNS</td>
<td>You need to check your link to the DNS IP address.</td>
<td>See Chapter 4, “Diagnosing network connectivity problems,” on page 25 to continue researching the problem.</td>
</tr>
<tr>
<td>Dig fails because DNS reports that the resource was not found <a href="http://www.johndoe.com">www.johndoe.com</a> is not a resource record known to DNS.</td>
<td></td>
<td>See the DNS administrator to add the name.</td>
</tr>
</tbody>
</table>
If dig succeeds, and the resolver cache has different information from what was returned by dig

The cache information might be information that was provided by a different name server, or might represent old information that was assigned a time-to-live (TTL) value that was excessive. The application might be acquiring inaccurate information about the hostname due to the resolver cache data.

Because the `dig` command bypasses the resolver cache, the `dig` command is unaffected by the resolver cache information. To remove the cache information, issue the MODIFY RESOLVER,FLUSH,ALL command to delete all entries from the cache. For more information about MODIFY FLUSH processing, see z/OS Communications Server: IP System Administrator's Commands.

If dig succeeds, but the resolver cache has the same information as dig, or has no information about the hostname

The problem in resolving the hostname using ping or another application might be in configuring the resolver, or might result from the resolver treating the name server as unresponsive.

The `dig` command bypasses the resolver cache, search orders, local host files, and domain names that are appended by the resolver. The best way to check the configuration is to start the Trace Resolver. It is important to use the Trace Resolver in the environment where the application is failing because the application might be using a different TCPIP.DATA file, environment variables, or search order than the environment where the `dig` command was issued.

The resolver might not be sending DNS queries that are generated by applications because the name server is considered to be unresponsive. See “Steps for responding to message EZZ9311E” on page 778 for more information.

### 4. If the Trace Resolver output indicates errors in the resolver configuration, issue the MODIFY RESOLVER,DISPLAY command and base your course of action on the following conditions:

<table>
<thead>
<tr>
<th>If MODIFY RESOLVER,DISPLAY output . . .</th>
<th>Then . . .</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes message EZD2039I WARNINGS ISSUED DURING RESOLVER INITIALIZATION</td>
<td>The resolver detected syntax errors or unrecognized setup statements when it was processing the resolver setup file statements during address space initialization. These errors might cause the resolver to use different settings than you intended.</td>
<td>Correct the errors in the resolver setup file. Issue the MODIFY RESOLVER,REFRESH,SETUP command to correct the resolver configuration.</td>
</tr>
<tr>
<td>If MODIFY RESOLVER,DISPLAY output . . .</td>
<td>Then . . .</td>
<td>Solution</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>Does not include message EZD2039I.</td>
<td>No syntax errors were in the resolver setup file. The configuration error might still be a value that is incorrectly specified on a resolver setup statement, or it might be an error in the application TCPIP.DATA file.</td>
<td>Correct the errors in the resolver setup file or application TCPIP.DATA file. Issue the MODIFY RESOLVER,REFRESH command to correct the configuration errors.</td>
</tr>
</tbody>
</table>

**Results**

You know that you are done when the application that previously failed to resolve the host name can now resolve it.

**Steps for responding to message EZZ9308E**

Message EZZ9308E is displayed when the resolver is monitoring the responsiveness of name servers, the network operator notification function is active, and the resolver determined that a name server is not responding to a significant percentage of queries over a 5-minute interval, where significant is defined by the setting of the UNRESPONSIVETHRESHOLD resolver setup statement. You might want to take action for your name servers when you see message EZZ9308E.

**Procedure**

Use the following steps to determine your course of action, if any, in response to message EZZ9308E:

1. Evaluate the scope of the problem with the name server.

Answer the following questions to determine whether there is a significant issue with the name server:

<table>
<thead>
<tr>
<th>Question</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the monitoring function enabled when it should not be enabled?</td>
<td>The resolver might have detected syntax errors when processing the resolver setup file, and might have used the default setting for UNRESPONSIVETHRESHOLD.</td>
</tr>
<tr>
<td>Are there known network problems that are contributing to the situation?</td>
<td>If known network problems exist, then message EZZ9308E is likely a result of those problems, and the name server issues should clear up once the network problem is resolved.</td>
</tr>
</tbody>
</table>
| Is only one name server unresponsive, or are multiple name servers unresponsive? | Resolver generates message EZZ9308E for each name server that is unresponsive.  
  - If multiple name servers are reported as unresponsive at roughly the same time, it is likely a more systemic network problem than a problem with any given name server.  
  - If only one name server is reported as unresponsive, it is more likely to be an issue with that specific name server. |
<table>
<thead>
<tr>
<th>Question</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this name server the primary, mission critical name server, or is it the backup name server?</td>
<td>Problems with the primary name server are likely to cause more disruption to the network and to your system, and thus are more likely to require intervention, than problems with a secondary name server.</td>
</tr>
<tr>
<td>Is the reported IP address not a valid address for contacting a name server?</td>
<td>One or more TCPIP.DATA data sets being used by applications on the systems have an incorrect IP address coded on an NSINTERADDR or NAMESERVER statement, and resolver is repeatedly attempting to send queries to that IP address.</td>
</tr>
<tr>
<td>Is the volume of requests that are failing significant?</td>
<td>Resolver reports the total number of resolver queries and total number of failures associated with this name server in message EZZ9310I, which is displayed when the name server is first identified as being unresponsive, and also at 5-minute intervals after that for as long as the name server remains unresponsive. High numbers of failures, or a significant percentage of a high number of requests, represents a larger disruption to your system than a small number of failures to a name server that is seldom used.</td>
</tr>
<tr>
<td>Is the name server responding, but not fast enough to be considered responsive by resolver?</td>
<td>Coding a very small RESOLVERTIMEOUT value might cause resolver to treat late arriving name server responses as failures to respond, even though the response from the name server is used by resolver to satisfy the API call. A less aggressive RESOLVERTIMEOUT value might alleviate the situation, or the situation could be ignored if slight network disruptions are thought to be the issue. Issue <code>dig</code> commands to query information at the name server being reported as unresponsive. Use the <code>+time</code> operand on the <code>dig</code> command to override the setting for RESOLVERTIMEOUT in order to determine whether the setting of RESOLVERTIMEOUT is possibly at fault.</td>
</tr>
<tr>
<td>Question</td>
<td>Implication</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Is the number of failures artificially high due to TCPIP.DATA settings?</td>
<td>The settings for RESOLVERUDPRETRIES and SEARCH might cause resolver to increment the failure count multiple times for a single resolver API call, thereby possibly exaggerating the impact of the failures to your system.</td>
</tr>
<tr>
<td></td>
<td>• If multiple domain names are coded on the SEARCH statement, multiple searches for one hostname, with the unique domain names appended, might be attempted.</td>
</tr>
<tr>
<td></td>
<td>• If a value greater than 1 is coded for RESOLVERUDPRETRIES, multiple attempts to contact the same name server for the same resource might be attempted.</td>
</tr>
<tr>
<td></td>
<td>In either case, a small number of API calls could result in a significantly higher failure rate than would be expected for a lightly used name server. If these settings are combined with a small RESOLVERTIMEOUT value, the number could potentially be very high and yet the name server could be running normally.</td>
</tr>
</tbody>
</table>

2. Based on the answer to your evaluation of the scope of the problem, take the following actions:

<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
<tbody>
<tr>
<td>The problem is related to errors in the resolver setup file.</td>
<td>a. Identify and correct the errors in the resolver setup file.</td>
</tr>
<tr>
<td></td>
<td>b. Issue the MODIFY RESOLVER,REFRESH,SETUP=setup_filename command to correct the resolver configuration settings.</td>
</tr>
<tr>
<td>The problem is network-related.</td>
<td>a. Identify and correct the network problem.</td>
</tr>
<tr>
<td></td>
<td>b. Optionally, clear the eventual action messages from the operator console, or leave the message on the operator console and wait for the resolver to clear the message when the name server is again responsive.</td>
</tr>
</tbody>
</table>
**Table 76. Message EZZ9308E name server resolution, part 2 (continued)**

<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
</table>
| The problem is related to a valid name server. | a. Identify and correct the problem with the name server.  
| | b. Optionally, enable the autonomic quiescing of unresponsive name servers function so that the resolver automatically stops forwarding DNS queries generated by an application to the valid name server while it is unresponsive. The automatic quiescing function requires you to define a global TCPIP.DATA file. Review the information about the resolver and the global TCPIP.DATA file in the z/OS Communications Server: IP Configuration Guide to determine whether you can use a global TCPIP.DATA file. If you can use a global TCPIP.DATA file, enable the automatic quiescing function by performing the following steps:  
| | • If you do not have a resolver setup file, create one.  
| | • If you do not have a global TCPIP.DATA file, create one. Code one or more NSINTERADDR statements in the global TCPIP.DATA file, specifying the IP addresses of the name servers to be used in your environment.  
| | • Code the GLOBALTCPIPDATA statement in the resolver setup file, and specify the name of your global TCPIP.DATA on the statement. Code the UNRESPONSIVETHRESHOLD statement in the setup file, specifying a threshold percentage and also specifying the AUTOQUIESCE operand. Issue the MODIFY RESOLVER,REFRESH,SETUP=setup_filename command to cause the resolver to use the new threshold value and to automatically stop forwarding DNS queries generated by an application to unresponsive name servers.  
<p>| | c. Optionally, clear the eventual action messages from the operator console, or alternatively leave the message on the operator console and wait for the resolver to clear the message when the name server is again responsive. |</p>
<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
<tbody>
<tr>
<td>The problem is related to an aggressive timeout value for resolver queries.</td>
<td>a. Identify the TCPIP.DATA data sets that have the small RESOLVERTIMEOUT.</td>
</tr>
<tr>
<td></td>
<td>b. Modify the TCPIP.DATA data sets to increase the timeout value.</td>
</tr>
<tr>
<td></td>
<td>c. Issue MODIFY RESOLVER,REFRESH to cause resolver to read the updated TCPIP.DATA data sets the next time any application using the data set issues a resolver request.</td>
</tr>
<tr>
<td></td>
<td>d. Optionally, clear the eventual action messages from the operator console, or alternatively leave the message on the operator console and wait for resolver to clear the message when the name server is again responsive.</td>
</tr>
<tr>
<td>The problem is related to an incorrect IP address.</td>
<td>a. Clear the eventual action messages from the operator console.</td>
</tr>
<tr>
<td></td>
<td>b. Identify the TCPIP.DATA data sets that have the incorrect IP address in the list of name servers to contact.</td>
</tr>
<tr>
<td></td>
<td>c. Modify the TCPIP.DATA data sets to eliminate the IP address.</td>
</tr>
<tr>
<td></td>
<td>d. Issue MODIFY RESOLVER,REFRESH to cause resolver to read the updated TCPIP.DATA data sets the next time any application using the data set issues a resolver request.</td>
</tr>
</tbody>
</table>
The problem is not considered to be an error, or is considered to be insignificant, or is a result of TCPIP.DATA settings that are adding to the problem.

<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
</table>
| The problem is not considered to be an error, or is considered to be insignificant, or is a result of TCPIP.DATA settings that are adding to the problem. | a. Clear the eventual action messages from the operator console.  
b. Optionally, if TCPIP.DATA settings are thought to be exaggerating the issue, and those settings can be modified without disrupting normal network processing, perform the following steps:  
  - Identify the TCPIP.DATA data sets that have the settings that need to be changed.  
  - Modify the TCPIP.DATA data sets to correct the RESOLVERUDPRETRIES or SEARCH settings.  
  - Issue MODIFY RESOLVER,REFRESH to cause the resolver to use the new settings.  
c. Optionally modify the value of threshold value for declaring a name server to be unresponsive in order to reduce the likelihood of future EZZ9308E messages being displayed for this name server. To modify the threshold value, perform the following steps:  
  - If you do not have a resolver setup file, create one.  
  - Code the desired percentage value for UNRESPONSIVETHRESHOLD in the setup file. Coding a value of zero will turn off the monitoring function.  
  - Issue the MODIFY RESOLVER,REFRESH,SETUP=setup_filename command to cause the resolver to use the new threshold value. |

3. Manually clearing message EZZ9308E does not mean that the name server is now responsive, so you might need to continue to monitor the state of the name server.

Based on your actions in Step 2, do one of the following:
<table>
<thead>
<tr>
<th>Monitoring function status</th>
<th>Actions required</th>
</tr>
</thead>
<tbody>
<tr>
<td>You did not turn off the monitoring function.</td>
<td>Monitor the operator console for these resolver messages:</td>
</tr>
<tr>
<td></td>
<td>a. EZZ9310I, which the resolver issues to provide statistics for unresponsive name servers at 5-minute intervals. Use the statistics provided in EZZ9310I to ensure that the problem with this name server does not become a more serious problem, for instance that the percentage of failed messages to the name server does not become significantly higher. If the name server continues to fail to respond to messages for a longer period of time than expected, or the percentage of queries receiving no response increases significantly, re-evaluate the problem by using the questions in Step 1.</td>
</tr>
<tr>
<td>You turned on the autonomic quiescing of unresponsive name servers function.</td>
<td>Issue the MODIFY RESOLVER,DISPLAY command to verify that the UNRESPONSIVETHRESHOLD statement is set to the percentage that you specified in the resolver setup file and that AUTOQUIESCE is set. If the name server remains unresponsive, the resolver will now issue message EZZ9311E, and will stop forwarding DNS queries generated by an application to the unresponsive name server.</td>
</tr>
<tr>
<td>You turned off the monitoring function.</td>
<td>Issue the MODIFY RESOLVER,DISPLAY command to verify that the UNRESPONSIVETHRESHOLD statement is set to 0. You will receive no new unresponsive messages, including EZZ9308E or EZZ9311E, until you restart the monitoring function.</td>
</tr>
</tbody>
</table>

**Results**

You know you are done when EZZ9308E no longer appears on the operator console and the name server is now responsive or the monitoring function is disabled or the autonomic quiescing function is active. If the monitoring function is still enabled and resolver subsequently determines that the name server is again unresponsive, a new message EZZ9308E is displayed.

**Steps for responding to message EZZ9311E**

You might want to take action regarding your name servers when you see message EZZ9311E.

**About this task**

Message EZZ9311E is displayed when the resolver is monitoring the responsiveness of name servers, the autonomic quiescing of unresponsive name servers function is active, and the resolver has determined that a name server is not responding to a significant percentage of queries over a 30-second interval where significant is defined by the setting of the UNRESPONSIVETHRESHOLD resolver setup statement.
The resolver will not forward DNS queries generated by an application to an unresponsive name server displayed in message EZZ9311E.

**Guideline:** If all possible name servers are unresponsive, the resolver sends queries generated by the application to the name servers rather than failing the application-query immediately.

**Procedure**

Use the following steps to determine your course of action, if any, in response to message EZZ9311E:

1. Evaluate the scope of the problem with the name server.

   Answer the following questions to determine whether there is a significant issue with the name server.

<table>
<thead>
<tr>
<th>Question</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the monitoring function enabled when it should not be enabled?</td>
<td>The resolver might have detected syntax errors when processing the resolver setup file, and might have used the default setting for UNRESPONSIVETHRESHOLD.</td>
</tr>
<tr>
<td>Are there known network problems that are contributing to the situation?</td>
<td>If known network problems exist, then message EZZ9311E is likely a result of those problems. The name server issues should stop when the network problem is resolved.</td>
</tr>
</tbody>
</table>
| Is only one name server unresponsive, or are multiple name servers unresponsive? | The resolver generates message EZZ9311E for each name server that is unresponsive.  
  • If multiple name servers are reported as unresponsive at roughly the same time, the network problem is probably a systemic problem, rather than a problem with any given name server.  
  • If only one name server is reported as unresponsive, the problem is probably an issue with that specific name server. |
| Is this name server the primary, mission-critical name server, or is it the backup name server? | Problems with the primary name server are likely to cause more disruption to the network and to your system, and are more likely to require intervention than problems with a secondary name server. |
| Is the reported IP address a valid address for contacting a name server?   | An incorrect IP address might be coded on an NSINTERADDR or NAMESERVER statement in your global TCPIP.DATA file. The resolver is repeatedly attempting to send DNS queries generated by an application or DNS polling queries to that IP address. |
| Is the volume of requests that are failing significant?                  | The resolver reports the total number of resolver queries and total number of failures associated with this name server in message EZZ93131, which is displayed along with message EZZ9311E when the name server is identified as unresponsive. The resolver will not consider a name server to be unresponsive if less than 10 total DNS queries completed during the monitoring interval. A high percentage of failures to your primary name server represents a larger disruption to your system than a small number of failures to a name server that is seldom used. |

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### Table 78. Message EZZ9311E name server resolution, part 1 (continued)

<table>
<thead>
<tr>
<th>Question</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the name server responding, but not fast enough to be considered responsive by the resolver?</td>
<td>Coding a low RESOLVETIMEOUT value might cause the resolver to treat name server responses that arrive late as failures to respond, even though the response from the name server is used by the resolver to satisfy the API call. A higher RESOLVETIMEOUT value might alleviate the situation. If you think that slight network disruptions are the problem, then you might choose to ignore the problem. Issue commands to query for information at the name server that is being reported as unresponsive. Use the +time operand on the command to override the setting for the RESOLVETIMEOUT statement to determine whether the RESOLVETIMEOUT setting is causing the problem.</td>
</tr>
</tbody>
</table>
| Is the number of failures artificially high due to TCPIP.DATA settings? | The settings for the RESOLVERUDPRETRIES and SEARCH statements might cause the resolver to increment the failure count multiple times for a single resolver API call. Multiple increments can exaggerate the impact of the failures to your system.  
- If multiple domain names are coded on the SEARCH statement, the resolver might attempt multiple searches for one host name, with the unique domain names appended.  
- If a value greater than 1 is coded for RESOLVERUDPRETRIES, the resolver might attempt to contact the same name server for the same resource multiple times. In either case, a low number of API calls could result in a significantly higher failure rate than you would expect for a name server that is not used often. If these settings are combined with a low RESOLVETIMEOUT value, the number of API calls could potentially be high and yet the name server could be running normally. |

2. Based on the answer to your evaluation of the scope of the problem in Step 1, take the appropriate action listed in Table 79 on page 780:

### Table 79. Message EZZ9311E name server resolution, part 2

<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
</table>
| The problem is related to errors in the resolver setup file. | a. Identify and correct the errors in the resolver setup file.  
b. Issue the MODIFY RESOLVER,REFRESH,SETUP=setup_filename command to correct the resolver configuration settings. |
<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
<tbody>
<tr>
<td>The problem is network-related.</td>
<td>a. Identify and correct the network problem.</td>
</tr>
<tr>
<td></td>
<td>b. Optionally, clear the eventual action messages from the operator console, or leave the message on the operator console and wait for the resolver to clear the message when the name server is again responsive.</td>
</tr>
<tr>
<td>The problem is related to the name server.</td>
<td>a. Identify and correct the problem with the name server.</td>
</tr>
<tr>
<td></td>
<td>b. Optionally, clear the eventual action messages from the operator console, or leave the message on the operator console and wait for the resolver to clear the message when the name server is again responsive.</td>
</tr>
<tr>
<td>The problem is related to a low timeout value for resolver queries.</td>
<td>a. Modify the global TCPIP.DATA data set to increase the timeout value.</td>
</tr>
<tr>
<td></td>
<td>b. Issue the MODIFY RESOLVER,REFRESH command to cause the resolver to read the updated TCPIP.DATA data sets the next time any application using the data set issues a resolver request.</td>
</tr>
<tr>
<td></td>
<td>c. Optionally, clear the eventual action messages from the operator console, or leave the message on the operator console and wait for the resolver to clear the message when the name server is again responsive.</td>
</tr>
<tr>
<td>The problem is related to an incorrect IP address.</td>
<td>a. Clear the eventual action messages from the operator console.</td>
</tr>
<tr>
<td></td>
<td>b. Modify the global TCPIP.DATA data set to eliminate the IP address.</td>
</tr>
<tr>
<td></td>
<td>c. Issue the MODIFY RESOLVER,REFRESH command to cause the resolver to read the updated TCPIP.DATA data sets the next time any application issues a resolver request.</td>
</tr>
</tbody>
</table>
### Table 79. Message EZZ9311E name server resolution, part 2 (continued)

<table>
<thead>
<tr>
<th>Answer</th>
<th>Actions required</th>
</tr>
</thead>
<tbody>
<tr>
<td>The problem is not considered to be an error or is a result of TCPIP.DATA settings that are adding to the problem.</td>
<td>a. Clear the eventual action messages from the operator console.</td>
</tr>
<tr>
<td></td>
<td>b. Optionally, if you think that TCPIP.DATA settings are exaggerating the issue and you can modify the settings without disrupting normal network processing, perform the following steps:</td>
</tr>
<tr>
<td></td>
<td>1) Modify the global TCPIP.DATA data set to correct the RESOLVERUDPRETRIES or SEARCH settings.</td>
</tr>
<tr>
<td></td>
<td>2) Issue the MODIFY RESOLVER,REFRESH command to cause the resolver to use the new settings.</td>
</tr>
<tr>
<td></td>
<td>c. Optionally, modify the threshold value for declaring a name server to be unresponsive to reduce the likelihood of future EZZ9311E messages being issued for this name server. To modify the threshold value, perform the following steps:</td>
</tr>
<tr>
<td></td>
<td>1) Code the percentage value for the UNRESPONSIVETHRESHOLD statement in the setup file. The value 0 turns off the monitoring function.</td>
</tr>
<tr>
<td></td>
<td>2) Issue the MODIFY RESOLVER,REFRESH,SETUP=setup_filename command to cause the resolver to use the new threshold value.</td>
</tr>
<tr>
<td>The problem is considered to be insignificant, or you no longer want the resolver to automatically stop forwarding DNS queries to unresponsive name servers.</td>
<td>Disable the autonomic quiescing of unresponsive name servers function. To disable the function, perform the following steps:</td>
</tr>
<tr>
<td></td>
<td>a. Remove the AUTOQUIESCE operand from the UNRESPONSIVETHRESHOLD statement in the resolver setup file. Code a percentage value for the UNRESPONSIVETHRESHOLD statement in the setup file. If you want to use the default value of 25%, you can delete the UNRESPONSIVETHRESHOLD statement from the setup file. The value 0 turns off the monitoring function.</td>
</tr>
<tr>
<td></td>
<td>b. Issue the MODIFY RESOLVER,REFRESH,SETUP=setup_filename command.</td>
</tr>
</tbody>
</table>

3. Manually clearing message EZZ9311E does not mean that the name server is now responsive, so you might need to continue to monitor the state of the name server.

Based on your actions in Step 2, take the appropriate action in Table 80 on page 783:
Table 80. Message EZZ9311E name server resolution, part 3

<table>
<thead>
<tr>
<th>Monitoring function status</th>
<th>Actions required</th>
</tr>
</thead>
<tbody>
<tr>
<td>You did not turn off the autonomic quiescing function.</td>
<td>a. Periodically issue the MODIFY RESOLVER,DISPLAY command. Use the failure rate information provided in the EZD2035I message associated with this name server to ensure that the problem with this name server does not become a more serious problem. For example, ensure that the percentage of failed DNS queries to the name server does not become significantly higher. If the name server continues to fail to respond to resolver DNS polling queries for a longer period of time than you expect, or the percentage of queries that receive no response increases significantly, re-evaluate the problem by going back to Step 1.</td>
</tr>
<tr>
<td></td>
<td>b. Monitor the operator console for message EZZ9312I, which the resolver issues to indicate that a previously unresponsive name server is responding to resolver DNS polling queries at an acceptable level. If EZZ9311E has not already been cleared by the operator, the resolver clears the message from the console.</td>
</tr>
<tr>
<td>You turned off the autonomic quiescing function.</td>
<td>Issue the MODIFY RESOLVER,DISPLAY command to verify that the UNRESPONSIVETHRESHOLD statement is set to the percentage that you specified in the resolver setup file (or the default value 25%), and to verify that AUTOQUIESCE is not displayed. If the name server remains unresponsive, the resolver issues message EZZ9308E and continues to forward DNS queries generated by an application to the name server.</td>
</tr>
<tr>
<td>You turned off the monitoring function completely.</td>
<td>Issue the MODIFY RESOLVER,DISPLAY command to verify that the UNRESPONSIVETHRESHOLD statement is set to 0. You will receive no new unresponsive messages, including messages EZZ9308E or EZZ9311E, until you restart the monitoring function.</td>
</tr>
</tbody>
</table>

Results

You know you are done when one of the following situations occurs:

- Message EZZ9311E no longer appears on the operator console and the name server is responsive
- The network operator notification function is active
- The monitoring function is disabled.

If the autonomic quiescing function is still enabled and resolver subsequently determines that the name server is again unresponsive, a new message EZZ9311E is displayed.

**TRACE RESOLVER**

You can activate Trace Resolver to collect Trace Resolver output. Trace Resolver output displays information about what the resolver looked for (the questions), where it looked (available name servers, resolver cache information, and local host table definitions), and what information was used to satisfy a
resolver API request. Because the resolver runs in the address space of the application, you must collect
Trace Resolver from the application address space. After the Trace Resolver output is collected, check the
following information in the output:

• Fix or check any problems reported at the top of the trace. These are errors in the resolver data sets, or
they might be errors detected in the resolver setup file during initialization of the resolver address
space.

• The environment (z/OS UNIX or native MVS) that the application is running in determines where the
resolver obtains the TCPIP.DATA statements to use. Are the data sets being used by the resolver the
ones you expected? If not, see the search orders for data sets in z/OS Communications Server: IP
Configuration Guide.

• Check that the expected MVS data sets or UNIX file system files are accessible by the user or batch job.
Errors detected by a security product (for example, RACF) or OPEN services can generate messages that
help indicate the problem. For example, IEC141I 013-C0 can be generated if a file does not have the
correct permission bit settings to allow it to be read. RACF message ICH408I can be issued if no OMVS
segment is defined or if insufficient authorization is granted to read a data set. See z/OS
Communications Server: IP Configuration Guide for more information.

• Check the TCPIP.DATA parameter values, especially NAMESERVER, NOCACHE, NOCACHEORDER,
NSINTERADDR, NSPORTADDR and SEARCH. TCPIP.DATA parameters are explained in z/OS
Communications Server: IP Configuration Reference.

• Check the questions posed by the Resolver to DNS or in searching the local host files. Are these the
queries you expected?

• Check for the cache query and cache add attempts being attempted by the resolver as part of
processing a resolver query. Are these the queries you expected, and the results that you anticipated for
those requests? Are the results from the cache-query attempts returning the information that you
expected to be returned for those target resources? If you suspect that there are problems with the
operations of the resolver cache, you will need to collect CTRACE records for further diagnosis. See
“CTRACE - RESOLVER” on page 803 for more details.

• Look for errors or failures in the trace.

• Did DNS respond (if you expected it to)? If not, see whether DNS is active at the IP address you
specified for NAMESERVER and NSINTERADDR and what port it is listening on. DNS logs can be helpful.
Ask the DNS administrator for help.

Tips: The resolver supports the Extension Mechanisms for DNS (EDNS0) standards, which permit DNS
messages of greater than 512 bytes to be returned by DNS to the resolver; however, some network
routers are configured to silently discard DNS messages of greater than 512 bytes. If the Trace Resolver
suggests that DNS did not respond, verify that no routers between the resolver and DNS are discarding
the messages.

The resolver dynamically determines the EDNS0 capability of each DNS, based on responses or
timeouts to DNS queries. The current view of the DNS capabilities is included in Trace Resolver output.
You can issue the Netstat HOME/-h command to examine Trace Resolver output. Use the Trace Resolver
information to verify that the resolver is using proper EDNS0 processing for a given DNS. Issue the
MODIFY REFRESH command to force the resolver to dynamically relearn the EDNS0 capability of the
name servers. Consider adjusting RESOLVERTIMEOUT values if timeout conditions cause the resolver to
mistakenly avoid EDNS0 processing for a given DNS.

• The following are some common misunderstandings:
  – If the queried name server returns NXDOMAIN, the resolver does not continue to the next name
server in the list. NXDOMAIN means the domain does not exist according to that name server.
  – The resolver only appends the specific names listed in the Search (or Domain) parameter. It does not
attempt shorter versions of these. For example, if you look for "johndoe" and your search list has
"anywhere.usa.com", the resolver looks for "johndoe.anywhere.usa.com" and "johndoe". (The order
depends on the value of option ndots.) The Resolver does not look for "johndoe.anywhere" or
"johndoe.anywhere.usa" or "johndoe.usa.com" or "johndoe.com".

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The contents of any local hosts files are not cached in the system-wide resolver cache, but are saved separately for each task.

Negative cache entries are created to represent the following responses from a name server:

- A response with a return code value of NXDOMAIN. This typically represents a host name that has no records of any type in the specified domain.
- A response with a return code value of NOERROR when no answer records are returned. This represents a host name that does not have any records of the type that was requested (A, AAAA, etc.) in the specified domain, but does have some records of a different type.
- A response with a return code value of NOERROR when the answer records returned represent canonical, or alias, names. This represents a resource that is officially known by other names in the specified domain, does not have any records of the type that was requested (A, AAAA, etc.), but does have some records for a different type of resource.

You cannot use the cache reordering function to ensure different reordered resolution results for individual applications. The list of cached IP addresses is reordered in a round-robin manner for an individual cached host name regardless of which applications request resolution of the host name. Therefore, an individual application that issues multiple resolution requests for the same host name might receive the cached IP addresses in the same order in response to each resolution request, even if the cache reordering function is active. Resolver address sorting algorithms can also cause the same results to be generated in response to multiple requests for the same host name. See Cache reordering in z/OS Communications Server: IP Configuration Guide for more information.

Activate Trace Resolver output in one of the following ways:

- Specify the z/OS UNIX RESOLVER_TRACE environment variable or a SYSTCPT DD allocation. Specifying the RESOLVER_TRACE environment variable or allocating the SYSTCPT DDname dynamically activates Trace Resolver output regardless of the TCPIP.DATA or the _res structure resDebug specification. Dynamic activation of Trace Resolver can be useful when you are not sure where the TCPIP.DATA statements might be found.
- Specify the TCPIP.DATA statement TRACE RESOLVER or OPTIONS DEBUG. When using a TCPIP.DATA statement to activate the trace, have the trace activation statement as your very first statement. This ensures that the trace is in effect for all statements in the TCPIP.DATA specification.
- Set the debug option (resDebug) in an application _res structure.
- Enable the CTRACE TRACERES option to collect Trace Resolver output. You can use this option to debug resolver problems in one of the following conditions:
  - Long running started tasks or jobs cannot be restarted.
  - Long running started tasks or jobs have significant resolver API activity that often occurs under multiple tasks.

You can use the CTRACE TRACERES option to collect the Trace Resolver output without restarting the started tasks or jobs. For more information, see “CTRACE - RESOLVER” on page 803.

The resolver uses the following search order to determine whether Trace Resolver output is necessary. The Trace Resolver data is contained in the specified output location. If the output location is not available for writing, the next search location is used. The default location for the Trace Resolver output in the z/OS UNIX environment is stdout. In the native MVS environment, it is as specified by the SYSPRINT DD.

1. The RESOLVER_TRACE environment variable (z/OS UNIX environment only).
2. The SYSTCPT DD allocation.
3. The TRACE RESOLVER or OPTIONS DEBUG statements. You must allocate STDOUT or SYSPRINT to generate trace data. The allocations need to exist in all operating environments including TSO, for example, your TSO Logon Procedure.
4. The resDebug bit set to on in the _res structure option field. STDOUT or SYSPRINT must be allocated or no trace data is generated.

Trace Resolver output can be written to any of the following:
• A TSO user terminal screen
• z/OS UNIX STDOUT
• JES SYSOUT
• An MVS Sequential data set (a member of a PDS is not supported). The data set must already exist or be allocated as new with the following DCB characteristics:
  – An LRECL between 80 and 256 with a RECFM of Fixed Block.
  – For an LRECL of 128 or larger, the last six print positions are the storage address of the MVS TCB that issued the resolver call. This can be helpful with multitask applications.
• A z/OS UNIX file system file. The file can either be an existing file or be dynamically allocated by the resolver when needed. The maximum line length used in the file is 255 characters. The last six print positions are the storage address of the MVS TCB that issued the resolver call. This can be helpful with multitask applications.

If the Trace Resolver output uses an MVS data set or z/OS UNIX file system file, the output is for the resolver services invoked by the last command or UNIX process. If possible, use SYSOUT=* or z/OS UNIX STDOUT to trace multiple resolver service invocations (for example, a multitask environment).

**Specifying the Trace Resolver output location**

Your environment determines the method to specify the Trace Resolver output location. This section includes the following environments:

• TSO
• z/OS UNIX
• MVS batch job
• z/OS UNIX batch

**TSO environment**

In the TSO environment, use one of the following to specify the Trace Resolver output location:

• For the user's terminal, enter the following:
  
  ```
  alloc dd(systcpt) da(*)
  ```

  When directing Trace Resolver output to a TSO terminal, define the screen size to be only 80 columns wide. Otherwise, trace output is difficult to read.

• For an existing MVS data set, enter the following:
  
  ```
  alloc dd(systcpt) da(appl.restrace)
  ```

  The user ID is used as the first qualifier for the data set. For example, if TSO USER1 entered the above command, user1 would be appended to the data set, as shown below:

  ```
  alloc dd(systcpt) da('user1.appl.restrace')
  ```

  To disable the Trace Resolver output, enter the following:

  ```
  free dd(systcpt)
  ```

**z/OS UNIX shell environment**

In the z/OS UNIX shell environment, use one of the following to specify the Trace Resolver output location:

• For STDOUT, enter the following:
  
  ```
  export RESOLVER_TRACE=STDOUT
  ```
If needed, you can redirect STDOUT when the z/OS UNIX command is issued. If your application was compiled with the z/OS C/C++ Language Environment Native ASCII support or your application uses the FTP Client Application Programming Interface (API) do not use STDOUT. If you use STDOUT with ASCII programs the trace data is not readable. If you use STDOUT with the FTP Client API the client's INIT command will fail. Instead send the trace data to an MVS data set or z/OS UNIX file system file as described below.

• For a new z/OS UNIX file system file or existing MVS data set, enter the following:

```bash
export RESOLVER_TRACE=/tmp/myjob.resolv.trace
export RESOLVER_TRACE=//appl.restrace
```

The user ID is used as the first qualifier for the data set. For example, if USER3 entered this command, user3 would be appended to the data set, as follows:

```bash
export RESOLVER_TRACE=//user3.appl.restrace
```

To disable the Trace Resolver output, enter the following:

```bash
set -A RESOLVER_TRACE
```

• For a z/OS UNIX file system file or an MVS data set that is already allocated to a ddname:

```bash
export RESOLVER_TRACE=//dd:ddname
```

or

```bash
export RESOLVER_TRACE=dd:ddname
```

### MVS batch job environment

In the MVS batch job environment, to use JES SYSOUT, enter the following statements:

```bash
//SYSTCPT DD SYSOUT=*  
//SYSPRINT DD SYSOUT=*  
```

You must allocate either SYSTCPT or SYSPRINT DD if the TCPIP.DATA statements TRACE RESOLVER or OPTIONS DEBUG are specified. If neither is allocated, then no trace output is written.

### z/OS UNIX batch environment

In the z/OS UNIX batch environment, use one of the following methods to specify the Trace Resolver output location:

• If the application resides in a z/OS UNIX file system file, use BPXBATSL to run the program. In this way, DD allocations is passed to the application. If the application does fork, the DD allocations are not passed to the new process, and the Trace Resolver output cannot be collected.

• To use the recommended JES SYSOUT, enter the following:

```bash
//SYSTCPT DD SYSOUT=*  
```

• Because STDOUT cannot be allocated to SYSOUT=* with BPXBATSL, use one of the following STDOUT DD JCL statements:

```bash
//STDOUT DD DISP=SHR, DSN=USER3.APPL.RESTRACE
//STDOUT DD PATH='/tmp/appl.stdout', PATHOPTS=(OWRONLY, OCREAT), PATHMODE=SIRWXU
```

**Note:** In this example, OTRUNC is not specified on the PATHOPTS statement. This means the Trace Resolver output is appended to the z/OS UNIX file system file. To avoid z/OS UNIX file system full conditions, manually delete trace output that is no longer needed to ensure that the file does not fill the specified directory (for example, /tmp/).
You must allocate either SYSTCPT or SYSPRINT DD if the TCPIP.DATA statements, TRACE RESOLVER or OPTIONS DEBUG, are specified. If neither is allocated, then no trace output is written.

- To pass the RESOLVER_TRACE environment variable using BPXBATSL or BPXBATCH, enter the following:

```bash
//STDENV DD JCL statement
```

The following shows an example:

```bash
//STDENV DD DISP=SHR,DSN=USER3.APPL.ENVIRON
```

The STDENV data set can be a fixed or variable (nonspanned) record format type. It can contain multiple environment variables, as shown in the following sample:

```bash
RESOLVER_TRACE=/'USER3.APPL.RESTRACE'
_BPXK_SETIBMOPT_TRANSPORT=TCPCS
```

**Note:**

1. Environment variables must start in column 1, and the data set must not contain any sequence numbers because they would be treated as part of the environment variable.
2. For the RESOLVERTrace environment variable, any blanks from a fixed-format STDENV data set is removed. Because this might not be true for all variables, a variable record format data set is recommended.
3. For applications that fork, use of an MVS data set is recommended. If you use a z/OS UNIX file system file, a C03 ABEND might occur when the forked process ends.

**Interpreting the Trace Resolver output**

The following example shows the setup files that are used, the command that is used to invoke the trace, and the Trace Resolver output:

**Setup files that are used for Trace Resolver:**

**Resolver Procedure:**

```bash
//RESOLVER PROC PARMS='CTRACE(CTIRESFL)'
//EZBREINI EXEC PGM=EZBREINI,REGION=0M,TIME=1440,PARM=&PARMS
//*
//SETUP DD DSN=TPOUSER.RESOLVER.SETUP.DATA,DISP=SHR,FREE=CLOSE
```

**Setup File TPOUSER.RESOLVER.SETUP.DATA contains:**

```bash
'; DEFAULTTCPIPDATA('TPOUSER.RESOLVER.DEFAULT.DATA')
'; GLOBALTCPIPDATA(/etc/tcpipglobal.data)
#
GLOBALTCPIPDATA('SYS1.TCPPARMS(RESGLOBL)')
```

**Global TCPIP.DATA file SYS1.TCPPARMS(RESGLOBL) contains:**

```bash
# Note that DOMAIN is ignored because SEARCH is mutually exclusive
# and SEARCH appears after DOMAIN.
Domain abcxyz
; Note that SEARCH can be specified on multiple lines.
SEARCH tcp.raleigh.ibm.com raleigh.ibm.com
SEARCH ibm.com com uk
SEARCH gov
#Search mil
SORTLIST 0.0.19.0/0.0.255.0 0.0.18.99/0.0.255.255 0.42.17.0/0.255.255.0
SORTLIST 129.42.16.0/255.255.255.0
#Sortlist 9.0.0.0
NSInterAddr 111.111.111.111
NameServer 9.67.128.255; not a server
NSInterAddr 2001::9:43:80:52
NSportAddr 53
#ResolveVia UDP
ResolverTimeout 3
```
ResolverUdpRetries 1 ; 1 means 1 total try, 0 would be no tries at all
1c loadDBCStables unknown
loadDBCStables big5
3 MVS000: Hostname MVS026

Default TCPIP.DATA file TPOUSER.RESOLVER.DEFAULT.DATA contains:

; TRACE RESOLVER
DatasetPrefix USER1
TcpipJobname TCPCS3
Hostname VIC097
; trace c sockets
; alwayswto no
; messagecase whoknows
; loadDBCStables tbd

Note: For this example, this file exists but is not used to obtain this example Trace Resolver output.

Local TCPIP.DATA file USER55.TCPIP.DATA contains:

; trace resolver
DATASET PREFIX USER55
# If an option is coded multiple times but can only have 1 value,
# the last occurrence is used.
TCP/IP Jobname TCPCS2
TCP/IP Jobname TCPCS
3 Hostname MVS000
DomainOrigin edu
; Name Server  127.0.0.1 ; loopback
#
2 Resolve Via TCP
Resolve Timeout 22
alwayswto xyz
messagecase mixed
loadDBCStables schinese

TSO commands issued to obtain the trace (gethostbyname):
allocate dd(systcpt) dsn(traceres) reuse
4 invoke a REXX application which issues gethostbyname for TESTBEN46.SVT390.COM

Trace Resolver output in USER55.TRACERES contains (gethostbyname):

5 Resolver Trace Initialization Complete -> 2009/06/18 15:51:51.737708
10 res_init Skipped option(s) on line  8: SYS1.TCPPARMS(RESGLOBL)
10 res_init Skipped option(s) on line 11: SYS1.TCPPARMS(RESGLOBL)
1c res_init Parse error on line 19: SYS1.TCPPARMS(RESGLOBL)
1d res_init Parse error on line 14: USER55.TCPIP.DATA

6 res_init Resolver values:
38 Setup file warning messages = No
36 CTRACE TRACERES option = No
Global Tcp/IP Dataset = SYS1.TCPPARMS(RESGLOBL)
Default Tcp/IP Dataset = TPOUSER.RESOLVER.DEFAULT.DATA
Local Tcp/IP Dataset = USER55.TCPIP.DATA
Translation Table = Default
UserId/JobName = USER55
19 Caller API = TCP/IP Rexx Sockets
20 Caller Mode = EBCDIC
32 System Name = MVS000 (from VMCF)
34 UnresponsiveThreshold = 25
(G) DataSetPrefix = USER55
3 (G) HostName = MVS026
(G) TcpIpJobName = TCPCS
(G) Search = tcp.raleigh.ibm.com
raleigh.ibm.com
ibm.com
com
uk
gov
(G) SortList = 0.0.19.0/0.0.255.0
0.0.18.99/0.0.255.255
0.42.17.0/0.255.255.0
129.42.16.0/255.255.255.0
3 (G) Name Server = 111.111.111.111
EDNS0 Support = Unknown  
9.67.128.255  
EDNS0 Support = Unknown  
2001::9:43:80:52  
EDNS0 Support = Unknown  

(G) NsPortAddr = 53  
(G) ResolverTimeout = 3  
(G) ResolverUdpRetries = 1  

(*) ResolveVia = UDP  
(*) Options NDots = 1  
(*) SockNoTestStor  
(*) AlwaysWto = NO  
(L) MessageCase = MIXED  

24 (*) Lookup = DNS LOCAL  

(*) Cache  
37 (*) CacheReorder  

(G) LoadDbcsTable = BIG5  

res_init Succeeded  
res_init Started: 2009/06/18 15:51:51.800668  
res_init Ended: 2009/06/18 15:51:51.800676  

***************************************************************************  
21 GetHostByName Started: 2009/06/18 15:51:51.815838  
GetHostByName Resolving Name: TESTBEN46.SVT390.COM  
GetHostByName Stack Name: TCPCS  
res_search(TESTBEN46.SVT390.COM, C_IN, T_A)  
res_search Host Alias Search found no alias  
res_querydomain(TESTBEN46.SVT390.COM, , C_IN, T_A)  
res_querydomain resolving name: TESTBEN46.SVT390.COM.  
Querying resolver cache for TESTBEN46.SVT390.COM.  
EZBRECFR: RetVal = 0, RC = 0, Reason = 0x00000000  
No cache information was available  
res_mkquery(QRYTESTBEN46.SVT390.COM, C_IN, T_A)  
7 res_mkquery created message:  
** ** ** ** Beginning of Message ** ** ** **  
Query Id:  
18693  
Flags:  
00000000 00000000  
Flags set:  
recurDes  
OpCode:  
QUERY  
Response Code:  
NOERROR  

Number of Question RRs:  1  
Question 1:  
TESTBEN46.SVT390.COM  
Type (0X0001) T_A  Class (0X0001) C_IN  
Number of Answer RRs:  0  
Number of Authority RRs:  0  
7a Number of Additional RRs:  1  
Additional 1:  
Type (0X0029) T_OPT  UDP Payload (0X0C00) 3072  
Extended RCODE 0  Version 0  Flags 0000  
** ** ** ** End of Message ** ** ** **  

24 res_send Name Server Capabilities  
24b Monitoring intervals used = 5  
Name server 111.111.111.111  
EDNS0 Support = unknown  
Queries sent = 0  
Failures = 0  
Percentage = 0%  
Use this name server for queries  
Name server 9.67.128.255  
EDNS0 Support = unknown  
Queries sent = 0  
Failures = 0  
Percentage = 0%  
Use this name server for queries  
8 res_send sending query to Name Server 111.111.111.111  
24 DNS Communication Started: 2009/06/18 15:51:51.816987  
24c DNS Communication RetVal = 0, RC = 0, Reason = 0x00000000, Type=IPv6  
22 No OPT RR record sent on request to 111.111.111.111  
BPXISTO: RetVal = 38, RC = 0, Reason = 0x00000000  
BPXIAOID Sched: RetVal = 1, RC = 0, Reason = 0x00000000  
BPXIAIO0 RECVMSG: From 111.111.111.111  
RetVal=502, RC=0, Reason=0x00000000  
UDP Data Length: 502  
9 res_send received data via UDP. Message received:  
** ** ** ** Beginning of Message ** ** ** **  
Query Id:  
18693
Flags: 10000111 10000000
Flags set: resp auth trunc recurDes recurAvl
OpCode: QUERY
Response Code: NOERROR

Number of Question RRs: 1
Question 1:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN

Trace terminated due to truncation condition
* * * * * End of Message * * * * *

27a DNS Communication Ended: 2009/06/18 15:51:51.836189 time used 00:00:00.019202
8a res_send Sending query to Name Server 111.111.111.111
27a DNS Communication Started: 2009/06/18 15:51:51.836812
22a EDNS0 Probe request sent to 111.111.111.111 id=18694
BPX1STO: RetVal = 49, RC = 0, Reason = 0x00000000
BPX1AID Sched: RetVal = 1, RC = 0, Reason = 0x00000000
BPX1AID RCVMSG: From 111.111.111.111
RetVal=553, RC=0, Reason=0x00000000
UDP Data Length: 553
9a res_send received data via UDP. Message received:
* * * * * Beginning of Message * * * * *
Query Id: 18694
Flags: 10000101 10000000
Flags set: resp auth recurDes recurAvl
OpCode: QUERY
Response Code: NOERROR

Number of Question RRs: 1
Question 1:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN

Number of Answer RRs: 29
Answer 1:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.5
Answer 2:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.6
Answer 3:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.7
Answer 4:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.8
Answer 5:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.9
Answer 6:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.10
Answer 7:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.11
Answer 8:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.12
Answer 9:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.13
Answer 10:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.14
Answer 11:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.15
Answer 12:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.16
Answer 13:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.17
Answer 14:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.18
Answer 15:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.19
Answer 16:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.20
Answer 17:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.21
Answer 18:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.22
Answer 19:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.23
Answer 20:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.24
Answer 21:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.25
Answer 22:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.26
Answer 23:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.27
Answer 24:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.28
Answer 25:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.29
Answer 26:
TESTBEN46.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.1
Answer 27:
TESTBEN46.SVT390.COM
Type (0X0001) T_A  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.2
Answer 28:
TESTBEN46.SVT390.COM
Type (0X0001) T_A  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.3
Answer 29:
TESTBEN46.SVT390.COM
Type (0X0001) T_A  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.14.103.4
Number of Authority RRs: 1
Authority 1:
SVT390.COM
Type (0X0002) T_NS  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
sdistcici.SVT390.COM
24 Number of Additional RRs: 2
Additional 1:
sdistcici.SVT390.COM
Type (0X0001) T_A  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.11.235.51
Additional 2:
Type (0X0029) T_OPT  UDP Payload (0X1000) 4096
Extended RCODE 0  Version 0  Flags 0000
* * * * * End of Message * * * * *
23 Oversized reply to probe request from 111.111.111.111
BPXICLO: RetVal = 0, RC = 0, Reason = 0x00000000
27a DNS Communication Ended: 2009/06/18 15:51:51.846582
33 Name Server Capability Updates
Name server 111.111.111.111
EDNS0 Support = up-level
Queries sent = 1
Failures = 0
res_send Succeeded
28 Attempting to cache results for TESTBEN46.SVT390.COM.
EZBRECAR: RetVal = 0, RC = 0, Reason = 0x00000000
Cache information was saved
res_query Succeeded
res_querydomain Succeeded
res_search Succeeded
10 GetHostByName Succeeded: IP Address(es) found:
IP Address(1) is 197.14.103.5
IP Address(2) is 197.14.103.6
IP Address(3) is 197.14.103.7
IP Address(4) is 197.14.103.8
IP Address(5) is 197.14.103.9
IP Address(6) is 197.14.103.10
IP Address(7) is 197.14.103.11
IP Address(8) is 197.14.103.12
IP Address(9) is 197.14.103.13
IP Address(10) is 197.14.103.14
IP Address(11) is 197.14.103.15
IP Address(12) is 197.14.103.16
IP Address(13) is 197.14.103.17
IP Address(14) is 197.14.103.18
IP Address(15) is 197.14.103.19
IP Address(16) is 197.14.103.20
IP Address(17) is 197.14.103.21
IP Address(18) is 197.14.103.22
IP Address(19) is 197.14.103.23
IP Address(20) is 197.14.103.24
IP Address(21) is 197.14.103.25
IP Address(22) is 197.14.103.26
IP Address(23) is 197.14.103.27
IP Address(24) is 197.14.103.28
IP Address(25) is 197.14.103.29
IP Address(26) is 197.14.103.3
IP Address(27) is 197.14.103.1
IP Address(28) is 197.14.103.3
IP Address(29) is 197.14.103.4
GetHostByName Ended: 2009/06/18 15:51:51.846582
***********************************************************************
Diagnosing resolver problems 793
TSO commands issued to obtain the trace (getaddrinfo):

```plaintext
  alloc dd(systcpt) dsn(traceres) reuse
CS V1R12: Pinging host TESTBEN46.SVT390.COM at IPv6 address 2000:197:14:103::15
Ping #1 timed out
```

Trace Resolver output in USER55.TRACERES contains (getaddrinfo):

```
5 Resolver Trace Initialization Complete - > 2009/06/18 15:56:52.840756
12 res_init Skipped option(s) on line 8: SYS1.TCPPARMS(RESGLOBL)
12 res_init Skipped option(s) on line 11: SYS1.TCPPARMS(RESGLOBL)
12 res_init Parse error on line 19: SYS1.TCPPARMS(RESGLOBL)
12 res_init Parse error on line 14: USER55.TCPIP.DATA

6 res_init Resolver values:
35 Setup file warning messages = No
36 CTRACE TRACERES option = No
19 Global Tcp/Ip Dataset = SYS1.TCPPARMS(RESGLOBL)
Default Tcp/IP Dataset = TPOUSER.RESOLVER.DEFAULT.DATA
Local Tcp/Ip Dataset = USER55.TCPIP.DATA
Translation Table = Default
UserlD/JobName = USER55
19 Caller API = TCP/IP Sockets Extended
19 Caller Mode = EBCDIC
19 System Name = MVS000 (from VMCF)
34 UnresponsiveThreshold = 25
(G) DataSetPrefix = USER55
19 (G) HostName = MVS026
19 (C) TcpIpJobName = TCPCS
19 (G) Search = tcp.raleigh.ibm.com
19 (G) NsPortAddr = 53
19 (G) ResolverTimeout = 3
19 (G) ResolverUdpRetries = 1
19 Options NDots = 1
19 SocketNoTestStor = 1
19 AlwaysWto = NO
19 MessageCase = MIXED
19 LookUp = DNS LOCAL
19 Cache = 1
19 CacheReorder = 1
(G) LoadDbcsTable = BIG5
19 res_init Succeeded
19 res_init Started: 2009/06/18 15:56:52.894280
19 res_init Ended: 2009/06/18 15:56:52.894288
***************************************************************************
19 res_init Started: 2009/06/18 15:56:52.900190
19 res_init Ended: 2009/06/18 15:56:52.900197
***************************************************************************
12 GetAddrInfo Started: 2009/06/18 15:56:52.900968
GetAddrinfo Invoked with following inputs:
Host Name: TESTBEN46.SVT390.COM
No Service operand specified
Hints parameter supplied with settings:
  ai_family = 0, ai_flags = 0x00000062
  ai_protocol = 0, ai_socktype = 0
13 GetAddrInfo Opening Socket for IOCTLs
31 BPX1SOC: RetVal = 0, RC = 0, Reason = 0x00000000, Type=IPv6
BPXIIOC: RetVal = 0, RC = 0, Reason = 0x00000000
GetAddrInfo Opened Socket 0x00000000
GetAddrInfo Both IPv4 and IPv6 Interfaces Exist
GetAddrInfo Host Alias Search found no alias
res_querydomain(TEBSTBEN46.SVT390.COM, , C_IN, T_AAAA)
res_querydomain resolving name: TESTBEN46.SVT390.COM.
794 z/OS Communications Server: IP Diagnosis Guide
No cache information was available
res_mkquery(QUERY, TESTBEN46.SVT390.COM., C_IN, T_AAAA)
res_mkquery created message:
* * * * * Beginning of Message * * * * *
Query Id:                52138
Flags:                   00000001 00000000
Flags set:               recurDes
OpCode:                  QUERY
Response Code:            NOERROR
Number of Question RRs:  1
Question 1:               TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA  Class (0X0001) C_IN
Number of Answer RRs:    20
Answer 1:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
Answer 2:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
Answer 3:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
Answer 4:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA  Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::1
Answer 5:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::2
Answer 6:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::3
Answer 7:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::4
Answer 8:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::5
Answer 9:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::6
Answer 10:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::7
Answer 11:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::8
Answer 12:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::9
Answer 13:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::10
Answer 14:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::11
Answer 15:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::12
Answer 16:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::13
Answer 17:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::14
Answer 18:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::15
Answer 19:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::16
Answer 20:
TESTBEN46.SVT390.COM
Type (0X001C) T_AAAA Class (0X0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
2000:197:14:103::17
Number of Authority RRs: 1
Authority 1:
SVT390.COM
Type (0x0002) T_NS Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
sdistcici.SVT390.COM

Number of Additional RRs: 2
Additional 1:
sdistcici.SVT390.COM
Type (0x0001) T_A Class (0x0001) C_IN
TTL: 86400 (1 days, 0 hours, 0 minutes, 0 seconds)
197.11.235.51

Additional 2:
Type (0x0029) T_OPT UDP Payload (0x1000) 4096
Extended RCODE 0 Version 0 Flags 0000

* * * * * End of Message * * * * *

DNS Communication Ended: 2009/06/18 15:56:52.908818 time used 00:00:00.006293

Name Server Capability Updates
Name server 111.111.111.111
Queries sent = 1
Failures = 0
res_send Succeeded

Attempting to cache results for TESTBEN46.SVT390.COM.
EZBRECAR: RetVal = 0, RC = 0, Reason = 0x00000000
Cache information was saved
res_query Succeeded
res_querydomain Succeeded
res_querydomain(TESTBEN46.SVT390.COM., C_IN, T_A)

res_querydomain resolving name: TESTBEN46.SVT390.COM.
res_query(TESTBEN46.SVT390.COM., C_IN, T_A)

EZBRECFR: RetVal = 0, RC = 0, Reason = 0x00000000
Cache data from 111.111.111.111 was retrieved
res_query Succeeded
res_querydomain Succeeded

GetAddrInfo Returned Zero as Port Number
GetAddrInfo Built 35 Addrinfos

GetAddrInfo Closing IOCTL Socket 0x00000000
BPXICLCO: RetVal = 0, RC = 0, Reason = 0x00000000

GetAddrInfo Succeeded: IP Address(es) found:
IP Address(1) is 2000:197:14:103::15
IP Address(2) is 2000:197:14:103::14
IP Address(3) is 2000:197:14:103::17
IP Address(4) is 2000:197:14:103::16
IP Address(5) is 2000:197:14:103::11
IP Address(6) is 2000:197:14:103::10
IP Address(7) is 2000:197:14:103::13
IP Address(8) is 2000:197:14:103::12
IP Address(9) is 2000:197:14:103::19
IP Address(10) is 2000:197:14:103::18
IP Address(11) is 2000:197:14:103::5
IP Address(12) is 2000:197:14:103::4
IP Address(13) is 2000:197:14:103::7
IP Address(14) is 2000:197:14:103::6
IP Address(15) is 2000:197:14:103::1
IP Address(16) is 2000:197:14:103::3
IP Address(17) is 2000:197:14:103::2
IP Address(18) is 2000:197:14:103::9
IP Address(19) is 2000:197:14:103::8
IP Address(20) is 2000:197:14:103::20
IP Address(21) is 197.14.103.5
IP Address(22) is 197.14.103.6
IP Address(23) is 197.14.103.7
IP Address(24) is 197.14.103.8
IP Address(25) is 197.14.103.9
IP Address(26) is 197.14.103.10
IP Address(27) is 197.14.103.11
IP Address(28) is 197.14.103.12
IP Address(29) is 197.14.103.13
IP Address(30) is 197.14.103.14
IP Address(31) is 197.14.103.15
IP Address(32) is 197.14.103.16
IP Address(33) is 197.14.103.17
IP Address(34) is 197.14.103.18
IP Address(35) is 197.14.103.19

GetAddrInfo Ended: 2009/06/18 15:56:52.914971

FreeAddrInfo Started: 2009/06/18 15:56:52.914971
FreeAddrInfo Called to free addrinfo structures
FreeAddrInfo Succeeded, Freed 35 Addrinfos
The following section describes highlighted numbered areas of the example setup files and example Trace Resolver output.

1. Errors that are deliberately entered into this example to show action taken:

   a. Line 8 in the global file specifies seven SEARCH values; the maximum number that is allowed is 6. The seventh value is ignored.

   b. Line 11 in the global file specifies five SORTLIST values; the maximum number that is allowed is 4. The fifth value is ignored.

   c. Line 19 in the global file has a value for LOADDBCSTABLES that is not valid. The value is ignored.

   d. Line 14 in the local file has a value for ALWAYSWTO that is not valid. The value is ignored and the default is used.

2. The ResolveVia field specifies UDP even though the local file indicated RESOLVEVIA TCP. UDP is used because GLOBALTCPIPDATA is being used. If a global file is used, then all resolver-related TCPIP.DATA statements must be specified in it. If the resolver statements are not specified, then default values are assigned. In this example, resolver statements are not specified as shown by RESOLVEVIA being commented out in the global file.

3. A local file cannot override the global file for any value. The global file specifies the hostname, therefore the local file value of MVS000 does not override the global value of MVS026. Likewise, since there is a GLOBALTCPIPDATA specified all resolver-related statements in a local file are ignored (for example, DOMAINORIGIN, NAMESERVER and RESOLVERTIMEOUT).

   The list of name servers to be queried also indicates whether the resolver considers the name server to support the Extension Mechanisms for DNS (EDNS0) capability. The resolver might believe that the name server supports EDNS0 (EDNS0 Support = Up-level), that the name server does not support EDNS0 (EDNS0 Support = Down-level), or that the capability of the name server is undetermined (EDNS0 Support = Unknown).

4. A REXX application calls GetHostByName at the indicated local date and time. The flow through the resolver API calls shows the parameters that are being passed.

5. Trace output reports the date and time the TCPIP.DATA statements were processed.

6. The res_init() resolver initialization values are reported. These values are the values actually being used by the resolver, with an indication of the origin of the value. The indicators are:

   * Default value
   A Modified by application
   D Default file (not used if the local file is found)
   E Environment variable
   G Global file
Local file

res_mkquery creates a DNS message (from Beginning of Message to End of Message). The message is interpreted, and flags and codes are spelled out.

res_mkquery appends an additional RR record (the OPT RR) to the request that is being built. The presence of the OPT RR record on the request indicates that the resolver supports the EDNS0 function and that UDP packets of up to 3072 bytes can be sent to the resolver (instead of the normal 512-byte limitation).

res_send sends the query to the name server. The res_send function calls several z/OS UNIX functions; the indentation of the lines that follow res_send indicate res_send was the caller. The IP address of the DNS is also displayed.

res_send receives a message from DNS. This message is truncated because the amount of data that the DNS has available to send regarding the resource is greater than 512 bytes.

res_send receives a message from DNS. This time, because the DNS query from resolver contained the OPT RR record that indicates up to 3072 bytes of UDP data could be returned, the DNS returns all 553 bytes of data that use UDP protocols. The total number of Answer records in this response is 29.

res_send receives a message from DNS. This message is also greater than 512 bytes, but since the OPT RR record is included on the query, the full amount of data can be sent on the first UDP response from the name server. The total number of Answer records in this response is 20.

The GetHostByName function reports success and lists the IP addresses returned. If addresses matched any of the values in the SORTLIST definitions, the order of the addresses would have been modified to match the SORTLIST specification.

LookUp specifies the order in which the DNS and the local host file are to be used for name resolution. There are four possible search orders:

- LOOKUP DNS LOCAL (DNS search first)
- LOOKUP LOCAL DNS (local host file search first)
- LOOKUP DNS (only DNS search)
- LOOKUP LOCAL (only local host file search)

Ping calls GetAddrinfo at the indicated local date and time. The flow through the resolver API calls shows the parameters that are being passed.

ai_family = 0 means that AF_UNSPEC is specified
ai_flags = x'00000062' means that AI_CANNONNAMEOK, AI_ALL, and AI_ADDRCONFIG are specified
ai_protocol = 0 and ai_socktype = 0 means that protocol and socktype are not specified

For more information about input values of getaddrinfo, see z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.

To honor the setting of ai_ADDRCONFIG, the Resolver must query the stacks to determine whether IPv6 or IPv4 interfaces exist (the results of the query are shown in message 14). A socket, separate from the one used to send DNS queries, is opened for communicating with the stacks.
The socket that is used for communicating with the stacks is closed before finishing Getaddrinfo processing.

The resolver detected that the system can handle both IPv4 and IPv6 addresses.

Because the system can handle both IPv4 and IPv6, and ai_ALL is specified, the resolver sends the IPv6 query (T_AAAA) for IPv6 to DNS first. For an explanation of how resolver decides to send an IPv6 or IPv4 query to DNS, see z/OS Communications Server: IPv6 Network and Application Design Guide.

The resolver prepares to send the IPv4 query (T_A). For an explanation of how resolver decides to send an IPv6 or IPv4 query to DNS, see z/OS Communications Server: IPv6 Network and Application Design Guide.

Because no Service operand is passed as input to Getaddrinfo, there is no service resolution to perform, so any sockaddr returned has a port number=0.

Before the resolver returns resolved addresses to the application, the resolver sorts all addresses so that the most preferable is the first in the address chain. For more information, see z/OS Communications Server: IPv6 Network and Application Design Guide.

The caller API value indicates which search order is used by the resolver for any required local table usage. The following caller API values indicate that the z/OS UNIX environment search order is used:

1. Language Environment C Sockets
   For more information about z/OS XL C/C++ runtime library functions, see z/OS XL C/C++ Runtime Library Reference.
2. Unix System Services
   For more information about z/OS UNIX System Services (z/OS UNIX) callable services, see z/OS UNIX System Services Programming: Assembler Callable Services Reference.

The following caller API values indicate that the native MVS environment search order is used:

1. TCP/IP Pascal Sockets
   For more information about z/OS Communications Server PASCAL API, see z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.
2. TCP/IP C Sockets
   For more information about z/OS Communications Server C/C++ API, see z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.
3. TCP/IP Rexx Sockets
   For more information about z/OS Communications Server REXX API, see z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.
4. TCP/IP Sockets Extended
   For more information about z/OS Communications Server Callable and Macro API, see z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference.

The Caller Mode value indicates the representation of any input characters as being either in EBCDIC or ASCII.

Because the resolver awareness of the EDNS0 capability of name servers is maintained on a system-wide level, it is possible that the resolver has a different awareness of the name server capability.
during res_send processing than it had during res_init processing. The current awareness level is displayed before any queries are sent to the name servers.

In addition to the current EDNS0 capability of the name servers, if the resolver is monitoring name server responsiveness, the system-wide responsiveness statistics for each name server are also displayed. These statistics are based on a sliding 5-minute interval or a 30-second interval, so these numbers represent the volume of requests that are sent to the name server in the past 5 minutes or 30 seconds. Two statistics are maintained and displayed: the total number of requests that are sent to the name server by the resolver and the number of those requests that received no response from the name server. The resolver compares the percentage of failures for each name server against the value of the UNRESPONSIVETHRESHOLD resolver setup statement to determine whether a name server is to be considered unresponsive.

If the resolver is not monitoring name server responsiveness because UNRESPONSIVETHRESHOLD is set to 0, only the current EDNS0 capability information is displayed in the trace.

a If the AUTOQUIESCE operand is coded on the UNRESPONSIVETHRESHOLD statement, the resolver stops sending DNS queries that are generated by an application to unresponsive name servers. This message indicates whether resolver sends DNS queries to a particular name server. In these examples, all name servers are responding with a failure rate less than the UNRESPONSIVETHRESHOLD value, so the resolver sends DNS queries to all name servers, if necessary. If the name server was unresponsive, the resolver would generate a different trace message that indicates that the name server was to be skipped for DNS queries that are generated by an application.

b If the AUTOQUIESCE operand is not coded on the UNRESPONSIVETHRESHOLD statement, the statistics that are displayed represent 5 minutes of data, or the sum of five 1-minute statistical intervals. If the AUTOQUIESCE operand is coded, the statistics represent 30 seconds of data, or one 30-second interval of data. The number of intervals that are used to calculate the statistics is displayed on this trace entry.

Because the EDNS0 capability of the target name server is currently unknown, the resolver does not send the OPT RR record on the request to the name server. The DNS query that is built during res_mkquery processing is manipulated to remove the additional record.

a The receipt of the truncated UDP response causes resolver to reissue the query, to the same DNS, but this time the OPT RR record is not removed from the request data. This query is treated as an EDNS0 capability probe, and the response we receive from the DNS will determine whether future queries to the DNS include the OPT RR record or not. The transaction ID for this EDNS0 probe is different from the first query, and the new value is included in the trace information.

b As displayed on message line 21, the name server is considered to be up-level in terms of EDNS0 support, so the resolver sends the OPT RR record that res_mkquery built on the DNS query.

The receipt of a UDP package greater than 512 bytes, in response to an EDNS0 probe, indicates that this name server is up-level. Future communication with this name server will always include the OPT RR record to allow the name server to send UDP responses of greater than 512 bytes without requiring more EDNS0 probe requests.

Since the resolver included an OPT RR on the request to indicate that the resolver supports EDNS0, the name server also includes an OPT RR on the response. The DNS indicates it can accept up to 4096 bytes of data on a UDP message, but the resolver does not use this information.
The setting of Cache indicates that the system is currently performing resolver caching and the application is permitted to use the caching function. An individual application can be prevented from using the resolver caching function by specifying NOCACHE in the TCPIP.DATA data set.

Because resolver caching is active and available for use by this application, before the query is sent to the DNS, the resolver cache is queried to see whether any information is currently available for this resource.

1. The cache has no information about the resource. The resolver must query the DNS to obtain the A record information.

2. The cache has no AAAA record information about the resource, although it does have A record information (from the previous GetHostByName call). The resolver must query the DNS to obtain the AAAA information.

3. The cache has A record information about the resource, which is saved from the previous GetHostByName call for the same resource, and the information is not expired, so the saved information is retrieved from the cache. No communication to the name server is necessary this time to obtain the A record information about the resource.

A timestamp is displayed when the query is actually sent to the DNS name server.

1. A corresponding timestamp is displayed when the response from the DNS is successfully processed. If no response is received, the timestamp represents when the resolver stopped waiting for the response. The amount of time that elapses from the start of communication with the name server is also displayed.

Because resolver caching is active and available for use by this application, the information about this resource is cached for later reuse by this application or other applications on the system.

The resolver returns at most 35 IP addresses for a resource, even if, as in this case, there are more IP addresses that could be returned (20 IPv6 addresses, and 29 IPv4 addresses). Priority is given to IPv6 addresses, so in this case, all the possible IPv6 addresses are returned, but only 15 of the possible IPv4 addresses.

The time to live (TTL) value represents the amount of time that the resolver cache can use the returned information about the resource. The MAXTTL resolver setup statement can be used to define an upper limit on the actual TTL value that is used for a resource by the resolver.

The Type value indicates whether an IPv6 socket or an IPv4 socket is being used. IPv4 sockets are used when the system does not support IPv6 sockets or when only IPv4 addresses are specified for the name servers to be searched.

System name indicates the value of the system_name parameter and where it was obtained. If VMCF is running, the value is the name that VMCF used when it started. Otherwise, it is the value of the z/OS CVT (Communication Vector Table) CVTSNAME field.

At the completion of res_send processing, if UNRESPONSIVETHRESHOLD is non-zero, resolver updates the system-wide responsiveness statistics, and possibly the EDNS0 capability, for each name server that is contacted as part of res_send processing. In this example, resolver sent one request successfully to the first name server in the list, and as part of res_send processing discovered that the name server supported EDNS0. The EDNS0 probe that resolver sent, after the truncated response is
received from the name server, is not included in the count of requests that are sent during res_send, since that probe is only used for resolver purposes.

Because only the first name server in the list was contacted, there were no updates to record for the second and third name servers in the list.

a Since resolver did not detect any changes in the EDNS0 capability of this name server, only the updates to the system-wide responsiveness statistics as part of res_send processing are displayed here.

34 The value of the UNRESPONSIVETHRESHOLD resolver setup statement at the time of the res_init processing is displayed. If the AUTOQUIESCE operand is specified on the resolver setup statement, the value that is displayed here would be in the form percentage,AUTOQUIESCE.

35 The resolver address space initializes even if syntax errors are detected in the resolver setup file. This statement indicates whether errors are detected during resolver address space initialization and are not yet corrected.

36 This statement indicates whether the CTRACE TRACERES option is enabled. If the application enables the CTRACE TRACERES option, Trace Resolver output is collected as Resolver CTRACE records. For more information, see “CTRACE - RESOLVER” on page 803.

37 The setting of CacheReorder indicates that the resolver reorders the list of cached IP addresses in a round-robin manner before the resolver returns the list to the requesting application. You can specify the NOCACHEREORDER statement in the TCPIP.DATA data set to disable cache reordering for an individual application.

Notes:
• If any errors occurred, see z/OS Communications Server: IP and SNA Codes.
• In a multitasking environment, if the LRECL of the Trace Resolver output is at least 128 characters, the MVS TCB storage address appears at the end of each line. The MVS TCB storage address can be useful in determining the origin of the resolver request.

**CTRACE - RESOLVER**

Component Trace (CTRACE) is used for the RESOLVER component (SYSTCPRE) to collect debug information. The TRACE RESOLVER traces information about a per-application basis and directs the output to a unique file for each application. The CTRACE shows resolver actions for all applications (although it might be filtered).

The CTRACE support allows for JOBNAME, ASID filtering, or both. The trace buffer is located in the Resolver private storage. The trace buffer minimum size is 128K, maximum 128M, default 16M. Trace records can optionally be written to an external writer.

The Resolver CTRACE initialization PARMLIB member can be specified at Resolver start time. Using the sample Resolver procedure shipped with the product, enter the following console command:

```
S RESOLVER,REUSASID=YES,PARMS='CTRACE(CTIRESxx)'
```

where xx is the suffix of the CTIRESxx PARMLIB member to be used. To customize the parameters used to initialize the trace, you can update the SYS1.PARMLIB member CTIRES00.

**Note:** In addition to specifying the trace options, you can also change the Resolver trace buffer size. The buffer size can be changed only at Resolver initialization.
If the CTIRES00 member is not found when starting the Resolver, the following message is issued:

```
IEEE538I  CTIRES00  MEMBER NOT FOUND in SYS1.PARMLIB
```

When this occurs, the Resolver component trace is started with a buffer size of 16MB and the MINIMUM tracing option.

After Resolver initialization, you must use the TRACE CT command to change the component trace options (see Chapter 5, “TCP/IP services traces and IPCS support,” on page 43). Each time a new component trace is initialized, all prior trace options are turned off and the new options are put into effect.

Trace options:

**ALL**

The standard set of CTRACE options for tracing resolver processing.

**Rule:** The TRACERES option is not included.

**MINIMUM**

The minimum set of options traces exceptions, Resolver initialization and termination, Resolver CTRACE changes, and Resolver operator messages.

**TRACERES**

Collects Trace Resolver information as Resolver CTRACE records.

The following sample shows the PARMLIB member:

```
/* ***************************************************************************/
/*                                                                          */
/* IBM Communications Server for z/OS                                      */
/* SMP/E Distribution Name: CTIRES00                                       */
/*                                                                          */
/* PART Name: CTIRES00                                                      */
/*                                                                          */
/*                                                                          */
/* Copyright:                                                              */
/* Licensed Materials - Property of IBM                                    */
/* 5694-A01                                                               */
/* (C) Copyright IBM Corp. 2001, 2003                                     */
/*                                                                          */
/* Status: CSV1R5                                                          */
/*                                                                          */
/* DESCRIPTION = This parmlib member causes component trace for             */
/* the TCP/IP provided Resolver to be initialized                         */
/* with a trace buffer size of 16M                                        */
/* This parmlib member only lists those TRACEOPTS values specific to the   */
/* TCP/IP Resolver. For a complete list of TRACEOPTS keywords and their    */
/* values see:                                                              */
/* z/OS MVS INITIALIZATION AND TUNING REFERENCE.                           */
/*                                                                          */
/* $PARMS(CTIRES00), COMP(RES ), PROD(TCPIP ): Resolver Component Trace*/
/* SYS1.PARMLIB member                                                     */
/*                                                                          */
/* ***************************************************************************/
TRACEOPTS
/*  Optionally start external writer in this file (use both WTRSTART and   */
/* WTR with same wtr_procedure)                                            */
/*+WTRSTART(wtr_procedure)                                                 */
/*+WTR(wtr_procedure)                                                       */
/*+ON OR OFF: PICK 1                                                       */
/*+OFF                                                                      */
/*+BUFSIZE: A VALUE IN RANGE 128K TO 128M                                  */
/*+BUFSIZE(16M)                                                            */
/*+JOBNAME(jobname1,...)                                                   */
```
When formatting the Resolver trace, use the CTRACE command. See Chapter 5, “TCP/IP services traces and IPCS support,” on page 43 for the syntax for formatting a CTRACE. For the Resolver, the following formatting OPTIONS are available:

**ASCII**
Resolver trace data is displayed with ASCII translation only. The default is EBCDIC.

**BOTH**
Resolver trace data is displayed with both EBCDIC and ASCII translations. Each line of formatted data contains the offset, the hexadecimal display, the EBCDIC translation, then the ASCII translation. The default is EBCDIC.

**EBCDIC**
Resolver trace data is displayed with EBCDIC translation only. This is the default.

**HEX**
Resolver trace data is displayed only in hexadecimal (no ASCII or EBCDIC translation). The default is EBCDIC.

**Guidelines:**
- If the formatted CTRACE display wraps on the screen, use the IPCS PROFILE LINESIZE(nn) command, where nn is the largest number of characters that displays on one line.
- The choice of ASCII or EBCDIC translation does not apply to CTRACE TRACERES records.

**CTRACE TRACERES**
The CTRACE TRACERES option collects the same Trace Resolver output as described in “Interpreting the Trace Resolver output” on page 788, but the Trace Resolver records are formatted as Resolver CTRACE records. All TRACERES records have the same trace record name. The trace record name is Formatted Trace Resolver. TRACERES records might be interspersed among other Resolver CTRACE records when CTRACE ALL is also specified.

**Guidelines:**
- The CTRACE TRACERES and Trace Resolver functions can be used independently or together. When both functions are active, Trace Resolver records are written as CTRACE records in addition to being written to the location that is described in “Specifying the Trace Resolver output location” on page 786.
- You must filter the recorded data to improve performance in the following ways:
  - Minimize the overhead of recording the trace
  - Make formatting faster
  - Save storage
  - Minimize wrapping, that is, new trace records overwriting older trace records

Use the JOBNAME or ASID option when you capture the trace to limit the trace data to one application.

**Enabling collection of CTRACE TRACERES records**
Use one of the following methods to enable collection of Trace Resolver output as Resolver CTRACE records.
- Take the following steps to activate collection when you start the Resolver:
  1. Specify the CTRACE TRACERES option in the ctrace PARMLIB member.
2. Start the Resolver with the PARMS keyword. For example:

```
S resolver jobname, PARMS='ctrace parmlib member'
```

- Take the following steps to activate collection after the Resolver is started:

1. Issue the `TRACE CT,ON` command and specify the CTRACE TRACERES option. For example:

```
TRACE CT,ON,COMP=SYSTCPRE,SUB=(resolver jobname)
R xx,OPTIONS=(TRACERES),END
```

2. To collect CTRACE information for only a subset of applications, specify the JOBNAME, or ASID, or both options as filters. For example:

```
TRACE CT,ON,COMP=SYSTCPRE,SUB=(resolver jobname)
R xx,OPTIONS=(TRACERES),JOBNAME=(...),ASID=(...),END
```

**Disabling collection of CTRACE TRACERES records**

Issue the `TRACE,CT,ON,COMP=SYSTCPRE,SUB=(resolver jobname)` command and use one of the following responses to disable collection of Trace Resolver output as Resolver CTRACE records:

- If the Resolver CTRACE function was enabled without filters, respond with `R xx,OPTIONS=(),END` to restore the default CTRACE options.
- If the Resolver CTRACE function was enabled by using filtering, use one of the following responses to restore the default CTRACE options and remove the filter setting:
  - If you filter by using the JOBNAME option, respond with `R xx,OPTIONS=(),JOBNAME=(...),END`.
  - If you filter by using the ASID option, respond with `R xx,OPTIONS=(),ASID=(...),END`.
  - If you filter by using both JOBNAME and ASID options, respond with `R xx,OPTIONS=(),JOBNAME=(...),ASID=(...),END`.

**Guideline:** In all cases, you can substitute `OPTIONS=(MINIMUM)` or `OPTIONS=(ALL)` for the `OPTIONS=()` response to disable the CTRACE TRACERES processing.

**Formatting the CTRACE TRACERES option**

Use the IPCS CTRACE,FULL command to format the trace regardless of whether the trace data is available in a dump or in an external data set. You can either type the CTRACE command on the IPCS command panel or use the panel interface. IPCS is also available in batch.

You can use several filters to limit the amount of formatted data. In addition to the CTRACE options such as start and stop time that IPCS provides, you can also use the following options:

- **JOBNAME**
  - The job name of the application.

- **ASID**
  - The address space identifier of the application.

- **CID**
  - The connection identifier of the application with a specific res_init() function call. You can use CID to correlate related resolver calls from the same application.

**Examples of the CTRACE TRACERES records**

```
+============================================================================+
| MVSTST TRACERES 00000002 15:07:45.880242 Formatted Trace Resolver         |
| ASID.... 0024 TCB.... 007FF320 JOBN.... USER23 CID.... 00000222          |
| Resolver Trace Initialization Complete -> 2014/01/07 15:07:45.861906      |
+============================================================================+

res_init Resolver values:
Setup file warning messages = No
CTRACE TRACERES option = Yes
Global Tcp/Ip Dataset = None
Default Tcp/ip Dataset = None
```
The following list describes highlighted numbered areas in the CTRACE TRACERES records example:

1. This separator line shows the trace record number of the previous SYSTCPRE component in hexadecimal.

2. The first data line contains the host name (MVSTST), trace option (TRACERES), trace code (000A0002), time, and trace record name. The trace record name is Formatted Trace Resolver for all CTRACE TRACERES records.

3. The second data line contains the application's ASID (0024), the MVS TCB address (007FF320), the application's job name (USER23), and the connection identifier (00000222).

   Tip: Use the ASID, JOBN, or CID value as input for the ASID, JOBNAME, or CID filter respectively to limit the amount of trace information that is formatted.

4. The contents of a CTRACE TRACERES record that follow the CTRACE headers represent a subset of the same Trace Resolver output as described in “Interpreting the Trace Resolver output” on page 788. The Trace Resolver output might be collected in multiple CTRACE records. In this example, two CTRACE records are necessary to collect all the Trace Resolver outputs that the res_init() processing generates.
Chapter 38. Diagnosing Simple Network Time Protocol (SNTP) problems

Simple Network Time Protocol (SNTP) is a standard protocol used to synchronize system clocks on routers and computer systems throughout the Internet through a specific formatted message. The Simple Network Time Protocol Daemon (SNTPD) is a TCP/IP daemon that is used to synchronize time between a client and a server.

This topic describes how to diagnose problems with SNTP daemon and contains the following sections:

- “Activating the SNTPD debug trace” on page 809
- “Abends” on page 809
- “Steps for stopping SNTPD” on page 809
- “Sample SNTPD debug output” on page 810

Activating the SNTPD debug trace

To activate the SNTPD debug trace, specify the -d or -df parameter when starting SNTPD via the z/OS UNIX shell or as an MVS started procedure.

<table>
<thead>
<tr>
<th>If this option is used...</th>
<th>Then (phrase) . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>-d parameter</td>
<td>Messages are written to the syslog daemon.</td>
</tr>
<tr>
<td>-df parameter</td>
<td>Messages are written to the file specified on the -df parameter.</td>
</tr>
</tbody>
</table>

Restriction: You must specify a path name and file name.

Abends

An abend during SNTPD processing should result in messages and error-related information being sent to the system console. A dump of the error is needed unless the symptoms already match a known problem.

Steps for stopping SNTPD

If SNTPD was started from the z/OS UNIX shell, the kill command must be used to stop SNTPD.

Before you begin

Before you issue the kill command, you must determine the process ID (PID) of SNTPD.

Procedure

Perform the following steps to stop the PID of SNTPD:

1. To find the PID, use one of the following methods:
   - Use D OMVS,U=userid. (This is the USERID that started SNTPD from the shell.)
   - Use the ps -ef command from the shell.
   - Write down the PID when you start SNTPD.

2. From a z/OS UNIX shell superuser ID, issue the kill command to the PID associated with SNTPD.
Results
You know you are finished when the following message appears: EZZ9601I SNTP SERVER ENDED. If
SNTPD was started as an MVS started procedure, you must use the stop command to stop SNTPD. For
example, code:

```
p sntpd
```

Sample SNTPD debug output

See z/OS Problem Management or see Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21, for
information about debugging dumps produced during SNTP processing.

The following shows a sample of SNTP debug output.

```
Tue Apr 2 15:26:14 2002 SNTP enabled options: Opening debugging file /tmp/bc6.log
(Multicast: every 120 seconds) (PID FILE: /etc/sntpd.pid) (DEBUG FILE: /tmp/bc6.log
Tue Apr 2 15:26:14 2002 Writing PID to file /etc/sntpd.pid
Tue Apr 2 15:26:14 2002 EZZ9602I SNTP server initializing
Tue Apr 2 15:26:14 2002 Initializing signal handling
Tue Apr 2 15:26:14 2002 Set sigaction of signal SIGINT
Tue Apr 2 15:26:14 2002 Set sigaction of signal SIGTERM
Tue Apr 2 15:26:14 2002 Set sigaction of signal SIGABND
Tue Apr 2 15:26:14 2002 Set sigaction of signal SIGABRT
Tue Apr 2 15:26:14 2002 Set sigaction of signal SIGQUIT
Tue Apr 2 15:26:14 2002 Set sigaction of signal SIGHUP
Tue Apr 2 15:26:14 2002 Initializing MVS command handling
Tue Apr 2 15:26:14 2002 Initializing pthread for MVS command
Tue Apr 2 15:26:14 2002 Initializing UDP socket(s)
Tue Apr 2 15:26:15 2002 SNTP port was set to 123
Tue Apr 2 15:26:15 2002 Bound to address: 9.67.2.1
Tue Apr 2 15:26:15 2002 Bound to address: 9.67.115.15
Tue Apr 2 15:26:15 2002 Bound to address: 9.67.2.2
Tue Apr 2 15:26:15 2002 Bound to address: 0.0.0.0
Tue Apr 2 15:26:15 2002 Initializing pthread for multicast/broadcast
Tue Apr 2 15:26:15 2002 Initializing pthread for unicast
Tue Apr 2 15:26:15 2002 EZZ9600I SNTP server ready
Tue Apr 2 15:29:15 2002 Sending NTP message to multicast address 224.0.1.1
Tue Apr 2 15:30:15 2002 Sending NTP message to multicast address 224.0.1.1
```
Chapter 39. Diagnosing Communications Server
SMTP application problems

The Communications Server SMTP (CSSMTP) application transfers electronic mail from JES spool data sets to SMTP mail relays for delivery to the final destination. See z/OS Communications Server: IP Configuration Guide for overview and setup of CSSMTP.

The following information describes how to diagnose problems with the CSSMTP application.

- “Gathering diagnostic information” on page 811
- “Resolving initialization or logging problems” on page 812
- “Resolving SMTPNOTE CLIST problems” on page 813
- “Diagnosing and resolving Resolver problems” on page 813
- “Resolving problems from the JES spool data set” on page 815
- “Resolving mail problems” on page 818
- “Resolving MODIFY command problems” on page 826
- “Diagnosing checkpoint problems” on page 826
- “Monitoring resources used” on page 827
- “Monitoring target servers” on page 830

Gathering diagnostic information

You might need to collect multiple pieces of data to accurately diagnose problems.

- Capture the MVS console messages.
- If the problem is caused by configuration issues or target server definitions, then save the configuration file.
- Capture the CSSMTP application log messages. See “Steps for gathering log information” on page 811 for details.
- If you get an abend during the CSSMTP application processing, messages and error-related information should be sent to the system console. A dump of the error is needed unless the symptoms already match a known problem. If an abend occurs, then save the resulting address space dump. See Chapter 3, “Diagnosing abends, loops, and hangs,” on page 21 for details.

Steps for gathering log information

Gather log information.

Procedure

1. Determine where log data is located.
   - If you are logging to a log file, then examine the LOGFILE DD statement in your started procedure to determine the log file or data set and save it. If you have not specified a LOGFILE DD, then the log will go to SYSLOGD.
   - If you are running multiple CSSMTP applications on the same system then you should be logging to SYSLOGD. Look in the SYSLOGD configuration file to determine where log records for CSSMTP are being written.
2. You should at least be executing with the default log level of error, warning, and event.
If more logging information is needed, you can specify a loglevel value greater than the default. See the LogLevel statement in z/OS Communications Server: IP Configuration Reference for valid CSSMTP / LogLevel statement information.

4. If your LOGFILE DD is not a z/OS UNIX file system, you might observe buffering of the logfile output. Only regular memory files and UNIX file system files support the no buffering mode. A "//LOGFILE DD SYSOUT=" will be treated as an MVS data set and may incur buffering. For further information, see z/OS XL C/C++ Runtime Library Reference, section General Description Controls buffering, for the specified stream, and z/OS XL C/C++ Programming Guide, section Buffering of C Streams.

**Resolving initialization or logging problems**

The following configuration messages indicate that initialization is done and you have successfully connected to at least one target for receiving mail.

- EZD1802I csproc INITIALIZATION COMPLETE FOR extWrtName
- EZD1821I csproc ABLE TO USE TARGET SERVER ipAddress

**Table 81. Common initialization and logging problems**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPXM023I</td>
<td>This message is prefixed to messages EZD1813E, EZD1815E, EZD1820E, and EZD1824E.</td>
<td>Define the CSSMTP id with READ access to BPX.CONSOLE CLASS(FACILITY), see z/OS UNIX System Services Programming: Assembler Callable Services Reference.</td>
</tr>
<tr>
<td>EZD1807I</td>
<td>This message indicates that initialization failed.</td>
<td>For details and other messages, see z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1824E</td>
<td>This message indicates that a TCP/IP stack is not available.</td>
<td>For details and other messages, see z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1815E</td>
<td>This message indicates that there was resolver problem at initialization.</td>
<td>For details and other messages, see z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1811I</td>
<td>This message indicates a problem in writing to the log file.</td>
<td>For details and other messages, see z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1835I</td>
<td>This message indicates that you did not configure a CHKPOINT DD statement.</td>
<td>For details and other messages, see z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1836I</td>
<td>This message indicates that you configured a CHKPOINT DD statement but checkpointing has failed.</td>
<td>For details and other messages, see z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
</tbody>
</table>
## Resolving SMTPNOTE CLIST problems

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZA5579E</td>
<td>This message indicates that the mail messages generated from the SMTPNOTE CLIST is unable to be transmitted.</td>
<td>Ensure that the SMTPNOTE CLIST is customized. See z/OS Communications Server: IP Configuration Guide for details and see the appropriate EZA5579E message in z/OS Communications Server: IP Messages Volume 1 (EZA).</td>
</tr>
</tbody>
</table>

The mail message was queued to the JES spool queue, but it has not been processed by the CSSMTP application.
- The specified `smtpjob` in the SMTPNOTE CLIST may have the wrong name.
- The specified `smtpjob` in the SMTPNOTE CLIST may not be active.
- Ensure that the SMTPNOTE CLIST is customized. See z/OS Communications Server: IP Configuration Guide for details.
- Start the `smtpjob` application.

## Diagnosing and resolving Resolver problems

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| No IP addresses were resolved from the TargetServer configuration statements. EZD1815E (during initialization) is issued or EZD1845I (MODIFY REFRESH or MODIFY REFRESHIPLIST command) is issued. See the appropriate EZD1815E, EZD1845I messages in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). | Possible causes for this error are:  
- The Resolver is not initialized.  
- There may be a problem in the DNS or the Resolver setup.  
- The name specified on the TargetServer statement (TargetName or TargetMx parameter) may be incorrect. | • If the resolver is not initialized, start the resolver. See the appropriate EZD1815E, EZD1845I messages in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).  
• If the name on the TargetServer is in error, update the name and issue the MODIFY REFRESH command to reprocess the configuration file.  
• If the name on the TargetServer statement is correct, investigate your DNS and/or resolver setup. |
### Table 83. Diagnosing and resolving Resolver problems (continued)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| Updated IP addresses were resolved from the TargetServer configuration statements with warnings. EZD1847I is issued. See the appropriate EZD1847I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). | Possible causes for this warning are:  
- A TargetName or TargetMx name could not resolve to any IP address  
- A TargetName or TargetMx name resolved to more than 4 IP addresses | Verify that the name specified on the TargetName or TargetMx parameter is correct. If the name is in error, update the name and issue the MODIFY REFRESH command to reprocess the configuration file. If the name is correct, investigate your DNS and/or resolver setup.  
If more than four addresses are resolved for a name specified on a TargetServer statement, only the first four are allowed and the rest ignored.  
**Note:** A warning is informational and no action is required. |
| No changed IP addresses were resolved from the TargetServer configuration statements as a result of the MODIFY REFRESH command or MODIFY REFRESHIPLIST command. EZD1843I or EZD1844I is issued. See the appropriate messages in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). | If changed IP addresses were expected, then it might indicate a problem.  
- The name specified on the TargetServer statement may not be updated with the new name.  
- The name specified on the TargetServer statement was changed, but the updates in the DNS or the Resolver setup may not be refreshed. | Verify that the name specified on the TargetName or TargetMx parameter is correct. If the name is in error, update the name and issue the MODIFY REFRESH command to reprocess the configuration file.  
Refresh the resolver so that the response is not coming from the cache, then issue the MODIFY REFRESHIPLIST command to refresh the TargetName or TargetMx. |
| MODIFY REFRESH or REFRESHIPLIST unsuccessful due to a MODIFY COMMAND in progress. EZD1806I is issued. See the appropriate EZD1806I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). | DNS setup may be in error causing the MODIFY COMMAND to take a long time. | Check if DNS is active at the IP address you specified for the NameServer or NSINTERADDR in the TCPIP.DATA data set.  
Check the port that DNS is listening on. The port is specified on the NSPORTADDR in the TCPIP.DATA data set. |

The Resolver trace shows requests and responses sent to and received from name servers. It also shows if local hosts tables are used for name resolution. This trace helps you diagnose problems with host name resolution. See “TRACE RESOLVER” on page 783 for more information about how to activate Trace Resolver and collect output.
### Resolving problems from the JES spool data set

#### Table 84. JES spool data set problems

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1807I with JES NOT AVAILABLE</td>
<td>The CSSMTP application ends with the error during initialization because JES is not available. This is a permanent JES subsystem error during spool file initialization (for example, authentication errors, The CSSMTP application is not allowed to read it, IEFSSREQ failed).</td>
<td>For details and other messages, see the appropriate EZD1807I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1813I or EZD1816I</td>
<td>No mail messages in the spool file have been processed, because the entire JES spool file is permanently inaccessible. Possible causes for the error are: • There is a spool file allocation error • There is a spool file open error • This user ID is not permitted to send output to the external writer that is configured to the CSSMTP application. • The spool file size is larger than the JesJobSize.</td>
<td>For details and other messages, see the appropriate EZD1813I or EZD1816I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). For details on MailAdministrator and JesJobSize configuration options, see z/OS Communications Server: IP Configuration Reference. For details on JES issues relating to CSSMTP see z/OS Communications Server: IP Configuration Guide.</td>
</tr>
</tbody>
</table>
### Table 84. JES spool data set problems (continued)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| **EZD1813I or EZD1816I** | Some of the mail messages in the JES spool file have been processed and sent, but the rest of the JES spool file is permanently inaccessible. Possible causes for the error are:  
- IO error during read  
- Permanent SAPI errors during read  
- Syntax errors from JES spool processing, for example:  
  - No valid HELO or EHLO SMTP command  
  - There is an incorrect beginning SMTP command for HELO, EHLO, MAIL FROM  
  - There is an incorrect ending SMTP command ".", RSET or next HELO or EHLO  
  - There are more than 
    JESSyntaxErrLimit invalid SMTP commands, or sequence errors  
  - The CSSSMTP application security user exit fails with the return code to stop processing the JES file | For details and other messages, see the appropriate EZD1813I or EZD1816I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).  
For details on MailAdministrator options and user exits see z/OS Communications Server: IP Configuration Reference.  
For details on JES issues relating to CSSSMTP see z/OS Communications Server: IP Configuration Guide.  
For details on syntax of mail see z/OS Communications Server: IP User's Guide and Commands. |
| **EZD1813I or EZD1816I** | Some of the individual mail message in a JES spool file are permanently non-deliverable. Possible causes for errors are:  
- There are non-mail boundary errors, for example:  
  - Missing RCPT TO  
  - JesMsgSize error  
- The CSSSMTP application security exit fails with the return code that causes only individual mail message to fail. | For details and other messages, see the appropriate EZD1813I or EZD1816I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).  
For details on MailAdministrator options and user exits see z/OS Communications Server: IP Configuration Reference.  
For details on JES issues relating to CSSSMTP see z/OS Communications Server: IP Configuration Guide.  
For details on syntax of mail see z/OS Communications Server: IP User's Guide and Commands. |
The following is an error report example to MailAdministrator or to the sysout file.

---

**Error Report for USER1U (JOB00085)**

**Job** USER1U / **/DEST** (JOB00085) created by VIC000.USER1 at Thu, 21 Aug 2008 12:41:24 -0400

**For DName:** SYSUT2 **Dataset name:** USER1.USER1U.JOB00085.D0000102.?

**CSSMTP_XYZ** generated the following messages:

--- Line 14 Mail 2 : Undeliverable mail for testid@test.com
Message-Id: USER1U.JOB00085.VIC000@tcp.com.Aug212008.124124.808675.2>
Error : No target server capable of receiving mail:
mail extensions not supported.

Mail was not delivered to the following recipients:
user41@vic000.tcp.com

--- Line 54 Mail 5 : RCPT TO: <user@vic000.tcp.com>
501 5.1.1 JES Syntax error in mailbox '<user'

--- Line 40 Mail 4 : Undeliverable mail for userx@vic000.tcp.com
Message-Id:<USER1U.JOB00085.VIC000@tcp.com.Aug212008.124124.808675.4>

Mail was not delivered to the following recipients:
userx@vic000.tcp.com
Reply : 550 User 'userx' Unknown

--- Line 26 Mail 3 : Undeliverable mail for testid@test.com
Message-Id:<USER1U.JOB00085.VIC000@tcp.com.Aug212008.124124.808675.3>

Mail was not delivered to the following recipients:
userx@vic000.tcp.com
Reply : 550 User 'userx' Unknown

--- Line 48 Mail 6 : Undeliverable mail for testid@example.com
Message-Id:<USER1U.JOB00085.VIC000@example.com.Aug212008.124124.808675.6>
Error : No target server capable of receiving mail:
already add to extended retry

Mail was not delivered to the following recipients:
user2@vic000.example.com

Completed at Thu, 21 Aug 2008 12:41:33 -0400

**9 = mail messages found**

**1 = mail messages with errors**

**3 = recipients to whom mail was sent successfully**

**4 = recipients to whom mail messages could not be delivered**

**Disposition of the JES file was HOLD**

---

**Figure 103. Error report example**

**Notes:**

1. This identifies the report with the jobname and jobid that contained the JES spool file
2. These further identify the source of the JES spool file with the jobname, the procedure step name, the job step name, the JES jobid, the originator node user ID, and the local time zone.
3. The CSSSMTP application jobname and external writer name
4. The line and mail found in the JES spool file cannot be delivered to listed recipients below. The Message-ID is from the header line which identifies this mail to the other SMTP servers. The Error: lines describe the reason the CSSSMTP application could not send the mail.
5. The line and mail found in the JES spool file where a JES syntax error was found. The next line identifies the cause of the error. In this case a blank in the mailbox.
6. The line and mail found in the JES spool file cannot be delivered to listed recipients below. In this case the target server rejected the mail because a mailbox could not be accepted.

7. Notice that the mail is listed in the order that they were completed and not in the order that they appear in the spool file.

8. The line and mail found in the JES spool file cannot be delivered. The mail message was saved for extended retry.

9. The processing of the spool file was completed at this date and time.

10. The number of mail messages found in the spool file.

11. The number of mail messages that contained parsing errors.

12. The number of recipients to whom mail sent successfully.

13. The number of recipients to whom mail could not be delivered.

14. The disposition of the JES spool file that was processed. If the value is HOLD or DELETE it reflects the setting of the BadSpoolDisp configuration statement. If the value is KEEP, it indicates that the CSSMTP application was interrupted during processing of this file. The file will continue to be processed when the application is restarted.

### Resolving mail problems

To resolve common problems with connecting to or communicating with a target server at a certain IP address, begin by reviewing messages sent to the system console. Review the CSSMTP log file for more detail about the specific problem. Table 85 on page 818 shows the possible messages and their meaning.

#### Target server problems

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1817I</td>
<td>This message indicates that the application has been unable to successfully connect to the target server at the indicated IP address due to a socket connect() failure or timeout.</td>
<td>For details and other messages, see the appropriate EZD1817I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Problem/Cause</td>
<td>Action</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| EZD1818I      | This message indicates that the application has been unable to communicate successfully with the target server at the indicated IP address due to an SMTP protocol problem or timeout after a successful connect. SMTP protocol problems can be the following:  
  • Initial SMTP greeting not sent  
  • 4xx or 5xx reply codes sent on EHLO SMTP command  
  • 4xx or 5xx reply codes sent on HELO SMTP command  
  Other problems are socket read() or write() failures on the connection.                                                                 | For details and other messages, see the appropriate EZD1818I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). If the problem appears to be in communicating with a target server, setting the loglevel to at least 39 will help to capture TCP/IP traces that show SMTP commands and remote SMTP server replies between the CSSMTP application and the TCP/IP network. |
| EZD1819I      | This message indicates that the application has been unable to establish a TLS connection with the target server at the indicated IP address due to an SMTP protocol problem, a security certificate problem or a timeout. SMTP protocol problems can have the following causes:  
  • STARTTLS option not supported on EHLO SMTP command  
  • 4xx or 5xx reply codes sent on STARTTLS SMTP command  
  • The stack does not support TLS policies.  
  • The policy agent is not started resulting in SIOCTTLSCTL ioctl() failures.  
  • Socket read() or write() failures on the connection.                                                                 | For details and other messages, see the appropriate EZD1819I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). For details setting up TLS security on the CSSMTP application, see z/OS Communications Server: IP Configuration Guide. If TLS is enabled and the definitions are configured on the client stacks but EZD1819I and log file ERROR messages indicates this is due to security see Chapter 27, “Diagnosing Application Transparent Transport Layer Security (AT-TLS),” on page 637. If TLS is set up correctly on CSSMTP, then verify that TLS is set up correctly on the server. |
| EZD1820E      | This message indicates that no target server is capable of receiving mail. There may be a networking problem affecting all target servers. Processing of mail is suspended when this message is generated.                                                                 | For details and other messages, see the appropriate EZD1820E message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).                                                                                           |
Table 85. Common messages indicating target server status (continued)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1824E</td>
<td>This message indicates that the application has been unable to successfully communicate to the TCP/IP stack as the result of a socket() failure. Processing of mail is suspended when this message is generated.</td>
<td>For details and other messages, see the appropriate EZD1824E message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
</tbody>
</table>

**Mail problems**

Generally, common problems dealing with individual mail messages are handled by creating an undeliverable mail notification when the mail message becomes undeliverable.

- If ReturnToMailFrom is set to YES on the UNDELIVERABLE statement or the default value is used, an undeliverable mail notification is created that contains the original mail text as well as additional information that indicates the reason why the mail could not be delivered. The undeliverable mail notification is sent to the originator's mail address as specified on the MAIL FROM command.
- If requested, a report is generated that contains the error text indicating why the mail message could not be delivered. The report is handled according to the setting on the REPORT configuration statement. See z/OS Communications Server: IP Configuration Reference for details.

The following steps help in debugging mail problems.

1. Start by reviewing the error text captured in the undeliverable mail notification for the undeliverable mail message. The following list contains reasons why mail can become undeliverable.
   - Common problems with mail messages can be that there are no target servers with the correct capabilities to send the mail, such as the following:
     - The mail requires a TLS connection. This requires the target server to be an ESMTP which supports the EHLO SMTP command and the extension option STARTTLS. The target server must reply positively to the STARTTLS command (2xx reply code). Also the CSSMTP application must be able to successfully issue the socket ioctl() to communicate with the TCP/IP stack to establish the TLS connection.
     - The mail message size is larger than what the target server indicates it can support on the EHLO reply response when it is an ESMTP server.
     - The mail message size is larger than what is configured on the parameter MessageSize associated with the TargetServer statement when it is an SMTP server.
   - Target server replies to SMTP commands with a 4xx reply code, which indicates that the mail message send be retried. However, the number of retries exceeded the configured maximum, see the statement RetryLimit in z/OS Communications Server: IP Configuration Reference for more information.
   - Target server connection timeouts occur, which indicates that the mail message send be retried. However, the number of retries exceeded the configured maximum, see the statement RetryLimit in z/OS Communications Server: IP Configuration Reference for more information.
   - Target server replies to MAIL FROM, RCPT TO, DATA and sending end of mail (EOM) sequence with a 5xx reply code indicating failure.
The following example shows general error text for a single recipient in the undeliverable mail notification.

```
[1] Received: from host1.ibm.com (host1)
    by host2.ibm.com (host2 [x.x.x.x])
    for <USER1@host1>
    with ESMTP (IBM CSSMTP z/OS V01R11.00)
    Id SMTP2.JOB00051.host2@ibm.com.Nov192008.134147.442406.1U ;
    Wed, 19 Nov 2008 13:54:31 -0500
[3] From: <CSSMTP@host2.ibm.com>
[4] To: <user1@ibm.com>
[5] Subject: Undeliverable Mail for MSG-ID SMTP2.JOB00051.host2@ibm.com.Nov192008.134147.442406.1
[6] Error text: No target server capable of receiving mail:
    retry limit count exceeded for this mail. Tried (1).
[7] Mail was not delivered to the following recipients:
[8]    <user2@samehost.ibm.com>
[9]    <user3@samehost.ibm.com>
[11]   <user4@samehost.ibm.com>
[12]   <user5@badhost.ibm.com>
[13]   Reply text: 550 "badhost" not found
```

```
[14] Original mail text:
    Received: from host1.ibm.com (host1)
    by host2.ibm.com (host2 [x.x.x.x])
    for <USER1@host1>
    with ESMTP (IBM CSSMTP z/OS V01R11.00)
    Id SMTP2.JOB00051.host2@ibm.com.Nov192008.134147.442406.1 ;
    FROM:     user1@ibm.com
    TO:       user2@samehost.ibm.com, user3@samehost.ibm.com, user4@samehost.ibm.com,
    user5@badhost.ibm.com
    SUBJECT: MSG1 JOB SMTP2 EHLO
    Date: Wed, 19 Nov 2008 13:53:18 -0500
    Message-ID: <SMTP2.JOB00051.host2@ibm.com.Nov192008.134147.442406.1>
    This is only a test.
```

Figure 104. Example of undeliverable mail notification

- **Receive line for the undeliverable mail notification.**
- **Date and time the undeliverable mail notification was created.**
- **The email address of the CSSMTP application that created the undeliverable mail notification.**
- **The email address to whom the undeliverable mail notification is sent.**
- **The subject line showing the MSG-ID SMTP2.JOB00051.host2@ibm.com.Nov192008.134147.442406.1 for the original piece of mail.** This is the same value as the Message-ID header in the original mail text.
- **General error text applies to all recipients that mail was not delivered to that do not have a specific error reply text. In this example, the general error text applies to the recipients in line [8] and [11].**
- **After this line, the list of recipients that did NOT receive the original mail text.**
- **Original mail text was not delivered to this recipient <user3@samehost.ibm.com> because of the specific error described in line [10] reply text. This recipient was unknown to the target server.**
Original mail text was not delivered to this recipient <user5@badhost.ibm.com> because of the specific error described in line [13] reply text. The email address of the recipient was not acceptable to the target server.

The original mail message - headers and content.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No target server capable of receiving mail: original message size too large.</td>
<td>The mail size is too large. Check size of the mail including headers. Use the MODIFY DISPLAY TARGETS command, see z/OS Communications Server: IP System Administrator's Commands to know what mail size is supported by target servers and whether the target server is SMTP or ESMTP.</td>
<td>If appropriate reduce mail size and resend. Otherwise, increase the mail size supported by the target server. To check target server configuration, see TargetServer statement in z/OS Communications Server: IP Configuration Reference if SMTP. Correct the target server on remote host if it is ESMTP.</td>
</tr>
<tr>
<td>No target server capable of receiving mail: retry count or interval is zero for this mail.</td>
<td>Review the log file. The target server is using reply code 4xx or is timing out the connection which requires a retry to occur.</td>
<td>Correct the target server or add a new target to the configuration. Change statement RetryLimit to allow retries to occur.</td>
</tr>
<tr>
<td>No target server capable of receiving mail: retry limit count exceeded for this mail.</td>
<td>Review the log file. The target server is using reply code 4xx or is timing out the connection which requires a retry to occur.</td>
<td>Correct the target server or add a new target to the configuration.</td>
</tr>
<tr>
<td>No target server capable of receiving mail: TLS support not available.</td>
<td>The batch job containing this mail required a TLS connection. The STARTTLS command is part of the batch job. Use the MODIFY DISPLAY TARGETS command. See z/OS Communications Server: IP System Administrator's Commands to determine whether TLS is supported by the target servers. Target servers must be ESMTP to support TLS.</td>
<td>If appropriate remove STARTTLS command from batch job. Check the target server configuration. Review the log file for the reply code from the target server or connection timeout which requires a retry to occur. Correct the target server or add a new target server capable of doing TLS to configuration.</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Problem/Cause</td>
<td>Action</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>EZD1826I</td>
<td>This message indicates that the dead letters cannot be written to the configured or default dead letter directory.</td>
<td>For details and other messages, see the appropriate EZD1826I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). No more dead letters are stored. The CSSMTP application internally sets the DeadLetterAction statement as it was set to Delete. The user can automate on this message to monitor storage utilization, and decide whether MODIFY SUSPEND command should be issued to suspend all new spool file processing and should examine and clean up all stored and unneeded dead letters to free up storage. Then MODIFY REFRESH command should be issued with DeadLetterAction set to STORE to tell the CSSMTP application to write dead letters into the configured or default dead letter directory again. MODIFY RESUME command is issued (if MODIFY SUSPEND command was issued previously) to resume new spool file processing.</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Problem/Cause</td>
<td>Action</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| EZD1827I   | This message indicates that mail messages cannot be written to the configured or default mail directory associated with the ExtendedRetry statement.                                                                 | For details and other messages, see the appropriate EZD1827I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). No more extended retry mail messages are stored. The CSSMTP application ends. Look up the return code and reason code values associated with the console message to determine the next action to take. If you determine that the z/OS UNIX file system mail directory is not accessible in write mode, perform one of the following actions:  
• Mount the z/OS UNIX file system in write mode.  
• Specify a new directory on the MailDirectory parameter of the ExtendedRetry configuration statement in the CSSMTP configuration file. CSSMTP must have write access to this directory.  
Restart the CSSMTP application. |
Table 88. Mail Directory problems (continued)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1852I</td>
<td>This message indicates that mail messages cannot be stored to the configured or default mail directory associated with the ExtendedRetry statement because the file system is out of space.</td>
<td>For details and other messages, see the appropriate EZD1852I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). No more extended retry mail messages are stored. The CSSMTP application ends. Perform one of the following actions and restart the CSSMTP application: • Delete any files in the file system that are no longer needed. • Define a new mail directory on z/OS UNIX file system with more space: 1. Define a new larger file system. 2. Mount the file system. 3. Use the <code>mkdir</code> command to define a new mail directory. 4. Copy all the files from the old mail directory to the new mail directory. 5. Update the configuration to use the new mail directory.</td>
</tr>
</tbody>
</table>

Using the undeliverable mail notification for problem determination

- If the error text captured in the undeliverable mail notification for the undeliverable mail is not enough to explain the problem, then review the log file that is generated under the started task by using the message-ID value that is found in the Subject: header and search through the log file to see how the mail message was processed.
- If the problem appears in communicating with a target server, set the loglevel value to at least 39 to capture TCP/IP traces. This shows SMTP commands and remote SMTP server replies between the CSSMTP application and the IP network. Resend the mail message.
- If the mail does not get sent and no undeliverable mail notification is returned to the originator of the mail, wait for CSSMTP to retry to send the mail message based on the configured RetryLimit statement values.

If there is still no undeliverable mail notification, do the following checks:
  - Check the configuration file for the undeliverable statement DeadLetterAction. If the statement is set to DELETE, then the undeliverable mail notification was deleted. If DeadLetterAction is set to STORE, then check the z/OS UNIX file system under the configured or default directory path.
Check the log file that was generated under the started task, by using the undeliverable mail notification message ID value to determine how the mail was processed. The following is the message ID for the undeliverable mail notification:

SMTP2.J0800051.host2@ibm.com.Nov192008.134147.442406.1U

Bad sequence of commands

If you run CSSMTP with Transport Layer Security (TLS) and you are receiving reply code 503 bad sequence of commands after a successful TLS negotiation, it is possible that the mail server requires an EHLO SMTP command following the TLS negotiation. Set the TLSEhlo option to Yes in the CSSMTP configuration file if an EHLO SMTP command is required following the TLS negotiation.

Bad character translations

If a mail message is received with characters that are not being translated correctly, for example the Euro sign (€), one of the following code page configuration settings might be incorrect:

- The TRANSLATE code page might be incorrect for the sysout files being read by CSSMTP. If so, configure the TRANSLATE statement with the code page that is used for the sysout files.
- The Charset code page might not be compatible with the target server. Some mail servers might use ISO8859-15 or 1252 instead of the default ISO8859-1. Configure the Charset parameter on the TargetServer statement.
- The MBCharset code page might not be compatible with the target server. Configure a compatible code page in the MBCharset parameter on the TargetServer statement.

Resolving MODIFY command problems

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1806I</td>
<td>This message indicates the modify command was unsuccessful.</td>
<td>For details and other messages, see the appropriate EZD1806I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1839I</td>
<td>This message indicates MODIFY REFRESH completed with errors.</td>
<td>For details and other messages, see the appropriate EZD1839I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1845I</td>
<td>This message indicates that there was a resolver problem with the MODIFY REFRESH or MODIFY REFRESHIPLIST commands.</td>
<td>For details and other messages, see the appropriate EZD1845I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
</tbody>
</table>

Diagnosing checkpoint problems

Since each message can have several specific problems, reviewing the trace logs captured under the started task will provide more details on common problems dealing with the checkpoint functions. The following table shows the possible messages and their meaning.
## Monitoring resources used

After the CSSMTP application is started it will periodically check the following resources, and determines if any action needs to be taken:

- JES tasks
- Storage use in the CSSMTP application address space
- Storage use for z/OS UNIX file system in the configured or default dead letter directory
- Storage use for z/OS UNIX file system in the configured or default mail directory

---

**Table 90. Common messages indicating checkpoint status**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1835I</td>
<td>This message indicates that the CHKPOINT DD statement was missing or the data set name was ‘NULLFILE’. The function is disabled.</td>
<td>For details and other messages, see the appropriate EZD1835I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1836I</td>
<td>This message indicates that the checkpoint data set could not be opened.</td>
<td>For details and other messages, see the appropriate EZD1836I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>EZD1849I</td>
<td>This message indicates that JES spool file could not be allocated by the SAPI interface. The spool file may have been previously purged by an operator command.</td>
<td>For details and other messages, see the appropriate EZD1849I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD).</td>
</tr>
<tr>
<td>Abend S08B</td>
<td>This abend is issued by the MVS Data-In-Virtual component when accessing the checkpoint data set. Reason code xxxx001D. The checkpoint data set is not a valid VSAM linear data set or an incorrect control interval size was used when the VSAM data set was defined.</td>
<td>For details about the S08B abend, see z/OS MVS System Codes.</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Problem/Cause</td>
<td>Action</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>EZD1856I</td>
<td>This message indicates either that over 75% of DEST JES tasks and 75% of WRITER JES tasks are waiting for long retry processing to complete one or more mail messages in a spool file.</td>
<td>For details and other messages, see the appropriate EZD1856I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). You should automate on this message to monitor the JES tasks that are not available. Use automation to decide whether to reissue the MODIFY FLUSHRetry command to remove mail messages from the retry queue to free up the JES tasks, or to issue the MODIFY SUSPEND command to suspend all new spool file processing. Message EZD1857I is issued when the usage of DEST JES tasks and the usage of WRITER JES tasks that are waiting for long retry processing drops below 50%. You can automate this message to monitor the usage of JES tasks, and to decide whether you should issue the MODIFY RESUME command (if MODIFY SUSPEND command was issued previously) to resume processing for the new spool files.</td>
</tr>
</tbody>
</table>
Table 91. Common messages used for monitoring resources (continued)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1858I</td>
<td>This message indicates that storage utilization in the CSSMTP application address space exceeds 75%.</td>
<td>For details and other messages, see the appropriate EZD1858I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). You should automate on this message to monitor storage utilization. Use automation to decide whether to issue the MODIFY SUSPEND command to suspend all new spool file processing. EZD1859I is issued when storage use drops below 50% in the CSSMTP application address space. You can automate this message to monitor storage use, and to decide whether you should issue the MODIFY RESUME command (if MODIFY SUSPEND command was issued previously) to resume processing for the new spool files.</td>
</tr>
<tr>
<td>EZD1860I</td>
<td>This message indicates that storage utilization for z/OS UNIX file system in the configured or default dead letter directory exceeds 75%.</td>
<td>For details and other messages, see the appropriate EZD1860I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). You should automate on this message to monitor storage use. Use automation to decide whether to issue the MODIFY SUSPEND command to suspend all new spool file processing and clean up all stored and unneeded dead letters to free up storage. EZD1861I is issued when storage use for the z/OS UNIX file system in the configured or default dead letter directory drops below 50%. You can automate this message to monitor storage use, and to decide whether you should issue the MODIFY RESUME command (if MODIFY SUSPEND command was issued previously) to resume the processing for the new spool files.</td>
</tr>
</tbody>
</table>
Table 91. Common messages used for monitoring resources (continued)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problem/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZD1862I</td>
<td>This message indicates that storage utilization for z/OS UNIX file system in the configured or default mail directory associated with the ExtendedRetry statement exceeds 75%.</td>
<td>For details and other messages, see the appropriate EZD1862I message in z/OS Communications Server: IP Messages Volume 2 (EZB, EZD). You should automate on this message to monitor storage use. Use automation to delete any files in the file system that are no longer needed. Do not delete any files from the mail directory. If target servers are available to receive the mail, decide whether to issue the MODIFY FLUSHRtry,AGE=days command to delete old mail messages from the mail directory. Use the MODIFY DISPLAY,TARgets command to monitor the number of mail messages in the extended retry directory and the state of the target servers used by CSSMTP. EZD1863I is issued when storage use for the z/OS UNIX file system in the configured or default mail directory drops below 50%. You can automate on this message to monitor the storage use.</td>
</tr>
</tbody>
</table>

Monitoring target servers

The Communication Server SMTP (CSSMTP) application automatically monitors the target servers for certain failures when the application is unable to communicate with the servers. Console messages (messages EZD1817I, EZD1818I, and EZD1819I) are generated for each target server. In some cases, the target servers can communicate with the CSSMTP application but the target servers cannot accept the mail message due to temporary error conditions. For temporary error conditions, the target servers pass the reply code 4xx. See RFC 2821 for more information about reply code processing. See Appendix D, “Related protocol specifications,” on page 893 for information about how to access RFCs.

To understand and handle the temporary error conditions, perform the following steps:

1. Determine how the CSSMTP application handles temporary error conditions.

   Two configuration statements control how CSSMTP handles temporary error conditions:

   **RetryLimit**
   - Mail messages are saved in memory and wait to be retried. The JES spool data set is held and waits for mail messages to be sent or failed permanently. This state is called long retry.

   **ExtendedRetry**
   - Mail messages are saved in the z/OS UNIX file system and wait to be retried. The JES spool data is deleted if there are no other errors to report in the spool data set. This state is called extended retry.
Use the MODIFY DISPLAY,CONFIG command to determine the current value of these statements.

2. Monitor whether temporary errors are occurring. Use the MODIFY DISPLAY,TARgets command to determine the number of mail messages currently in retry processing and check the following cases:
   - Check whether the number is increasing or is high under the GLOBAL INFORMATION: CURRENT RETRY label for mail messages in long retry.
   - Check whether the number is increasing or is high under the EXTENDED RETRY: CURRENT label for mail messages in extended retry.

3. Use traces to determine the temporary errors. The target servers must be available.
   a. Issue the MODIFY LOGlevel,LEVEL=logLevel command. Set the logLevel value to the current level plus 32, which is the value at which message-level TCP/IP messages are logged. This command traces the CSSMTP commands and remote SMTP target server replies between CSSMTP and the TCP/IP network.
   b. Look for the remote SMTP server replies that contain any of the following information:
      - A reply code that begins with of the number 4, for example, 450.
      - A reply message that indicates a timeout with the servers.

   If mail messages are not being sent when traces are activated, you can force the mail messages off the retry queues and return to the active queue.
      - For mail messages in long retry, use the MODIFY FLUSHRetry,TKID=tkid command, where tkid is the task ID associated with the JES spool data set.
      - For mail messages in extended retry, use the MODIFY FLUSHRetry,AGE=days command.

4. Handle the temporary error conditions.
   - If the target server is short of resources such as memory or space, take one of the following actions:
     - Add resources to existing target servers.
     - Add a target server that has extra resources to the target server list in CSSMTP configuration file. The maximum number of possible target servers is four. Use the MODIFY REFRESH command to make the CSSMTP application update the target server list.
   - If the recipient's mailbox is full, take corrective actions at the target server where the mailbox is located.
   - If timeout errors occur during the communication between CSSMTP and target servers, check the configured timeout values in the CSSMTP configuration file and the configured timeout values at the target servers, and increase the values.

**ExtendedRetry Mail Directory**

The CSSMTP application has an extended retry function. When this function is activated, it creates a control file (cf) and a data file (df) in a directory that is specified by the MailDirectory parameter that is associated with the ExtendedRetry statement. Users or mail administrators cannot modify the content of these files because the CSSMTP application needs to control the content of these files and to control when they are created and deleted. If the CSSMTP application has a problem with these files, it renames them to CF and DF. You can check the CSSMTP log to determine why the CF and DF files were renamed. You can delete them after you complete your analysis.
Chapter 40. Diagnosing sendmail to CSSMTP bridge problems

With the sendmail to CSSMTP bridge (sendmail bridge), you can send emails by using the facilities of the z/OS shell. The sendmail bridge command parses input command switches, reads the mail message from the UNIX System Services file, and processes the mail message. The input mail message is updated by adding SMTP commands and SMTP headers, if no headers are specified in the input mail message. The updated mail message is transmitted to the JES spool data set that Communications Server SMTP (CSSMTP) application can process.

See z/OS Communications Server: IP Configuration Guide for overview and setup of sendmail to CSSMTP bridge. Also see z/OS Communications Server: IP Configuration Guide for overview and setup of CSSMTP.

When you use the sendmail bridge command to send email, problems can be detected in the command itself or in the CSSMTP application.

- Take one of the following steps to detect an error parsing the command, reading the input mail message, or updating the mail message before transmitting the mail message to the JES spool data set that the Communications Server SMTP (CSSMTP) application processes.
  - Specify -ddebugginglevel with the command to see more debug log information. See z/OS Communications Server: IP User’s Guide and Commands for information about the -d command.
  - You can redirect the log output to a file with >logfile at the end of the command.

  Tip: When redirecting output under z/OS UNIX, nothing is displayed on the command prompts, and it is difficult to know when input is requested.

- When the command is processed successfully and is queued to the JES spool queue, you should see a logged message on the screen or in the output file with >>>One JES spool file is built and queued to CSSMTP.

  Compiled on Jun 28 2016 at 17:40:28
  Input command is: sendmail -t <inputmails
  >>>One JES spool file is built and queued to CSSMTP

  - You can use command -v to see more information about the updated mail message that is queued to the JES spool queue.

  Compiled on Jun 28 2016 at 17:40:28
  Input command is: sendmail -t -v <inputmails
  >>>MAIL From:<user1@tstsys.sample.com>
  >>>RCPT To:<user1@work.com,
  >>>RCPT To:<user2@work.com>
  >>>DATA
  >>>From: user1@tstsys.sample.com
  >>>To: user1@work.com, user2@work.com
  Total SMTP body 7 line(s) not shown
  >>>>.
  >>>>QUIT
  >>>>One JES spool file is built and queued to CSSMTP

  - If the mail message was queued to the JES spool queue, but it has not been processed by the CSSMTP application, one of the following errors might be the cause:

    - The CSSMTP external writer name might be defined incorrectly to the sendmail bridge. For more information about defining the CSSMTP external writer name, see Sendmail to CSSMTP bridge in z/OS Communications Server: IP Configuration Reference.

    - The CSSMTP application with the defined external writer name is not running.
- If the sendmail bridge configuration statement D{tls_version} is configured, TLS protection is required to send the message. The secured connection is setup between CSSMTP and the target mail server based on configured AT-TLS policy. Verify that the necessary AT-TLS policy is defined. See “Resolving mail problems” on page 818 in Chapter 39, “Diagnosing Communications Server SMTP application problems,” on page 811.

- Use the $DOUTCLASS(A) command to check the disposition of message class A. If the disposition is HOLD, use the $TOUTCLASS(A),OUTDISP=(WRITE,WRITE) command to have data sets that are spooled to message class A go to the output queue rather than the hold queue.

- If the mail message was processed by the CSSMTP application, but the mail message has not been received by the recipients, see Chapter 39, “Diagnosing Communications Server SMTP application problems,” on page 811 for more information.
Chapter 41. Diagnosing storage abends and storage growth

The key to the successful resolution of most storage problems is to first determine whether the storage problem you are experiencing is related to common, private or communication storage manager (CSM) storage. This topic outlines steps you can use to determine the type of storage you are having a problem with and the steps to take to diagnose the storage problem.

This topic contains the following subtopics:

- “Storage definitions” on page 835
- “Monitoring storage utilization” on page 835
- “Limiting TCP/IP common and private storage utilization” on page 836
- “Limiting CSM storage utilization” on page 837
- “Storage messages” on page 837
- “Abends” on page 839
- Problem determination
- Collecting documentation

Storage definitions

TCP/IP uses several types of storage.

**common storage**
Common storage is shared across the whole system and can be accessed from any address space. Common storage is managed by the Virtual Storage Management component of the z/OS operating system. TCP/IP's usage of common storage for the most part is for ECSA (extended common service area).

**private storage**
Private storage is storage that is unique to an address space. Private storage is also referred to as pool storage.

**CSM**
Communication Storage Manager (CSM) enables TCP/IP, VTAM, and other applications to use CSM buffers to reduce data movement. CSM interfaces with the z/OS operating system to provide the storage buffers. Buffers are maintained in both common storage and in the CSM data spaces. The application (for example TCP/IP) has the option of requesting the buffers from common storage or the CSM data spaces. The storage is managed in pools of the following predefined buffer sizes:

- 4 KB
- 16 KB
- 32 KB
- 60 KB
- 180 KB

See z/OS Communications Server: CSM Guide for additional information relating to the CSM component.

Monitoring storage utilization

Storage is a resource that many users monitor very closely to determine their average utilization. You can monitor storage by using storage monitors; by manually issuing TCP/IP and CSM display commands; or by...
using NetView CLISTs that are triggered at specific time intervals. Automatically issuing commands to your system log at periodic intervals is the most efficient way to monitor your storage utilization.

Use this log output to establish a storage utilization history. Knowing how much common, private, or CSM storage you typically use can be helpful when trying to resolve problems where TCP/IP storage utilization is increasing (also referred to as a storage creep) or you receive an abend related to an out of storage condition.

Monitor TCP/IP common and private storage utilization by issuing the Display TCPIP,,STOR console command:

For example:

```
d tcpip,,stor
TCPIP STORAGE
TCPCS STORAGE CURRENT MAXIMUM LIMIT
TCPCS ECSA 14M  28M   120M
TCPCS POOL  52M  62M  NO LIMIT
DISPLAY TCPIP STOR COMPLETED SUCCESSFULLY
```

or

```
d tcpip,tcpip2,stor
TCPIP STORAGE
TCPIP2 STORAGE CURRENT MAXIMUM LIMIT
TCPIP2 ECSA 45654K  56823K  204800K
TCPIP2 POOL 124634K 143743K  524288K
DISPLAY TCPIP STOR COMPLETED SUCCESSFULLY
```

For additional information regarding the Display TCPIP,,STOR command, see z/OS Communications Server: IP System Administrator's Commands.

TCP/IP's CSM storage utilization is not included in the TCP/IP display. TCP/IP's CSM storage utilization can be monitored by issuing the following console commands.

To display information about storage managed and used by CSM for all owners, issue the following command:

d net,csm,ownerid=all

To display information about CSM utilization for TCP/IP:

d net,csm,ownerid=TCP/IP asid

For example:

```
d net,csm,ownerid=01f6
IVT5508I DISPLAY ACCEPTED
IVT5549I PROCESSING DISPLAY CSM COMMAND - OWNERID SPECIFIED
IVT5530I BUFFER BUFFER
IVT5551I SIZE SOURCE STORAGE ALLOCATED TO OWNER
IVT5532I  4K ECSA  256K
IVT5541I TOTAL ECSA  256K
IVT5532I  4K DATA SPACE 64  128K
IVT5541I TOTAL DATA SPACE  128K
IVT5532I  4K DATA SPACE 143743K 524288K
IVT5541I TOTAL FOR OWNERID 384K
IVT5571I OWNERID: ASID = 01F6  JOBNAME = TCPIP
IVT5599I END
```

For additional information about the command, see z/OS Communications Server: SNA Operation.

### Limiting TCP/IP common and private storage utilization

You can limit the amount of common and private storage that TCP/IP can use by coding the GLOBALCONFIG parameters ECSALIMIT and POOLLIMIT in the TCP/IP profile.
• The ECSALIMIT parameter specifies the maximum amount of common storage that TCP/IP can use.
• The POOLLIMIT parameter specifies the maximum amount of TCP/IP private storage that TCP/IP can use.

The ECSALIMIT parameter ensures that TCP/IP does not overuse common storage. It can improve system reliability by limiting TCP/IP's storage usage. The limit must account for peak storage usage during periods of high system activity or TCP/IP storage abends might occur. The limit does not include the CSM storage used by TCP/IP.

**Tip:** Care should be taken when coding the ECSALIMIT parameter. Setting it too low can cause TCP/IP to terminate prematurely.

Specifying a nonzero ECSALIMIT value enables warning messages EZZ4360I, EZZ4361I, and EZZ4362I to be issued when a storage shortage occurs.

If necessary, the ECSALIMIT and POOLLIMIT parameter values on the GLOBALCONFIG statement in the TCP/IP profile may be increased with a VARY TCPIP,,OBEYFILE command. For additional information regarding the VARY TCPIP,,OBEYFILE command, see z/OS Communications Server: IP System Administrator's Commands.

See z/OS Communications Server: IP Configuration Reference for more information regarding use of the GLOBALCONFIG statement ECSALIMIT and POOLLIMIT in the TCP/IP profile.

---

### Limiting CSM storage utilization

CSM storage limits are located in the SYS1.PARMLIB member IVTPRM00. The values you can allocate are:

- **ECSA MAX** - the maximum amount of ECSA storage that CSM can allocate.
- **FIXED MAX** - the maximum amount of fixed storage that CSM can allocate. This includes fixed CSM ECSA, CSM data space storage, and high virtual common (HVCOMM) storage above the 2 GB bar.
- **HVCOMM MAX** - the maximum amount of HVCOMM storage that CSM can allocate.

If you do not specify values in the IVTPRM00 parmlib member, the system uses the default values of 100M ECSA, 200M FIXED, and 2000M HVCOMM. You can change these values dynamically with the MODIFY CSM command. If the limit specified by these values is reached, results are unpredictable. TCP/IP might not be able to continue. IVTxxxx messages will be issued if CSM is unable to obtain storage.

See z/OS MVS Initialization and Tuning Reference for additional information about the IVTPRM00 parmlib member.

To change your CSM settings dynamically, issue the following command:

`MODIFY net,CSM,ECSA=value,FIXED=value,HVCOMM=value`

where the ECSA value is in the range 1024 KB - 2048 MB, the FIXED value is in the range 1024 KB - 30720 MB, and the HVCOMM value is in the range 100 MB - 999999 MB. Additional information regarding the MODIFY command for CSM can be found in z/OS Communications Server: SNA Operation.

---

### Storage messages

The following messages are issued for TCP/IP common or private storage shortage problems. The messages are documented in greater detail in z/OS Communications Server: IP Messages Volume 4 (EZZ, SNM).

Common storage messages are as follows:

- **EZZ4360I** `jobname` ECSA CONSTRAINED
- **EZZ4361I** `jobname` ECSA CRITICAL
- **EZZ4362I** `jobname` ECSA EXHAUSTED
- **EZZ4363I** `jobname` ECSA SHORTAGE RELIEVED
Specifying a nonzero ECSALIMIT value enables warning messages EZZ4360I, EZZ4361I and EZZ4362I to be issued when a storage shortage occurs. Details regarding the TCP/IP profile GLOBALCONFIG parameter ECSALIMIT can be found in z/OS Communications Server: IP Configuration Reference.

Private storage messages are as follows:

- EZZ4364I jobname POOLL CONSTAINED
- EZZ4365I jobname POOLL CRITICAL
- EZZ4366I jobname POOLL EXHAUSTED
- EZZ4367I jobname POOLL SHORTAGE RELIEVED

Specifying a nonzero POOLLIMIT enables warning messages EZZ4364I, EZZ4365I, and EZZ4366I to be issued when a storage shortage occurs. Details regarding the TCP/IP profile, GLOBALCONFIG parameter POOLLIMIT, can be found in z/OS Communications Server: IP Configuration Reference. If storage limits were set using the TCP/IP profile GLOBALCONFIG ECSALIMIT statement or the GLOBALCONFIG POOLLIMIT statement look for the TCP/IP warning messages described previously that are issued each time a storage limit boundary is crossed. These messages might indicate a need to raise the limits.

CSM messages always start with the message prefix IVT. For a complete list of messages issued by CSM, see z/OS Communications Server: SNA Messages.

CSM messages identify whether the storage problem is related to CSM ECSA or CSM fixed storage. Examine the IVTPRM00 parmlib member to determine whether the limits for the particular type of CSM storage that is depleted should be increased. Issue the Display CSM command to get more details on current CSM allocation and limits. As previously described, CSM limits can be increased using the Modify CSM command without reloading the initial program.

For more information about the Display CSM and Modify CSM commands, see z/OS Communications Server: SNA Operation.

**Sysplex Problem Detection and Recovery (SPDR) storage messages**

Critical storage shortages for CSM, ECSA, or PRIVATE are always detected by SPDR. Storage failures (when GLOBALCONFIG LIMITS values are not coded) are detected only when an allocation in the Sysplex code fails.

Sysplex Problem Detection and Recovery (SPDR) issues one of the following messages when a storage request for common, private, or CSM storage cannot be satisfied.

- EZD1170E
- EZD1187E
- EZZ9679E

**EZD1170E**

*tcpstackname WAS NOT ABLE TO GET TCP/IP storagetype STORAGE*

When the TCP/IP profile GLOBALCONFIG statement ECSALIMIT or POOLLIMIT parameter is not coded, message EZD1170E is issued. In this situation, the storage request fails because ECSA or private storage is exhausted.

**EZD1187E**

*tcpstackname WAS NOT ABLE TO GET TCP/IP storagetype STORAGE*

When TCP/IP profile GLOBALCONFIG statement ECSALIMIT or POOLLIMIT is coded, EZD1187E is issued. In this situation the storage request fails because ECSA or private storage is critical.

**EZZ9679E**

*tcpstackname DETERMINED THAT CSM WAS CRITICAL FOR AT LEAST timevalue SECONDS*

SPDR issues EZZ9679E when CSM storage problems are detected. This message is issued when CSM storage has been critical for the configured value specified on the GLOBALCONFIG SYSPLEXMONITOR TIMERSECS parameter or the default value of 60 seconds if the parameter is not specified.
Abends

There are abends for each of the three types of storage problems:

**Common storage**

Common storage shortages typically result in the following abends:

- ABEND878 RC04 or RC08
- ABEND80A RC04 or RC08
- ABEND4C5 rsn xxxx2500

For common storage problems, determine which jobs or address spaces are using an excessive amount of storage. To determine the users of common storage, enable common storage tracking (CSA Tracker). For information about how to activate and review data provided by common storage tracking, see z/OS MVS Initialization and Tuning Guide. The storage totals for TCP/IP in the CSA tracker report does not reflect all the storage in use by TCP/IP. A number of TCP/IP getmain transactions are issued with the owner as SYSTEM. This storage is reported as OWNER = SYSTEM, and not OWNER = TCP/IP.

Contact the IBM Support Center for the owner of the storage that you think is causing the problem. See “Collecting documentation to submit to the IBM Support Center” on page 844 for more information.

**Private storage**

Private storage shortages typically result in the following abends:

- ABEND878 RC0C or RC10
- ABEND80A RC0C or RC10

If the problem is with TCP/IP private storage, submit a problem record with the IBM TCP/IP support team for dump analysis. See “Collecting documentation to submit to the IBM Support Center” on page 844 for more information.

**CSM storage**

For CSM storage problems, review the output from any monitoring you have been doing for CSM storage usage. Determine the largest users of the CSM ECSA and dataspace pools (4k, 16k, 32, 60k and 180k). See z/OS Communications Server: SNA Operation for additional information.

Contact the IBM Support Center for the owner of the CSM storage that you think is being used in excess. See “Collecting documentation to submit to the IBM Support Center” on page 844 for more information.

If you have not been tracking CSM storage utilization, see “Monitoring storage utilization” on page 835 to determine how to monitor this storage for use in problem diagnosis.

Diagnosing a storage problem

There are several causes of storage problems. When diagnosing a storage problem, whether it is an out of storage abend condition or a storage growth problem, you must first determine whether the storage problem is related to common, private, or CSM storage.
Steps for reviewing a storage problem

Determine whether a storage problem is related to common, private, or CSM storage.

Procedure

Perform the following steps:

1. Issue D TCPIP,,STOR and D Net,CSM,Ownerid=All commands to track storage usage.
2. Determine whether a lot of application data is accumulated on the queues for TCP connections. See “Steps for reviewing data on the queue if you are using IDS” on page 842.
3. Look in the system log for messages related to storage.
4. Run the EREP program against the SYS1.LOGREC log and review software records, looking for any storage-related abends.
5. Review the messages and abends you found to determine whether they indicate a common, private, or CSM storage problem.
6. Review your storage settings for any identified problem area (for example common, CSM, or private storage).
7. Compare your current storage usage to your previous usage. If usage has increased, do you know of any situations that would cause increased usage (for example, new applications that use common storage or increased connections)?
8. Review your response to step 6. Can the storage problem be resolved by increasing your storage limits?
9. If you have a dump that was created as a result of the storage problem, proceed to step 11.
10. If no dump was taken, see “Collecting documentation to submit to the IBM Support Center” on page 844 before proceeding to step 9. If you are unable to obtain a slip or console dump of the problem, a stand-alone dump may be the only method to gather documentation for the IBM Support Center. See z/OS MVS Diagnosis: Tools and Service Aids to determine how to take a stand-alone dump.
11. Call the IBM Support Center for assistance in reviewing the documentation.

Results

You know you are done when you have determined the storage problem can be remedied by increasing your storage limits or you have called the IBM Support Center for assistance.

Steps for reviewing data on the TCP queues

This topic provides the steps to be taken to determine whether data accumulated on the queues for TCP connections is contributing to a storage problem. The steps to be taken depend on whether you are using the intrusion detection services (IDS) and, if you are using IDS, how you have IDS configured.

Procedure

Complete the steps under the first bullet that describes your configuration:

• If you are using IDS, and you have IDS TCP Queue Size attack detection enabled, and your IDS policy for the TCP Queue Size attack type indicates that connections should be reset, then TCP connections with excessive or old data accumulated on their queues are automatically reset. Data accumulated on TCP queues should not be contributing to the storage problem. Proceed to Step “3” on page 840 in “Steps for reviewing a storage problem” on page 840.
• Complete the following steps if you are using IDS, and you have IDS TCP Queue Size attack detection enabled, and your IDS policy for the TCP Queue Size attack type indicates that events should be logged to the system console:
  a) Look for console message groups that begin with message EZZ8761I and that indicate an event type of TCP Queue Constrained on message EZZ8762I.
This message group indicates that the TCP connection identified by messages EZZ8764I and EZZ8765I had excessive or old data accumulated on one of its queues. The following is an example of this message group:

```
EZZ8761I IDS EVENT DETECTED
EZZ8730I STACK TCPCS3
EZZ8762I EVENT TYPE: TCP QUEUE CONSTRAINED
EZZ8763I CORRELATOR 21 - PROBEID 040A0001
EZZ8764I SOURCE IP ADDRESS 4.4.4.4 - PORT 301
EZZ8765I DESTINATION IP ADDRESS 3.3.3.3 - PORT 300
EZZ8766I IDS RULE TCPQueSz
EZZ8767I IDS ACTION QueSzAction
```

The correlator value in message EZZ8763I identifies a unique instance of excessive or old data accumulated on a queue for a TCP connection. When the excessive or old data is removed from the queue, a similar message group that indicates an event type of TCP Queue Unconstrained on message EZZ8762I is issued. The same correlator value is used in the message group for this TCP Queue Unconstrained event as was used in the corresponding message group for the TCP Queue Constrained event.

- If none of these message groups have been issued, the data accumulated on TCP queues is not contributing to the storage problem. Proceed to Step “3” on page 840 in “Steps for reviewing a storage problem” on page 840.
- If these message groups have been issued, then go to Step 2.

b) For each TCP Queue Constrained message group located in step 1, look for a console message group that begins with message EZZ8761I and that indicates an event type of TCP Queue Unconstrained and includes the same correlator value as the TCP Queue Constrained message group.

The following is an example of this message group:

```
EZZ8761I IDS EVENT DETECTED
EZZ8730I STACK TCPCS3
EZZ8762I EVENT TYPE: TCP QUEUE UNCONSTRAINED
EZZ8763I CORRELATOR 21 - PROBEID 040A0002
EZZ8764I SOURCE IP ADDRESS 4.4.4.4 - PORT 301
EZZ8765I DESTINATION IP ADDRESS 3.3.3.3 - PORT 300
EZZ8766I IDS RULE TCPQueSz
EZZ8767I IDS ACTION QueSzAction
```

- If this message group has been issued, the excessive or old data that was on the queue for this TCP connection has been processed and is not contributing to the storage problem. Continue with the next TCP Queue Constrained message group located in step 1.
- If this message group has not been issued, the excessive or old data is still on the queue for this TCP connection. Resolve the problem that is causing the data to not be processed, or reset the connection to release the storage.

c) If the storage problem is not resolved, proceed to Step “3” on page 840 in “Steps for reviewing a storage problem” on page 840.

- Complete the following steps if either you are using IDS, and you have IDS TCP Queue Size attack detection enabled, and your IDS policy for the TCP Queue Size attack type indicates that events should not be logged, or TRMD and syslogd are not both active:
  a) Issue the Netstat ALL/-A command to determine whether a lot of application data has accumulated on the queues for TCP connections.
      - If no connections are found with a significant amount of data on their queues, then data accumulated on TCP queues is not contributing to the storage problem. Proceed to Step “3” on page 840 in “Steps for reviewing a storage problem” on page 840.
      - If connections are found with a significant amount of data on their queues, then go to Step 2.
  b) For each connection with a significant amount of data on any of its queues, resolve the problem that is causing the data to not be processed, or reset the connection to release the storage.
c) If the storage problem is not resolved, proceed to Step “3” on page 840 in “Steps for reviewing a
storage problem” on page 840.

• Complete the following steps if none of the previous bullets describes your configuration:

  a) Look in the syslogd output for messages EZZ8662I, EZZ8664I, or EZZ8666I. These messages
  indicate that excessive or old data is accumulating on the receive, send, or out-of-order queue for a
  TCP connection. The correlator value in these messages identifies a unique instance of excessive or
  old data accumulated on a queue for a TCP connection. This same correlator value will appear in a
  EZZ8663I, EZZ8665I, or EZZ8667I message that is issued when the excessive or old data has been
  removed from the TCP queue.

  – If EZZ8662I, EZZ8664I, and EZZ8666I messages do not appear in syslogd, then data
    accumulated on TCP queues is not contributing to the storage problem. Proceed to Step “3” on
    page 840 in “Steps for reviewing a storage problem” on page 840.

  – If EZZ8662I, EZZ8664I, and EZZ8666I messages do appear in syslogd, then go to Step 2.

  b) For each EZZ8662I, EZZ8664I, or EZZ8666I message located in step 1, look for a corresponding
  EZZ8663I, EZZ8665I, or EZZ8667I message that includes the same correlator.

  – If a corresponding message with the same correlator has been issued, the excessive or old data
    that was on the queue for this TCP connection has been processed and is not contributing to the
    storage problem. Continue with the next EZZ8662I, EZZ8664I, or EZZ8666I message located in
    step 1.

  – If a corresponding message with the same correlator has not been issued, the excessive or old
    data is still on the queue for this TCP connection. Resolve the problem that is causing the data to
    not be processed, or reset the connection to release the storage.

  c) If the storage problem is not resolved, proceed to Step “3” on page 840 in “Steps for reviewing a
  storage problem” on page 840.

Steps for reviewing data on the queue if you are using IDS

If you are using IDS, review the data on the queue.

Before you begin
You need to have issued the D TCPIP,,STOR and D Net,CSM,Ownerid=All commands to track storage use.

Procedure

1. If TCP QUEUE Size attack detection is enabled with console logging, look for console message groups
  that begin with message EZZ8761I and that indicate a TCP QUEUE Constrained event.

  • If these message groups have not been issued, then data accumulated on TCP queues is not
    contributing to the storage problem and you can proceed to Step “3” on page 840 in “Steps for
    reviewing a storage problem” on page 840.

  • If these message groups have been issued, then go to Step 2.

2. Depending on your configuration, take the following actions to determine whether data is accumulated
   on the queue:
<table>
<thead>
<tr>
<th>If . . .</th>
<th>Then . . .</th>
<th>And take the following actions...</th>
</tr>
</thead>
</table>
| TRMD or syslog are not active, or TCP QUEUE Size attack detection is not configured to log to syslogd | Issue the Netstat ALL/-A command to determine whether a lot of application data has accumulated on the queues for TCP connections. | - If no data, or an insignificant amount of data, has accumulated on the queue, go to Step “3” on page 840 in “Steps for reviewing a storage problem” on page 840.  
- If data has accumulated on the queue, then resolve the problem that is causing the data to not be processed, or reset those connections to release the storage. |
| TRMD and syslog are active, and TCP QUEUE Size attack detection is configured to log to syslogd | Look in the syslogd output for messages EZZ8621I, EZZ86641I, or EZZ8666I. These messages indicate that excessive or old data is accumulating on the receive, send, or out-of-order queue for a TCP connection. | - If these messages do not appear in syslogd, go to Step “3” on page 840 in “Steps for reviewing a storage problem” on page 840  
- If one or more of these messages do appear in syslogd, determine whether there is a corresponding message (EZZ863I, EZZ8665I, or EZZ8667I) that indicates that the accumulated data has been processed. If no corresponding message appears, resolve the problem that is causing the data to not be processed, or reset those connections to release the storage. |

**Results**

You can now perform the steps for the decision you have made.

**Steps for reviewing data on the queue if you are not using IDS**

Before you begin, you need to have issued the D TCPIP,,STOR and D Net,CSM,Ownerid=All commands to track storage use.

Depending on your configuration, take the following actions to determine whether data is accumulated on the queue:
You can now perform the steps for the decision you have made.

Collecting documentation to submit to the IBM Support Center

If your storage problem is caused by TCP/IP common or private storage usage, ensure that you have a dump of TCP/IP; IBM service will need to review it. If you did not get a system dump for the abend, or if you want to obtain a dump of TCP/IP to perform a storage analysis, use the following table for commands you can issue.

<table>
<thead>
<tr>
<th>Commands</th>
<th>Type of dump</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL SET, COMP=xxx, ACTION=SVCD, JOBNAME=tcipprocname, SDATA=(NUC, RGN, CSA, SQA, LSQA, TRT), END</td>
<td>SLIP DUMP of the abend</td>
</tr>
<tr>
<td>where xxx equals the abend code you are receiving (for example, 878).</td>
<td></td>
</tr>
<tr>
<td>SL SET, COMP=xxx, ACTION=SVCD, JOBNAME=tcipprocname, DSPNAME=(1.CSM*), SDATA=(NUC, RGN, CSA, SQA, LSQA, TRT), END</td>
<td>SLIP dump of the abend if your storage problem is related to TCP/IP's CSM storage usage (includes the CSM data spaces in your dump).</td>
</tr>
</tbody>
</table>

where xxx equals the abend code you are receiving (for example, 878).
Table 92. Commands for various types of dumps (continued)

<table>
<thead>
<tr>
<th>Commands</th>
<th>Type of dump</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUMP COMM=('storage growth')</td>
<td>Dump of TCP/IP and any TCP/IP related applications that may be having storage problems (for example Omproute, FTP)</td>
</tr>
<tr>
<td>R xx, JOBNAME=('tcpipprocname', 'applname'), CONT</td>
<td></td>
</tr>
<tr>
<td>R xx, SDATA=('NUC', 'RGN', 'CSA', 'SQA', 'LSQA', 'LPA', 'TRT'), END</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Wildcards (*) allow you to use a single specification to indicate a number of address spaces whose names match the wildcard pattern. This can be useful if you need to dump multiple TCP/IP stacks. You can specify a wildcard on the JOBLIST and DSPNAME parameters of a SLIP. And, the JOBNAME and DSPNAME parameters of the console dump command. For information about how to use wildcards in a SLIP and DUMP command, see z/OS MVS System Commands.

Submit the console log, and all dumps to the IBM Support Center for review.
Appendix A. Overview of internetworking

This topic gives an overview of internetworking and contains the following subtopics:

- “Maximum transmission unit (MTU)” on page 848
- “Fiber Distributed Data Interface (FDDI)” on page 849
- “Token-Ring IEEE 802.5” on page 850
- “IEEE 802.3” on page 851
- “Ethernet — DIX V2” on page 851
- “Subnetwork Access Protocol (SNAP)” on page 851
- “IP routing” on page 852
- “Internet Protocol Version 4 (IPv4) and Internet Protocol Version 6 (IPv6)” on page 852
- “Direct routing” on page 855
- “Indirect routing” on page 855
- “Simplified IP datagram routing algorithm” on page 855
- “IPv4 subnetting” on page 856
- “IPv6 prefixes” on page 857
- “Simplified IP datagram routing algorithm with subnets” on page 858
- “Static routing” on page 859
- “Dynamic routing” on page 860

Networking with TCP/IP connects different networks so that they form one logical interconnected network. This large overall network is called an internetwork, or more commonly, an intranet or internet. Each network uses its own physical layer, and the different networks are connected to each other by means of machines that are called gateways.

Gateways transfer IP datagrams between networks. This function is called routing; therefore, the internet gateways are often called routers. Within this appendix, the terms router and gateway are synonymous; both refer to a machine that transfers IP datagrams between different networks.

If IP datagrams are not passed properly over a bridge, none of the higher TCP/IP protocols or applications work correctly. For a discussion of bridges, see TCP/IP Tutorial and Technical Overview.

Linking networks in this way takes place at the network level of the International Organization for Standardization (ISO). It is possible to link networks at a lower-level layer using bridges. Bridges link networks at the ISO data link layer. Bridges pass packets or frames between different physical networks regardless of the protocols contained within them. An example of a bridge is the IBM 8209, which can interconnect an Ethernet network and a token-ring network.

A bridge does not connect TCP/IP networks together. It connects physical networks together that still forms the same TCP/IP network. (A bridge does not do IP routing.)

Figure 105 on page 848 depicts a router and a bridge. The router connects Network 1 to Network 2 to form an intranet.
Maximum transmission unit (MTU)

Different physical networks have different maximum frame sizes. Within the different frames, there is a maximum size for the data field. This value is called the maximum transmission unit (MTU), or maximum packet size in TCP/IP terms.

Figure 106 on page 849 shows the relationship between MTU and frame size.
If an IP datagram is to be sent out onto the network and the size of the datagram is bigger than the MTU, IP fragments the datagram into multiple fragments, so that it fits within the data fields of the frames. If the MTU is larger than the network can support, then the data is lost.

The value of MTU is especially important when bridging is used because of the different network limits. RFC 791 —Internet Protocols states that all IP hosts must be prepared to accept datagrams of up to 576 bytes.

The minimum MTU for IPv6 is 1280. See RFC 2460, Internet Protocol, Version 6 (IPv6) Specification for more information.

You can configure an MTU value by using the MTU parameter on the BEGINROUTES statement.

**Fiber Distributed Data Interface (FDDI)**

The FDDI specifications define a family of standards for 100 Mbps fiber optic LANs that provide the physical layers and media access control sublayer of the data link layer, as defined by the ISO/OSI Model.

IP-FDDI defines the encapsulating of IP datagrams and ARP requests and replies in FDDI frames.

All frames are transmitted in standard IEEE 802.2 LLC Type 1 Unnumbered Information format, with the DSAP and SSAP fields of the 802.2 header set to the assigned global SAP value for SNAP (decimal 170). The 24-bit Organization Code in the SNAP header is set to zero, and the remaining 16 bits are the EtherType from Assigned Numbers:

- 2048 for IP
- 2054 for ARP

Typically, the MTU is set to 4352.

Mapping of 32-bit internet addresses to 48-bit FDDI addresses is done by the ARP dynamic discovery procedure. The broadcast internet addresses (whose <host address> is set to all ones) are mapped to the broadcast FDDI addresses (all ones).

IP datagrams are transmitted as a series of 8-bit bytes using the usual TCP/IP transmission order called big-endian or network byte order.

For more information about FDDI architecture, see *LAN Concepts and Products*. 
**Token-Ring IEEE 802.5**

When a token-ring frame passes through a bridge, the bridge adds information to the routing information field (RIF) of the frame (assuming that the bridge supports source route bridging). The RIF contains information concerning the route taken by the frame and, more importantly, the maximum amount of data that the frame can contain within its data field. This is called the maximum information field (I-field). The value specified for the maximum I-field is sometimes referred to as the largest frame size, but this means the largest frame size, excluding headers. See Figure 107 on page 850 for details on the relationship of the I-field to the header fields.

**Guideline:** It is important to be aware that the IBM implementation limits the number of bridges through which a frame can be passed to seven. An attempt to pass a frame through an eighth bridge fails.

The maximum I-field is always decreased by a bridge when it cannot handle the value specified. So, for a given path through a number of token-ring bridges, the maximum I-field is the largest value that all of the bridges support. This value is specified in the Routing Control (RC) field within the RIF as shown in Figure 107 on page 850.

![Figure 107. Format of an IEEE 802.5 token-ring frame](image)

The size of the MTU is the maximum amount of data that is allowed within a frame. The token-ring architecture specifies the maximum value of the I-field in the data frame, which corresponds to the maximum size of the L-PDU. The maximum I-field value is determined by the bit configuration in the RC field, and is present in all routed frames.

Table 93 on page 850 shows the relationship between the RC field and the maximum I-field values.

<table>
<thead>
<tr>
<th>Routing control field</th>
<th>Maximum I-field in bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>x000 xxxx xxxx xxxx</td>
<td>516</td>
</tr>
<tr>
<td>x001 xxxx xxxx xxxx</td>
<td>1500</td>
</tr>
<tr>
<td>x010 xxxx xxxx xxxx</td>
<td>2052</td>
</tr>
<tr>
<td>x011 xxxx xxxx xxxx</td>
<td>4472</td>
</tr>
<tr>
<td>x100 xxxx xxxx xxxx</td>
<td>8144</td>
</tr>
<tr>
<td>x101 xxxx xxxx xxxx</td>
<td>11407</td>
</tr>
<tr>
<td>x110 xxxx xxxx xxxx</td>
<td>17800</td>
</tr>
</tbody>
</table>

Figure 107 on page 850 shows that, within the L-PDU, the Logical Link Control (LLC) header uses 8 bytes. Thus the MTU value is 8 bytes less than the maximum I-field. The L-PDU contains a SNAP header, as described in “Subnetwork Access Protocol (SNAP)” on page 851. Follow this example to calculate the...
MTU for a token-ring. The token-ring bridges always adjust the value of the maximum I-field to that of the smallest one in the path. Ensure that the MTU value is less than the value specified by the bridge.

Typically, within a 4-Mbps token-ring network, the value of maximum I-field is 2052 bytes. Therefore, the MTU would be set to 2044 bytes (2052 minus 8 bytes for the LLC header).

**IEEE 802.3**

The frame used in IEEE 802.3 Ethernet networks is shown in Figure 108 on page 851.

![Figure 108. Format of an IEEE 802.3 frame](image)

The maximum size of the L-PDU for a 10Mbps network is 1500 bytes. Because 8 bytes are used within the L-PDU for the LLC header, this means that the maximum size of the data field is 1492 bytes. Therefore, set the MTU for IEEE 802.3 networks to 1492 bytes.

**Ethernet — DIX V2**

The frame used in DIX Ethernet networks is shown in Figure 109 on page 851.

![Figure 109. Format of an Ethernet V2 frame](image)

There is no LLC data in an Ethernet V2 frame. The maximum size for the frame is 1526 bytes. This means that the data field can be 1500 bytes maximum. The MTU for Ethernet V2 can be set to 1500 bytes.

It is possible to bridge Ethernet V2 frames to either IEEE 802.3 or IEEE 802.5 networks; an LLC header is added or removed from the frame, as required, as part of the conversion when bridging.

**Subnetwork Access Protocol (SNAP)**

The TCP/IP software provides protocol support down to the ISO network layer. Following this layer is the data link layer, which can be separated into two sublayers. These are the **Logical Link Control (LLC)** and the **Media Access Control (MAC)** layers.

The IEEE 802.2 standard defines the LLC sublayer, and the MAC sublayer is defined in IEEE 802.3, IEEE 802.4, and IEEE 802.5.

The format of an IEEE 802.2 LLC header with the SNAP header is shown in Figure 110 on page 852.

[Overview of internetworking 851](#)
The values of the fields in the LLC header when a SNAP header is used are specified in RFC 1042 - Standard for Transmission of IP Datagrams over IEEE 802 Networks. The values specified are:

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSAP</td>
<td>X'AA'</td>
</tr>
<tr>
<td>SSAP</td>
<td>X'AA'</td>
</tr>
<tr>
<td>CONT</td>
<td>X'03' Specifies unnumbered information (UI)</td>
</tr>
<tr>
<td>P_id</td>
<td>X'00 00 00'</td>
</tr>
<tr>
<td>Type</td>
<td>X'8006' — ARP</td>
</tr>
<tr>
<td></td>
<td>X'8035' — RARP</td>
</tr>
<tr>
<td></td>
<td>X'86dd' — IPv6</td>
</tr>
</tbody>
</table>

**IP routing**

IP routing is based on routing tables held within a router or internet host. These tables contain routes which can either be static or dynamic. Typically, static routes are predefined within a configuration file, and dynamic routes are learned from the network, using a routing protocol.

**Internet Protocol Version 4 (IPv4) and Internet Protocol Version 6 (IPv6)**

There are two Internet protocols used to assign addresses to links on a host, Internet Protocol Version 4 (IPv4) and Internet Protocol Version 6 (IPv6). The majority of current internets use IPv4. This protocol is nearly 20 years old and is approaching the limits of the node addresses that its 32 bit addresses allow. IPv6 is the next generation of the Internet Protocol, designed to replace IPv4. Among other advantages, the 128 bit addresses defined by IPv6 provide nearly limitless addresses.

Although IPv6 is expected to eventually replace IPv4, they are likely to coexist for a number of years during the transition.

Figure 111 on page 853 shows a simple network with a bridge and a router.
Machine D is acting as an IP router and transfers IP datagrams between the class C, 192.9.200, network and the class A, 9.67.32 network. It is important to note that for Machine B to communicate with Machine C using TCP/IP, both Machine D and the bridge have to be correctly configured and working.

TCP/IP uses the HOME statements, defined in the data set hlq.PROFILE.TCPIP, to assign home addresses and associated link names. HOME statements can be updated using the VARY TCPIP command. See the z/OS Communications Server: IP Configuration Reference for more information about both the HOME statements.

### Internet Protocol Version 4 (IPv4)

A link on a host on an intranet is identified by its IP address. Internet Protocol (IP) is the protocol that is used to deliver datagrams between such hosts. It is assumed the reader is familiar with the TCP/IP protocols. Details of some of the protocols can be found in the TCP/IP Tutorial and Technical Overview. Specific information relating to the Internet Protocol can be found in RFC 791.

An IPv4 address is a 32-bit address that is usually represented in dotted decimal notation, with a decimal value representing each of the four octets (bytes) that make up the address. For example:

<table>
<thead>
<tr>
<th>00001001010000110110000100000010</th>
<th>32-bit address</th>
</tr>
</thead>
<tbody>
<tr>
<td>00001001 01000011 01100001 00000010</td>
<td>4 octets</td>
</tr>
<tr>
<td>9        67       97       2</td>
<td>dotted decimal notation (9.67.97.2)</td>
</tr>
</tbody>
</table>

The IPv4 address consists of a network address and a host address. Within the Internet, the network addresses are assigned by a central authority, the Network Information Center (NIC). The portion of the
The class of the address is determined by the first octet of the IPv4 address. Figure 113 on page 854 shows how the class of address is determined. The figure also shows Class D addresses. Class D addresses represent multicast groups, not network IP addresses. Multicast group addresses consist of the high-order, four bits of 1110 and the remaining 28 bits, which form a multicast group ID.

<table>
<thead>
<tr>
<th>32-bit address</th>
<th>xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>0xxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx</td>
</tr>
<tr>
<td>min</td>
<td>00000000</td>
</tr>
<tr>
<td>max</td>
<td>01111111</td>
</tr>
<tr>
<td>range</td>
<td>1 - 126 (decimal notation; 0 and 127 are reserved)</td>
</tr>
<tr>
<td>Class B</td>
<td>10xxxxxx xxxxxxxx xxxxxxxx xxxxxxxx</td>
</tr>
<tr>
<td>min</td>
<td>10000000</td>
</tr>
<tr>
<td>max</td>
<td>10111111</td>
</tr>
<tr>
<td>range</td>
<td>128 - 191 (decimal notation)</td>
</tr>
<tr>
<td>Class C</td>
<td>110xxxxx xxxxxxxx xxxxxxxx xxxxxxxx</td>
</tr>
<tr>
<td>min</td>
<td>11000000</td>
</tr>
<tr>
<td>max</td>
<td>11011111</td>
</tr>
<tr>
<td>range</td>
<td>192 - 223 (decimal notation)</td>
</tr>
<tr>
<td>Class D</td>
<td>1110xxxx xxxxxxxx xxxxxxxx xxxxxxxx</td>
</tr>
<tr>
<td>min</td>
<td>11100000</td>
</tr>
<tr>
<td>max</td>
<td>11101111</td>
</tr>
<tr>
<td>range</td>
<td>224-239 (decimal notation)</td>
</tr>
</tbody>
</table>

As shown in Figure 113 on page 854, the value of the bits in the first octet determine the class of address, and the class of address determines the range of values for the network and host segment of the IPv4 address. For example, the IPv4 address 9.67.97.2 would be a class A address, since the first two bits in the first octet contain B'00'. The network part of the IPv4 address is 9 and the host part of the IPv4 address is 67.97.2.

See RFC 1166–Internet Numbers for more information about IPv4 addresses. See RFC 1060–Assigned Numbers for more information about reserved network and host IPv4 addresses, such as a network broadcast address.

### Internet Protocol Version 6 (IPv6)

As described above, IPv4 addresses are represented in dotted-decimal format. The 32-bit address is divided along 8-bit boundaries. Each set of 8 bits is converted to its decimal equivalent and separated by periods. In contrast, IPv6 addresses are 128-bits divided along 16-bit boundaries. Each 16-bit block is converted to a 4-digit hexadecimal number and separated by colons. The resulting representation is called colon-hexadecimal.

There are three conventional forms for representing IPv6 addresses as text strings:
The preferred form is x:x:x:x:x:x:x:x, where x is the hexadecimal value of the eight 16-bit pieces of the address. For example:


**Guideline:** It is not necessary to write the leading zeros in an individual field, but there must be at least one numeral in every field. The following is the only exception.

It is common in some styles of IPv6 addresses to contain long strings of zero bits. To make writing addresses containing zero bits easier, a special syntax is available to compress the zeros. Use two colons (::) to indicate multiple groups of 16 bits of zeros. The two colons (::) can appear only once in an address. The two colons (::) can also be used to compress the leading zeros, the trailing zeros, or both in an address.

For example, the following addresses:

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080::8:800:200C:417A</td>
<td>a unicast address</td>
</tr>
<tr>
<td>FF01::0:0:0:0:0:101</td>
<td>a multicast address</td>
</tr>
<tr>
<td>0:0:0:0:0:0:0:1</td>
<td>the loopback address</td>
</tr>
<tr>
<td>0:0:0:0:0:0:0:0</td>
<td>the unspecified addresses</td>
</tr>
</tbody>
</table>

can be represented as:

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080::8:800:200C:417A</td>
<td>a unicast address</td>
</tr>
<tr>
<td>FF01::101</td>
<td>a multicast address</td>
</tr>
<tr>
<td>::1</td>
<td>the loopback address</td>
</tr>
<tr>
<td>::</td>
<td>the unspecified addresses</td>
</tr>
</tbody>
</table>

An alternative form that is sometimes more convenient when dealing with a mixed environment of IPv4 and IPv6 nodes is x:x:x:x:x:d.d.d.d, where x is the hexadecimal value of the six high-order 16-bit pieces of the address, and d is the decimal value of the four low-order 8-bit pieces of the address (standard IPv4 representation). For example, 0:0:0:0:0:13.1.68.3 can be expressed in condensed form as ::13.1.68.3

**Direct routing**

Direct routing can take place when two hosts are directly connected to the same physical network. This can be a bridged token-ring network, a bridged Ethernet, or a bridged token-ring network and Ethernet. The distinction between direct routing and indirect routing is that, with direct routing, an IP datagram can be delivered to the remote host without subsequent interpretation of the IP address, by an intermediate host or router.

In Figure 111 on page 853, a datagram traveling from Machine A to Machine B would be using direct routing, although it would be traveling through a bridge.

**Indirect routing**

*Indirect routing* takes place when the destination is not on a directly attached IP network, forcing the sender to forward the datagram to a router for delivery.

In Figure 111 on page 853, a datagram from Machine A being delivered to Machine C would be using indirect routing, with Machine D acting as the router (or gateway).

**Simplified IP datagram routing algorithm**

To route an IP datagram on the network, the algorithm shown in Figure 114 on page 856 is used.
Does destination IP network address equal one of my IP network addresses?

Send IP datagram to gateway corresponding to the destination IP address.

Send IP datagram on local network.

**Figure 114. General IP routing algorithm**

Using this general routing algorithm, it is easy to determine where an IP datagram is routed. Following is a simple example based on the configuration shown in Figure 111 on page 853.

<table>
<thead>
<tr>
<th>Machine A IP Address = 192.9.200.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routing Table</td>
</tr>
<tr>
<td>Destination</td>
</tr>
<tr>
<td>192.9.200.1</td>
</tr>
<tr>
<td>9.0.0.0</td>
</tr>
</tbody>
</table>

Machine A sends a datagram to host 192.9.200.3 (Machine B), using the direct route, 192.9.200.1 (its own network interface). Machine A sends a datagram to host 9.67.32.2 (Machine C), using the indirect route, 192.9.200.2 (Machine D), and Machine D then forwards the datagram to Machine C.

**IPv4 subnetting**

IPv4 allows for a variation of the network and host segments of an IP address, known as *subnetting*, can be used to physically and logically design a network. For example, an organization can have a single internet network address (NETID) that is known to users outside the organization, yet configure its internal network into different departmental subnets. Subnetwork addresses enhance local routing capabilities, while reducing the number of network addresses required.

To illustrate this, consider a simple example. Assume that we have an assigned class C network address of 192.9.200 for our site. This would mean that we could have host addresses from 192.9.200.1 to 192.9.200.254. If we did not use subnetting, then we could only implement a single IP network with 254
hosts. To split our site into two logical subnetworks, we could implement the network scheme shown in Figure 115 on page 857:

<table>
<thead>
<tr>
<th>Network Address</th>
<th>Host Address Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.9.200</td>
<td>1 - 254</td>
</tr>
</tbody>
</table>

**Without Subnetting:**

<table>
<thead>
<tr>
<th>Subnet Address</th>
<th>Host Address Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.9.200.64</td>
<td>65 - 126</td>
</tr>
<tr>
<td>192.9.200.128</td>
<td>129 - 190</td>
</tr>
</tbody>
</table>

The subnet mask would be:

00000000 00000000 00000000 11000000

**With Subnetting:**

<table>
<thead>
<tr>
<th>Subnet Address</th>
<th>Host Address Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.9.200.64</td>
<td>65 - 126</td>
</tr>
<tr>
<td>192.9.200.128</td>
<td>129 - 190</td>
</tr>
</tbody>
</table>

The subnet mask would be:

00000000 00000000 00000000 11000000

**Figure 115. Subnetting scheme**

z/OS TCP/IP uses a slightly different scheme for the subnet mask when defining the BEGINROUTES statements in the hlq.PROFILE.TCPIP data set and for displaying the subnet mask within a Netstat ROUTE/-r command. The subnet mask is applied only to the host segment of the IP address, and Netstat ROUTE/-r displays the subnet mask for only the host segment of the IP address. The subnet mask in the preceding chart as defined for z/OS TCP/IP would be:

00000000 00000000 00000000 192.0.0.192

Although z/OS TCP/IP defines the subnet mask differently, the application of the subnet mask and subnet value to the IP address is consistent with RFC-architected routing algorithms. A subnet mask of 255 is used for the remainder of this section, to retain symmetry with other routing documents that use 255 as the subnet value for the network segment of an IP address.

Because subnets B'00' and B'11' are both reserved, only two subnets are available. All 0s and all 1s have a special significance in internet addressing and should be used with care. Also notice that the total number of host addresses that we can use is reduced for the same reason. For instance, we cannot have a host address of 16 because this would mean that the subnet/host segment of the address would be B'0001000', which with the subnet mask we are using, would mean a subnet value of B'00', which is reserved.

The same is true for the host segment of the fourth octet. A fourth octet value of B'01111111' is reserved because, although the subnet of B'01' is valid, the host value of B'1' is reserved.

The network segment of the subnet mask is always assumed to be one, so each octet has a decimal value of 255. For example, with a class B address, the first two octets are assumed to be 255.255.

---

**IPv6 prefixes**

The IPv6 prefix concept is similar to IPv4 subnetting. An IPv6 address with a prefix is written as an IPv6 address followed by a decimal number representing the number of bits in the address that constitute the prefix. It is written as:

ipv6-address/prefix-length
where:

**ipv6-address**

is an IPv6 address in any notation

**prefix-length**

is a decimal value specifying how many of the leftmost contiguous bits of the address comprise the prefix.

For example, the following are legal representations of the 60-bit prefix 12AB0000000CD3 (hexadecimal):

```
12AB:0000:0000:CD30:0000:0000:0000:0000/60
12AB::CD30::0:0:0/60
12AB:0:0:CD30::/60
```

When writing both a node address and a prefix of that node address (for example, the node subnet prefix), the two can be combined as follows:

The node address

```
12AB:0:0:CD30:123:4567:89AB:CDEF
```

and its subnet number

```
12AB:0:0:CD30::/60
```

can be abbreviated as

```
12AB:0:0:CD30:123:4567:89AB:CDEF/60
```

---

**Simplified IP datagram routing algorithm with subnets**

When subnetting is used, the algorithm required to find a route for an IP datagram is similar to the one for general routing, with the exception that the addresses that are compared are the result of a logical AND of the subnet mask and the IP address.

For example:

```
| IP address:       | 9.67.32.18 | 00001001 01000011 00100000 00010010 |
| Subnet Mask: 255.255.255.240 | 11111111 11111111 11111111 11110000 |
| Result of Logical AND: | 9.67.32.16 | 00001001 01000011 00000000 00010000 |
```

The subnet address is 9.67.32.16, and it is this value that is used to determine the route used.  
**Figure 116 on page 859** shows the routing algorithm used with subnets.
Figure 116. Routing algorithm with subnets

Figure 117 on page 859 shows how a subnet route is resolved.

Figure 117. Example of resolving a subnet route

Static routing

Static routing, as the name implies, is defined within the local host, and must be manually changed as the network changes. Typically, a configuration file contains the definitions for directly-attached networks, routes for specific hosts, and a possible default route that directs packets to a destination for networks that are not previously defined.

Static routes can be defined using the z/OS TCP/IP BEGINROUTES statement to configure the internal routing tables; the statement is defined in the hlq.PROFILE.TCPIP data set. The internal routing tables for z/OS TCP/IP can be modified by one of the following ways:

- Changing the BEGINROUTES statement and recycling the TCP/IP address space.
• Using the VARY TCPIP,OBEYFILE command.
See z/OS Communications Server: IP System Administrator’s Commands for details about defining the BEGINROUTES statement.

**Tip:** When the BEGINROUTES statement is updated by using VARY TCPIP,OBEYFILE, all previously defined static routes are discarded and replaced by the new BEGINROUTES definitions.

## Dynamic routing

Dynamic routing is the opposite of static routing. A TCP/IP protocol is used to dynamically update the internal routing tables when changes to the network occur.

### IPv4

For IPv4, there are two dynamic routing protocols available. One routing protocol is the Routing Information Protocol (RIP). It is implemented by the OMPROUTE routing applications. A newer protocol is open shortest path first (OSPF). It is implemented by OMPROUTE only. For more details about OMPROUTE, see Chapter 30, “Diagnosing OMPROUTE problems,” on page 687. For configuration information about both applications, see z/OS Communications Server: IP Configuration Reference.

### IPv6

For IPv6, dynamic routing is performed by the Router Discovery protocol and by the IPv6 OSPF and IPv6 RIP dynamic routing protocols of OMPROUTE. For more information about IPv6 dynamic routing, see z/OS Communications Server: IP Configuration Guide.
Appendix B. IKE protocol details

This topic provides an overview of the IKE protocols, IKE version 1 (IKEv1) and IKE version 2 (IKEv2).

IKE version 1 protocol

Overview of negotiating IKEv1 security associations

The ISAKMP protocol is a framework for dynamically establishing security associations and cryptographic keys in an Internet environment. This framework defines a set of message flows (exchanges) and message formats (payloads). ISAKMP defines a generic payload for key exchange information. This enables the ISAKMP protocol to manage cryptographic keys independent of the key exchange protocol that is used to generate them.

ISAKMP defers the interpretation of the key exchange payload to individual key exchange protocols. Internet Key Exchange (IKE) is such a protocol. IKE augments the ISAKMP protocol to facilitate the creation of authenticated keying material. IKE defines how keying material is generated. The exchanges that are defined by ISAKMP require authentication to take place, but they do not specify how authentication is to be performed. IKE defines how authentication is to be performed.

ISAKMP defines two phases of negotiation. Both of these phases are also applicable to the IKE protocol. The first phase is referred to as phase 1. In phase 1, two ISAKMP servers agree on how to protect traffic between themselves. This agreement results in the creation of an ISAKMP security association. The second phase is referred to as phase 2. In phase 2, security associations for other security protocols are established; for example, AH or ESP. Negotiations during each phase are accomplished using an ISAKMP-defined exchange or by an exchange that is specific to a key exchange protocol.

Phase 1

IKE supports two types of phase 1 exchanges:

- Main mode
- Aggressive mode

Both of these exchange modes are based on exchanges that are defined by ISAKMP. Main mode is an implementation of ISAKMP’s Identity Protect exchange. Aggressive mode is an implementation of ISAKMP’s Aggressive exchange.

IKE defines four techniques for authentication of phase 1 exchanges:

- Pre-shared key
- Signature-based
- Public key encryption
- Revised public key encryption

Restriction: Of these techniques, the z/OS IKE daemon supports only pre-shared key authentication and signature-based authentication using RSA signatures.

Main mode

A Main mode exchange is composed of six messages as shown in Figure 118 on page 862.
Messages 1 and 2 provide agreement on the negotiable attributes of the ISAKMP security association. These associations are used to protect phase 2 negotiations that are established by using this phase 1. The initiator sends a list of acceptable security associations to the responder in message 1. Each security association defines an acceptable combination of attributes for the ISAKMP SA that is being negotiated. The responder picks a security association that is acceptable and returns the choice to the initiator in message 2.

The following attributes can be negotiated in phase1:

- Authentication method (for example, pre-shared key or RSA signature)
- Hash algorithm (for example, MD5 or SHA1)
- Encryption algorithm (for example, DES, 3DES or AES)
- Diffie-Hellman group information (for example, group 1, group 2, group 5 or group 14)
- Life time and life size of the ISAKMP SA

Messages 3 and 4 are used to exchange information specific to the generation of a shared secret key. This information includes Diffie-Hellman public values and a randomly generated value called a nonce. The initiator sends their Diffie-Hellman public value (for example, \(g^x \mod n\)) and a nonce in message 3. The responder sends a Diffie-Hellman public value (for example, \(g^y \mod n\)) and a nonce in message 4. With this information, both the responder and initiator can independently generate the identical keying information. The calculations that are used to generate keying information vary depending on the authentication method that was agreed upon during messages 1 and 2.

The keying information that is generated by both sides includes the following:

- A key that authenticates messages sent under the protection of this ISAKMP SA (for example, phase 2 messages)
• A key that encrypts messages that are sent under the protection of this ISAKMP SA (for example, phase 2 messages)
• Keying material that derives keys that are established for phase 2 SA

Messages 5 and 6 are used to exchange identity information and authentication information. The authentication information varies depending on the authentication method that was agreed upon during messages 1 and 2. For pre-shared key authentication, public key encryption authentication, and revised public key encryption authentication, the information takes the form of an encrypted hash. For signature-based authentication, this information takes the form of a signature. The initiator includes their identity and authentication information in message 5. The responder includes their identity and authentication information in message 6.

Main mode provides a mechanism to exchange certificates when signature-based authentication is used. This mechanism is not shown in Figure 118 on page 862, but works in the following way. In message 5 the initiating ISAKMP server can include the certificate it used to create its signature. In message 6 the responding ISAKMP server might include the certificate it used to create its signature. Inclusion of the certificate is optional unless the ISAKMP server’s peer explicitly requests that the certificate be sent.

**Aggressive mode**

An aggressive mode exchange is comprised of three messages, as shown in Figure 119 on page 863.

![Figure 119. Aggressive mode exchange](image)

Aggressive mode exchanges the same information as Main mode, with the exception of the following:

• In Aggressive mode, the initiator can send only one proposal. In Main mode, the initiator can send a list of proposals.
• In Aggressive mode, only three messages are exchanged instead of six messages as in Main mode.
  – Message 1 of Aggressive mode contains all the information that was contained in messages 1 and 3 of Main mode, plus the identity information sent in message 5 of Main mode.
- Message 2 of Aggressive mode contains all the information sent in messages 2, 4, and 6 of Main mode.
- Message 3 of Aggressive mode contains the authentication information that was contained in message 5 of Main mode.
- In Aggressive mode, no messages are required to be encrypted. Message 3 can be sent encrypted, but doing so provides little additional protection. In Main mode, messages 5 and 6 are required to be encrypted. The ISAKMP servers send their identity in messages 5 or 6 of Main mode. The result is that Main mode protects the identity of the ISAKMP servers while Aggressive mode does not. Aggressive mode provides a mechanism to exchange certificates when signature-based authentication is used. This mechanism is not shown in Figure 119 on page 863 but works in the following way. In message 2 the responding ISAKMP server can include the certificate it used to create its signature. In message 3, the initiating ISAKMP server can include the certificate it used to create its signature. Inclusion of the certificates is optional unless the peer of the ISAKMP server explicitly requests that the certificate be sent.

**Interpreting IKEv1 daemon phase 1 SA states**

The two IKE modes for negotiating phase 1 SAs (main and aggressive) are not themselves negotiable SA attributes. The initiator determines the mode based on the initiator's local policy. The responder can accept or reject the negotiation mode that is selected by the initiator.

Figure 120 on page 865 shows how to interpret phase 1 SA states in Main mode.
The following state descriptions apply to the Communications Server IKE daemon when acting as the initiator or responder of a main mode phase 1 SA negotiation (Figure 120 on page 865). These states are shown in the state field of the `ipsec -k display` command output. See “Main mode” on page 861 for a description of the contents of the messages. The numbers in the following list correspond to the numbered items in Figure 120 on page 865.

1. The INIT state on the initiator side indicates that message 1 has not yet been sent.
2. The INIT state on the responder side indicates that the responder is processing message 1, which was received from the initiator.

3. This WAIT SA state indicates that the initiator has sent message 1 and is waiting for message 2 from the responder.

4. The WAIT KE state indicates that the responder has processed message 1 and is waiting for message 3 from the initiator.

5. The IN KE state on the initiator side indicates that the initiator has sent message 3.

6. The IN KE state on the responder side indicates that the responder has received message 3.

7. The DONE state on the initiator side indicates that the initiator has received message 6.

8. The DONE state on the responder side indicates that the responder has sent message 6.

Figure 121 on page 866 shows how to interpret phase 1 SA states in aggressive mode.

**Aggressive Mode (Phase 1)**

![Diagram](image)

*Figure 121. Interpreting phase 1 SA states in Aggressive mode*
The following state descriptions apply to the Communications Server IKE daemon when acting as the initiator or responder of an Aggressive mode phase 1 SA negotiation (Figure 121 on page 866). These states are shown in the state field of the `ipsec -k display` command output. See "Aggressive mode" on page 863 for a description of the contents of the messages. The numbers in the following list correspond to the numbered items in Figure 121 on page 866.

1. The INIT state on the initiator side indicates that message 1 has not yet been sent.
2. The INIT state on the responder side indicates that the responder is processing message 1 received from the initiator.
3. The WAIT SA state on the initiator side indicates that the initiator has sent message 1.
4. The IN KE state on the initiator side indicates that the initiator has processed message 1.
5. The IN KE state on the responder side indicates that the responder has received message 2.
6. The DONE state on the initiator side indicates that the initiator has sent message 3.
7. The DONE state on the responder side indicates that the responder has received message 3.

**Phase 2**

IKE supports one type of phase 2 exchange, Quick mode. Quick mode is an IKE-specific exchange. It is not based on an ISAKMP-defined exchange. Quick mode exchanges are bound to a specific phase1 exchange. This is accomplished by encrypting a hash of each Quick mode message with a cryptographic key derived during the phase 1 exchange. No explicit authentication of the identities involved in a phase 2 exchange is done.

**Quick mode**

A Quick mode exchange is comprised of three messages, as shown in Figure 122 on page 867.

![Quick mode exchange messages](image-url)
In Quick mode, each message contains an encrypted hash. This hash authenticates the source of the message (for example, verifies that it is bound to an ISAKMP SA), authenticates the integrity of the message, and proves liveliness. In message 1, the initiator sends a list of acceptable proposals to the responder. Each proposal defines an acceptable combination of attributes for the non-ISAKMP SA that is being negotiated (AH or ESP SA). The responder picks a proposal that is acceptable and returns the choice to the initiator in message 2.

The attributes that can be negotiated in Quick mode include the following:

- Protocol (AH, ESP, or both AH and ESP)
- Authentication algorithm (for example, Hmac-Md5 or Hmac-Sha)
- Encapsulation mode (tunnel or transport)
- Encryption algorithm (for example, DES, 3DES or AES)
- Diffie-Hellman group information (for example, group 1, group 2, group 5 or group 14)
- Life time and life size of the IPSec SA

Quick mode enables an optional Diffie-Hellman exchange to occur. When the Diffie-Hellman exchange is to take place, the initiator includes a Diffie-Hellman public value (for example, $g^x \mod n$) in message 1, and the responder includes a Diffie-Hellman public value (for example, $g^y \mod n$) in message 2. The key generated from this Diffie-Hellman exchange is used in the calculation that generates the keying material for the non-ISAKMP SA. The Diffie-Hellman exchange provides perfect forward secrecy (PFS).

**Quick mode with commit bit**

The ISAKMP protocol defines a bit in the ISAKMP message header known as the commit bit. When the commit bit is turned on during a Quick mode exchange, the responder should acknowledge the receipt of message 3. The responder does this by extending the Quick mode exchange to include a fourth message. The major advantage of commit-bit processing is increased interoperability and the elimination of a potential window where IP packets could be dropped during the process of negotiating a new security association.

The z/OS IKE daemon uses commit-bit support as defined in the IKE draft dated May 1999. This draft was written after RFC 2409. No special configuration is required to take advantage of this support. When acting as a responder of a phase 2 negotiation, the IKE daemon always uses commit-bit logic. When acting as an initiator of a phase 2 negotiation, the IKE daemon always honors the commit-bit preference of the responder.

Figure 123 on page 869 shows the new fourth message in the Quick mode exchange, which includes an encrypted hash along with a notify payload indicating that message 3 was received.
In a normal Quick mode exchange, the initiator can start using a newly negotiated SA immediately after sending message 3. The responder does not start using the newly negotiated SA until it receives message 3. Message 3 is sent using UDP. Because UDP is not a reliable protocol, it is possible that the initiator sends message 3 and that this message never gets processed by the responder. In this case, the responder retransmits message 2 back to the initiator, causing the initiator to retransmit message 3. Unfortunately, during the time between such retransmissions, the initiator might start using the SA to protect an IP packet. Any such packet would be discarded by the responder until it successfully processed message 3.

In a Quick mode exchange with commit processing, the initiator defers the usage of a newly negotiated SA until one of the following events occur:

- The initiator receives a connected notify message
- The initiator receives an IP packet that was protected with the SA

The responder continues to start using the newly negotiated SA when it receives message 3. This eliminates the window where one side might start using an SA before the other side knows that it is safe to use the SA.

On z/OS, an SA is considered to be in a pending state while the initiator is waiting for a connected notify message (for example, message 4). An SA is placed into a pending state only if another SA that could be used to protect outbound traffic exists. An SA in pending state remains in pending state until one of the following events occur:

- A connected notify is received
• A message protected by the SA is received
• The last usable SA expires

**Interpreting IKEv1 daemon phase 2 SA states**

Commit-bit support is not a negotiable phase 2 SA attribute. The Communications Server IKE daemon always includes the commit bit when initiating a Quick mode negotiation. If the responder does not support commit-bit processing, the Communications Server IKE daemon does not wait for a connected notify message from the responder. If the initiator does not have commit-bit support, then the Communications Server IKE daemon does not send a connected notify message when acting as the responder.

*Quick mode (phase 2) SA states without commit-bit support*

Figure 124 on page 871 shows interpreting Quick mode (phase 2) SA states without commit-bit support
The following state descriptions apply to the Communications Server IKE daemon when acting as the initiator or responder of a Quick mode (phase 2) SA negotiation without commit-bit support (Figure 124 on page 871). These states are shown in the state field of the `ipsec -y display -b` command output. See “Quick mode” on page 867 for a description of the contents of the messages.

1. The INIT state on the initiator side indicates that message 2 has not yet been received.

2. The INIT state on the responder side indicates that the responder has not yet sent message 2.

3. A phase 1 SA must be established between the initiator and responder before the initiator can send message 1 of Quick mode. The PENDING state indicates that the initiator is waiting for a phase 1 negotiation to complete with the responder. For more information, “Interpreting IKEv1 daemon phase 1 SA states” on page 864. After the phase 1 negotiation completes, message 1 of Quick mode can be sent.
4. The KEP state on the initiator side indicates that message 2 has been received.
5. The KEP state on the initiator side indicates that message 2 has been sent.
6. The DONE state on the initiator side indicates that message 3 has been sent.
7. The DONE state on the responder side indicates that message 3 has been received.

**Quick mode (phase 2) SA states with commit-bit support**

Figure 125 on page 873 shows interpreting Quick mode (phase 2) SA states with commit-bit support.
Quick Mode (Phase 2) (with commit bit)

Figure 125. Quick (phase 2) SA states with commit-bit support
The following state descriptions apply to the Communications Server IKE daemon when acting as the initiator or responder of a Quick mode (phase 2) SA negotiation with commit-bit support (Figure 125 on page 873). These states are shown in the state field of the `ipsec -y display -b` command output. See “Quick mode with commit bit” on page 868 for a description of the contents of the messages.

1. The INIT state on the initiator side indicates that message 2 has not yet been received.
2. The INIT state on the responder side indicates that the responder has not yet sent message 2.
3. A phase 1 SA must be established between the initiator and responder before the initiator can send message 1 of Quick mode. The PENDING state indicates that the initiator is waiting for a phase 1 negotiation to complete with the responder. For more information, see “Interpreting IKEv1 daemon phase 1 SA states” on page 864. After the phase 1 negotiation completes, message 1 of Quick mode can be sent.
4. The KEP state on the initiator side indicates that message 2 has been received.
5. The KEP state on the responder side indicates that message 2 has been sent.
6. The NOTIFY state indicates that the initiator has sent message 3 and is waiting for message 4.
7. The DONE state on the initiator side indicates that message 4 has been received.
8. The DONE state on the responder side indicates that message 4 has been sent.

**ISAKMP Main mode limitations**

This topic contains information about three Main mode scenarios.

**Main mode scenario 1**

Key policy definition is based on the identities of remote ISAKMP servers. Unfortunately, during a Main mode exchange the responding ISAKMP server must accept a key proposal prior to learning the identity of the initiating ISAKMP server. The responder must later verify that the proposal that was agreed to is acceptable with defined policy when the identity becomes known.

The z/OS IKE daemon handles this limitation as follows:

1. Upon receipt of message 1, the IKE daemon uses the IP address of the initiator and responder to find an applicable KeyExchangeRule, which encapsulates the key policy:
   - If an applicable KeyExchangeRule is found, it is considered tentative until the identity of the initiator becomes known.
2. Upon receipt of message 5, which includes the initiator's identity, the IKE daemon uses the IP address of the initiator, the IP address of the responder, and the identity of the initiator to find an applicable KeyExchangeRule:
   - If a KeyExchangeRule is not found or is found but is inconsistent with the proposal accepted in message 1, the negotiation fails.
   - If a KeyExchangeRule is found and is consistent with the proposal accepted in message 1, it is considered final, and the negotiation proceeds.

**Main mode scenario 2**

Pre-shared keys are defined based on the identities of ISAKMP servers. Ideally, pre-shared keys are unique between ISAKMP server pairs. Unfortunately, during a Main mode exchange the responding ISAKMP server must determine the pre-shared key to use before learning the identity of the initiating ISAKMP server.

The z/OS IKE daemon handles this limitation as follows:

1. A key proposal is selected as described in “Main mode scenario 1” on page 874.
2. If the selected key proposal indicates pre-shared key mode authentication, then the IKE daemon must use a pre-shared key to generate message 4.
3. Upon receipt of message 5, the IKE daemon must use the same pre-shared key to decrypt the message to learn the identity of the initiating ISAKMP server.
4. After message 5 is successfully decrypted, the IKE daemon uses the IP address of the initiator, the IP address of the responder, and the identity of the initiator to find an applicable KeyExchangeRule:

- If a KeyExchangeRule is not found or is found but is inconsistent with the proposal accepted in message 1, the negotiation fails.
- If a KeyExchangeRule is found and is consistent with the proposal accepted in message 1, it is considered final, and the negotiation proceeds.

**Main mode scenario 3**

Certificate authority (CA) certificates are associated with the identities of remote ISAKMP servers. When RSA signature mode authentication is being performed, the ISAKMP responder might send one or more certificate requests to the ISAKMP initiator to guide the initiator in selecting a certificate signed by an acceptable CA. Unfortunately, during a Main mode exchange the responding ISAKMP server must send a certificate request before learning the identity of the initiating ISAKMP server.

The z/OS IKE daemon handles this limitation as follows:

1. A key proposal is selected as described in Scenario 1.
2. If the selected key proposal indicates RSA signature mode authentication, then the IKE daemon includes one or more certificate requests in message 4.
   - If a tentative KeyExchangeRule is in effect and the KeyExchangeRule's RemoteSecurityEndpoint includes one or more CaLabels, a certificate request corresponding to each CaLabel is included in message 4.
   - If the RemoteSecurityEndpoint does not include a CaLabel, a certificate request corresponding to each SupportedCertAuth is included in message 4.
   - If there are no applicable CaLabels or SupportedCertAuth statements configured, an empty certificate request is included in message 4, indicating that the initiator can use a certificate signed by any CA.

**IKE version 2 protocol**

IKE version 2 (IKEv2) is defined in RFC 5996, and is intended to replace IKEv1. This topic describes how the IKEv2 protocols are used to negotiate security associations (SAs) and exchange keys between two systems that want to communicate securely.

**Overview of negotiating IKEv2 security associations**

The IKEv2 protocol is very similar to IKEv1 in many respects. Both protocols establish SAs in two phases. They first establish an SA that securely carries IKE messages between the peers, and subsequently establish additional SAs to carry the protected ESP or AH traffic. For IKEv2, the SA that carries IKE messages is referred to as the IKE SA, and the SAs for ESP and AH are child SAs.

For IKEv1, the corresponding terms for the two types of SAs are "ISAKMP SA" and "IPSec SA". We use the terms "phase 1 SA" and "phase 2 SA" to refer to the two SA types when the version of IKE is unknown or unimportant.

The message formats defined for IKEv2 are very similar to those for IKEv1. Both formats start with a message header that contains a protocol version field, so a receiving node can receive both types of messages on a single UDP port (by default, port 500), and easily tell whether the message is IKEv1 or IKEv2. Both include variable length payloads of a similar generic format.

The specific content and sequences of messages for IKEv2 are quite different from IKEv1. In IKEv2, all communications consist of pairs of messages: a request and a response. The pair is called an "exchange". The initial exchanges consist of the IKE_SA_INIT exchange and the IKE_AUTH exchange. These two exchanges establish both the IKE SA and the first Child SA. Subsequent exchanges are the CREATE_CHILD_SA exchanges and INFORMATIONAL exchanges, which perform other duties such as establishing additional child SAs and deleting SAs.
Initial exchanges

Activation of an IKE_SA requires completion of two exchanges, IKE_SA_INIT exchange and IKE_AUTH exchange, as illustrated in Figure 126 on page 876.

Figure 126. IKEv2 initial exchanges

The first exchange of an IKEv2 activation attempt is the IKE_SA_INIT exchange. The initiator sends a list of security association proposals to the responder in the IKE_SA_INIT request. Each proposal defines a combination of attributes for the IKE SA that is being negotiated. The initiator also includes its nonce and Diffie-Hellman value in the IKE_SA_INIT request. The responder picks a proposal that is acceptable and returns its choice to the initiator in the IKE_SA_INIT response, along with its own nonce and Diffie-Hellman value.

The following attributes of the IKE SA can be negotiated during the IKE_SA_INIT exchange:

- Message authentication algorithm (for example, HMAC-MD5-96 or HMAC-SHA1-96)
- Pseudo-random function for key generation (for example, HMAC-MD5 or HMAC-SHA1)
- Encryption algorithm (for example, DES, 3DES or AES)
- Diffie-Hellman group information (for example, group 1, group 2, group 5 or group 14)

Once the IKE_SA_INIT exchange completes successfully, both the responder and initiator can independently generate the identical keying information that supports the IKE SA. This keying information includes the following:

- A pair of keys used to authenticate the IKE peers
• A pair of keys used to authenticate messages sent under the protection of this IKE SA
• A pair of keys used to encrypt messages that are sent under the protection of this IKE SA
• Keying material that derives keys that are established for child SAs

Note that, unlike IKEv1, each IKEv2 peer chooses its own authentication method. On a single IKE SA, one peer might choose to be authenticated using a pre-shared key, while the other peer chooses digital signature authentication. If the two peers both choose pre-shared key as the authentication method, the IKEv2 protocol allows their keys to be different, but the z/OS implementation requires both peers to use the same key. Also, the IKE SA life time and life size are not negotiated between the two IKEv2 peers. Each peer manages its own independent value of life time and life size for each IKE SA.

In some cases, negotiation of these attributes may require more than one IKE_SA_INIT exchange. The initiator makes a guess as to which proposal the responder will choose, and sends a Diffie-Hellman value that corresponds to that guess. If the responder chooses a different proposal, it rejects the IKE_SA_INIT, and includes an indication in the response that identifies its chosen proposal. The initiator learns the correct choice from the IKE_SA_INIT response, and initiates a new IKE_SA_INIT exchange with the responder’s chosen proposal and corresponding Diffie-Hellman value.

IKEv2 also provides a mechanism to exchange certificates when signature-based authentication is used. In the IKE_AUTH request the initiator can include the certificate it used to create its signature. In the IKE_AUTH response, the responder can include the certificate it used to create its signature. Inclusion of the certificates is optional. IKEv2 can be configured to send and/or receive new certificate encoding types that are not supported for IKEv1:
• Hash and URL of an X.509 certificate
• Hash and URL of an X.509 bundle

Because both peers have all the required keying information, all but the headers of all subsequent requests and responses sent on the IKE SA, by either peer, are encrypted and authenticated.

The second exchange is the IKE_AUTH exchange. This exchange completes the activation of the IKE SA, and also sets up an SA for the first (and often only) AH or ESP child SA. Details of first child SA activation are described in “First Child SA” on page 879.

**Note:** The z/OS IKE daemon uses the Network Security Services (NSS) Certificate service for creating and verifying digital signatures during the IKE_AUTH exchange.

To complete activation of the IKE SA, the initiator transmits an IKE_AUTH request that contains its identity and authentication information. The authentication information varies depending on the initiator’s authentication method that was declared in the IKE_SA_INIT request. For pre-shared key authentication, the information takes the form of an encrypted hash. For signature-based authentication, this information takes the form of a digital signature. The initiator may also include the expected identity of the responder in the IKE_AUTH request. This is useful when the machine on which the responder is running is hosting multiple identities at the same IP address. The responder includes its identity and authentication information in the IKE_AUTH response.

When a certificate payload of one of these encoding types is received, the actual certificate is retrieved from an HTTP server using the provided URL, and the retrieved certificate is verified using the provided hash. The hash and URL are typically smaller than the certificate they refer to, so some efficiency is gained by using them. However, there is additional cost to retrieve the certificate from the HTTP server.

**Interpreting IKEv2 IKE SA states**

Figure 127 on page 878 shows how to interpret IKE SA states.
Figure 127. Interpreting IKEv2 IKE SA states

The following state descriptions apply to the Communications Server IKE daemon when acting as the initiator or responder of an IKEv2 phase 1 SA negotiation. These states are shown in the state field of the
ipsec -k display command output. See “Initial exchanges” on page 876 for a description of the contents of the messages. The numbers in the following list correspond to the numbered items in Figure 127 on page 878.

1. The INIT state on the initiator side indicates that the IKE_SA_INIT request has not yet been sent.
2. The INIT state on the responder side indicates that the responder is processing the IKE_SA_INIT request, which was received from the initiator.
3. This WAIT KE state indicates that the initiator has sent the IKE_SA_INIT request and is waiting for the IKE_SA_INIT response from the responder.
4. The WAIT KE state indicates that the responder has processed the IKE_SA_INIT and is waiting for the IKE_AUTH request from the initiator.
5. The WAIT AUTH state on the initiator side indicates that the initiator has sent the IKE_AUTH request.
6. The WAIT AUTH state on the responder side indicates that the responder has received the IKE_AUTH request.
7. The DONE state on the initiator side indicates that the initiator has received the IKE_AUTH response.
8. The DONE state on the responder side indicates that the responder has sent the IKE_AUTH response.

**Child SA activation**

For IKEv2, activation of the first Child SA under an IKE_SA is handled slightly differently than activation of subsequent Child SAs under that same IKE SA.

**First Child SA**

The IKEv2 protocol was designed so that the first Child SA is activated during processing of the IKE_AUTH request and response. For many configurations, this means that the IKE SA and Child SA are both activated by only four messages.

The IKE_AUTH request contains the initiator’s list of SA proposals, and the traffic selectors that describe the traffic to be protected by the Child SA. However, the IKE_AUTH request does NOT contain keying information or a nonce that is specific to the Child SA. The nonces and keying information from the IKE_SA_INIT exchange are used in computing the keys for the first Child SA. See Figure 126 on page 876 for an illustration of the IKE_AUTH exchange.

Processing of the SA proposals and the traffic selectors during the IKE_AUTH exchange is the same as in CREATE_CHILD_SA processing, described in “Additional Child SAs” on page 879.

**Additional Child SAs**

Each additional Child SA is established using a single CREATE_CHILD_SA exchange, as illustrated in Figure 128 on page 879.

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**Figure 128. IKEv2 CREATE_CHILD_SA exchange**

The initiator sends a CREATE_CHILD_SA request, containing a list of acceptable proposals for the Child SA. Each proposal defines an acceptable combination of attributes for the Child SA that is being activated.

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negotiated (AH or ESP SA). The responder picks a proposal that is acceptable and returns the choice to the initiator in the CREATE_CHILD_SA response. The attributes that can be negotiated include the following:

- Protocol (AH or ESP)
- Authentication algorithm (for example, HMAC-MD5 or HMAC-SHA)
- Encapsulation mode (tunnel or transport)
- Encryption algorithm (for example, DES, 3DES or AES)
- Diffie-Hellman group information (for example, group 1, group 2, group 5 or group 14)

Unlike IKEv1, the Child SA life time and life size are not negotiated between the two IKEv2 peers. Each peer manages its own independent value of life time and life size for each Child SA.

An optional Diffie-Hellman exchange may occur during the CREATE_CHILD_SA exchange. When the Diffie-Hellman exchange is to take place, the initiator includes a Diffie-Hellman public value in the CREATE_CHILD_SA request, and the responder includes a Diffie-Hellman public value in the CREATE_CHILD_SA response. The key generated from this Diffie-Hellman exchange is used in the calculation that generates the keying material for the Child SA. The Diffie-Hellman exchange provides perfect forward secrecy (PFS), which ensures the Child SA keys are derived independently from the IKE SA keys.

Traffic selectors that describe the traffic to be protected by the SA are also negotiated during the CREATE_CHILD_SA exchange. The initiator sends a set of proposed traffic selectors in the CREATE_CHILD_SA request, and the responder can narrow the traffic selection by sending a subset of the initiator’s proposed traffic selectors on the CREATE_CHILD_SA response.

As with IKE_SA_INIT, in some cases, negotiation of these attributes may require more than one CREATE_CHILD_SA exchange. The initiator makes a guess as to which proposal the responder will choose, and sends a Diffie-Hellman value that corresponds to that guess. If the responder chooses a different proposal, it rejects the CREATE_CHILD_SA, and includes an indication in the response that identifies its chosen proposal. The initiator learns the correct choice from the CREATE_CHILD_SA response, and initiates a new CREATE_CHILD_SA exchange with the responder's chosen proposal and corresponding Diffie-Hellman value.

**Interpreting IKEv2 Child SA states**

Figure 129 on page 881 shows how to interpret IKE_SA states.
IKEV2 Initiator

1. The INIT state on the initiator side indicates that the CREATE_CHILD_SAs Request has not yet been sent.

2. The INIT state on the responder side indicates that the responder is processing the CREATE_CHILD_SAs Request, which was received from the initiator.

3. This IN KE state indicates that the initiator has sent the CREATE_CHILD_SA Request and is waiting for the CREATE_CHILD_SA Response from the responder.

4. The IN KE state indicates that the responder is processing the CREATE_CHILD_SAs Request.

5. The DONE state on the initiator side indicates that the initiator has received the CREATE_CHILD_SAs Response.

IKEV2 Responder

6. The DONE state on the responder side indicates that the responder has received the CREATE_CHILD_SAs Response.

Figure 129. IKEv2 Child SA states

The following state descriptions apply to the Communications Server IKE daemon when acting as the initiator or responder of an IKEv2 phase 2 SA negotiation. These states are shown in the state field of the `ipsec -y display -b` command output. See “Child SA activation” on page 879 for a description of the contents of the messages. The numbers in the following list correspond to the numbered items in Figure 129 on page 881.

1. The INIT state on the initiator side indicates that the CREATE_CHILD_SA Request has not yet been sent.

2. The INIT state on the responder side indicates that the responder is processing the CREATE_CHILD_SA Request, which was received from the initiator.

3. This IN KE state indicates that the initiator has sent the CREATE_CHILD_SA Request and is waiting for the CREATE_CHILD_SA Response from the responder.

4. The IN KE state indicates that the responder is processing the CREATE_CHILD_SA Request.

5. The DONE state on the initiator side indicates that the initiator has received the CREATE_CHILD_SA Response.
6. The DONE state on the responder side indicates that the responder has sent the CREATE_CHILD_SA Response.

Key exchange limitations

Key policy definition is based on the identities of remote IKE servers. During an IKEv2 authentication exchange, the IKE daemon must choose a key exchange rule and action before the identity of the remote IKE server is known. This determines policy decisions that are made early in the negotiation. These decisions cannot be reversed later in the negotiation; however, where applicable, once the identity of the remote IKE server is known these policy decisions are verified. The z/OS IKE daemon manages the policy selection process as described in the following topics:

- "Responder" on page 882
- "Initiator" on page 882

Responder

When z/OS IKED is acting as responder:

- Upon receipt of the IKE_SA_INIT request message, the IKE daemon uses the IP addresses of the initiator and responder to find the first applicable KeyExchangeRule that encapsulates these addresses. If a rule is found, it is considered to be tentative until the identity of the initiator becomes known. All KeyExchangePolicy settings applicable to the IKE_SA_INIT and IKE_AUTH exchanges are determined from this tentative rule, including SA proposal attributes, pre-shared key, and certificate authority (CA) labels.

- Upon receipt of the IKE_AUTH request message, which includes the initiator's identity (IDi):
  - If the request message also contains the optional requested responder identity (IDr), the IKE daemon uses the IP addresses of the initiator and responder, plus both the initiator and responder identities contained in the request message, to find an applicable KeyExchangeRule. At this point:
    - If a KeyExchangeRule is not found, the negotiation continues to step B below.
    - If a KeyExchangeRule is found, and the SA is using pre-shared key identity protection in either direction, and the KeyExchangeRule's pre-shared key does not match the pre-shared key of the tentative KeyExchangeRule, the negotiation continues to step B below.
    - If a KeyExchangeRule is found, but it does not include an SA proposal that is consistent with the proposal accepted in the IKE_SA_INIT exchange, the negotiation continues to step B below.
    - Otherwise, the new KeyExchangeRule is considered final, and the negotiation proceeds. This KeyExchangeRule may contain a local security endpoint identity that is different from the tentative KeyExchangeRule.
  - If the request message does not contain the optional requested responder identity (IDr), or if it does but step A above fails, the IKE daemon uses the IP addresses of the initiator and responder, plus the identity of the initiator, to find an applicable KeyExchangeRule. At this point:
    - If a KeyExchangeRule is not found, the negotiation fails.
    - If a KeyExchangeRule is found, and the SA is using pre-shared key identity protection in either direction, and the KeyExchangeRule's pre-shared key does not match the pre-shared key of the tentative KeyExchangeRule, the negotiation fails.
    - If a KeyExchangeRule is found, but it does not include an SA proposal that is consistent with the proposal accepted in the IKE_SA_INIT exchange, the negotiation fails.
    - Otherwise, the new KeyExchangeRule is considered final, and the negotiation proceeds. This KeyExchangeRule may contain a local security endpoint identity that is different from the tentative KeyExchangeRule.

Initiator

When z/OS IKED is acting as initiator:
• Prior to sending the IKE_SA_INIT request, the initial KeyExchangeRule is selected according to the rules specified in the IpLocalStartAction statement. See z/OS Communications Server: IP Configuration Reference for more information. If a rule is found, it is considered to be tentative until the identity of the responder becomes known. All KeyExchangePolicy settings applicable to the IKE_SA_INIT and IKE_AUTH exchanges are determined from this tentative rule, including SA proposal attributes, pre-shared key, and certificate authority (CA) labels.

• The initiator identity (IDi) that the IKE daemon sends in the IKE_AUTH request message is determined from this, and if applicable, the optional responder identity (IDr) sent in the IKE_AUTH request is also determined from this.

• Upon receipt of the IKE_AUTH response message, which includes the responder's identity (IDr), the IKE daemon uses the IP addresses of the initiator and responder, the initiator identity determined from the tentative KeyExchangeRule, plus the responder identity contained in the response message, to find an applicable KeyExchangeRule. At this point:
  – If a KeyExchangeRule is not found, the negotiation fails.
  – If a KeyExchangeRule is found, and the SA is using pre-shared key identity protection in either direction, and the KeyExchangeRule's pre-shared key does not match the pre-shared key of the tentative KeyExchangeRule, the negotiation fails.
  – If the tentative KeyExchangeRule was located using a RemoteSecurityEndpoint configured on an IpLocalStartAction statement, and if the remote IKE daemon's identity (IDr) is not encompassed by the tentative RemoteSecurityEndpoint identity, the negotiation fails.
  – If a KeyExchangeRule is found, but it does not include an SA proposal that is consistent with the proposal accepted in the IKE_SA_INIT exchange, the negotiation fails.
  – Otherwise, the new KeyExchangeRule is considered final, and the negotiation proceeds.

Traversing a NAT

There are several incompatibility issues that exist between IPSec and Network Address Translation (NAT). These incompatibility issues are described in RFC 3715, IPsec-Network Address Translation (NAT) Compatibility Requirements. Three RFCs were written to address these incompatibility issues:

• RFC 3947, Negotiation of NAT-Traversal in the IKE
• RFC 3948, UDP Encapsulation of IPsec ESP Packets
• RFC 5996, Internet Key Exchange (IKEv2) Protocol

All of these RFCs have been implemented on z/OS, providing z/OS with the capability to perform IPSec while traversing a NAT in a limited set of environments. RFC 3947 augments IKE's Main mode, Aggressive mode, and Quick mode messages flows to include additional information. It also provides for the negotiation of two new encapsulation modes.

To provide the possibility of interoperability with some pre-RFC 3947 implementations z/OS also provides support for the following pre-RFC 3947, Negotiation of NAT-Traversal in the IKE drafts:

• draft-ietf-ipsec-nat-t-ike-02
• draft-ietf-ipsec-nat-t-ike-03

Impacts to IKEv1 phase 1 (Main and Aggressive mode)

RFC 3947 requires that a vendor ID payload containing a NAT traversal vendor ID be exchanged between two IKEv1 peers. The vendor ID payload is an existing ISAKMP payload. The vendor ID payload is used by an IKE daemon to advertise support for a feature that is an extension to RFC 2408 (ISAKMP) and RFC 2409 (IKE). The vendor ID that is contained in the payload identifies the feature. The NAT traversal vendor ID is defined to be an MD5 hash of the vendor string RFC 3947.

The NAT traversal vendor ID must be received before an IKE daemon can send any of the new payloads and encapsulation modes that are defined in RFC 3947. Likewise, an IKE daemon should not send any of the new payloads and encapsulation modes defined in RFC 3947 without first sending the NAT traversal vendor ID.
If the initiator of an IKEv1 phase 1 negotiation wants to advertise support for RFC 3947, it must send the NAT traversal vendor ID in message 1 of a Main mode exchange or message 1 of an Aggressive mode exchange. If the responder of an IKEv1 phase 1 negotiation wants to advertise support for RFC 3947, it must send the NAT traversal vendor ID in message 2 of a Main mode exchange or message 2 of an Aggressive mode exchange.

z/OS provides limited support for several pre-RFC 3947 drafts, as well as additional z/OS-to-z/OS NAT traversal capabilities. Unique vendor IDs are used to identify these various levels of NAT traversal support. Table 94 on page 884 shows the NAT traversal vendor IDs that are recognized by z/OS. The vendor IDs are listed from least functional to most functional. If z/OS receives multiples of these IDs, it uses the most functional level of support that it received.

Table 94 on page 884 lists vendor ID strings.

<table>
<thead>
<tr>
<th>Vendor ID string</th>
<th>Vendor ID</th>
</tr>
</thead>
</table>
| draft-ietf-ipsec-nat-t-ike-02
|                                  | 90cb8091 3ebb696e 086381b5 ec427b1f |
| draft-ietf-ipsec-nat-t-ike-02     | cd604643 35df21f8 7cfdb2fc 68b6a448 |
| draft-ietf-ipsec-nat-t-ike-03     | 7d9419a6 5310ca6f 2c179d92 15529d56 |
| RFC 3947                          | 4a131c81070358455c5728f20e95452f |
| z/OS CS-IKE NAT Traversal Level 1 | 95305bb5 64b82a30b 66968bbc 5326a8d |

In z/OS, NAT traversal support can be enabled or disabled with the AllowNat parameter. The AllowNat parameter can be specified on the KeyExchangePolicy statement, the KeyExchangeAction statement of the IPSec Policy file, or both. When AllowNat is set to NO the z/OS IKE daemon does not send NAT traversal vendor IDs. See z/OS Communications Server: IP Configuration Reference for additional details about the AllowNat parameter.

RFC 3947 defines a mechanism for discovering the existence of NAT devices residing between two IKE daemons using IKEv1, as well as the location of the NAT devices. This mechanism is the NAT Discovery (NAT-D) payload. The NAT-D payload is an extension to RFC 2408 and 2409. It contains a hash of several pieces of information including an IP address and port value from the IP packet that is being sent to an IKE peer (for example, the packet containing the NAT-D payload).

Each IKEv1 peer sends two or more NAT-D payloads. The destination IP address and port of the outbound IKE packet are used to construct the hash that is contained within the first NAT-D payload. The source IP address and port of the outbound IKE packet are used to construct the hash that is contained within the second NAT-D payload. Normally, only two NAT-D payloads are exchanged; however, if the sender of the packet has multiple IP addresses and it does not know which IP address is used to send the packet, it can send a NAT-D payload for each IP address it owns.

The initiator of an IKEv1 phase 1 negotiation must send its NAT-D payloads in message 3 of a Main mode exchange or message 3 of an Aggressive mode exchange. The responder of an IKEv1 phase 1 negotiation must send its NAT-D payloads in message 4 of a Main mode exchange or message 2 of an Aggressive mode exchange.

**Impacts to IKEv2 phase 1 (IKE_SA_INIT)**

RFC 5996 requires that an IKE daemon that supports IKEv2 NAT traversal must send NAT_DETECTION_SOURCE_IP and NAT_DETECTION_DESTINATION_IP payloads.

In z/OS, you can enable or disable NAT traversal support with the AllowNat parameter. You can specify the AllowNat parameter on the KeyExchangePolicy statement, the KeyExchangeAction statement of the IPSec Policy file, or both. When AllowNat is set to NO, the z/OS IKE daemon does not send NAT_DETECTION_SOURCE_IP or NAT_DETECTION_DESTINATION_IP payloads. See z/OS Communications Server: IP Configuration Reference for additional details about the AllowNat parameter.
If the initiator of an IKEv2 phase 1 negotiation wants to advertise support for IKEv2 NAT Traversal, it must send NAT_DETECTION_SOURCE_IP and NAT_DETECTION_DESTINATION_IP payloads in the IKE_SA_INIT request. If the responder of an IKEv2 phase 1 negotiation wants to advertise support for IKEv2 NAT Traversal, it must send NAT_DETECTION_SOURCE_IP and NAT_DETECTION_DESTINATION_IP payloads in the IKE_SA_INIT response.

RFC 5996 defines a mechanism for discovering the existence of NAT devices residing between two IKE daemons utilizing IKEv2, as well as the location of the NAT devices. This mechanism is based upon the NAT_DETECTION_SOURCE_IP and NAT_DETECTION_DESTINATION_IP payloads. The NAT_DETECTION_SOURCE_IP payload contains a hash of several pieces of information including the source IP address and source port value from the IP packet that is being sent to an IKE peer (for example, the packet containing the NAT_DETECTION_SOURCE_IP payload). The NAT_DETECTION_DESTINATION_IP payload contains a hash of several pieces of information including the destination IP address and destination port value from the IP packet that is being sent to an IKE peer (for example, the packet containing the NAT_DETECTION_DESTINATION_IP payload).

Each IKEv2 peer sends one or more NAT_DETECTION_SOURCE_IP payloads and one NAT_DETECTION_DESTINATION_IP payload. The destination IP address and port of the outbound IKE packet are used to construct the hash that is contained within the first NAT_DETECTION_DESTINATION_IP payload. The source IP address and port of the outbound IKE packet are used to construct the hash that is contained within the NAT_DETECTION_SOURCE_IP payload. Normally, only one NAT_DETECTION_SOURCE_IP payload is sent; however, if the sender of the packet has multiple IP addresses and it does not know which IP address is used to send the packet, it can send a NAT_DETECTION_SOURCE_IP payload for each IP address it owns.

z/OS provides limited support for IKEv2 NAT traversal, as well as additional z/OS-to-z/OS NAT traversal capabilities. A unique vendor ID is used to identify one z/OS IKE daemon to another. The z/OS IKE daemon sends a vendor ID payload incorporating the "z/OS CS-IKE NAT Traversal Level 1" vendor ID string shown in Table 94 on page 884 to identify itself as a z/OS IKE daemon to the peer. The z/OS IKE daemon includes this vendor ID payload in messages it sends that contain the NAT_DETECTION_SOURCE_IP and NAT_DETECTION_DESTINATION_IP payloads.

### Impacts to IKEv1 phase 2 (Quick mode)

RFC 3947 defines two new encapsulation mode values: UDP-Encapsulated-Transport and UDP-Encapsulated-Tunnel. These new encapsulation modes are defined in RFC 3948. See z/OS Communications Server: IP Configuration Guide for a description of these new modes.

When one or more NAT devices are detected between two IKEv1 peers, messages 1 and 2 of a Quick mode exchange should not use offers containing tunnel or transport mode of encapsulation. Offers containing UDP-Encapsulated-Transport or UDP-Encapsulated-Tunnel mode of encapsulation should be used instead. Likewise, when no NAT devices are detected between two IKEv1 peers, messages 1 and 2 of a Quick mode exchange should not use offers containing UDP-Encapsulated-Transport or UDP-Encapsulated-Tunnel mode of encapsulation.

On z/OS, only the tunnel or transport mode of encapsulation can be specified on the IpDataOffer statement (see z/OS Communications Server: IP Configuration Reference). The decision to use UDP-Encapsulated-Transport or UDP-Encapsulated-Tunnel mode is made heuristically by the IKE daemon. When a NAT is detected between two IKEv1 peers, the z/OS IKE daemon converts IpDataOffer statements containing tunnel mode encapsulation to UDP-Encapsulated-Tunnel mode and IpDataOffers containing transport mode encapsulation to UDP-Encapsulated-Transport mode.

In order to facilitate incremental TCP and UDP checksum verification, RFC 3947 requires that IKEv1 peers exchange their view of each other’s IP addresses when sending SA offers containing UDP-Encapsulated-Transport mode encapsulation. RFC 3947 defines a new payload for this purpose. This new payload is the NAT Original Address (NAT-OA) payload. The NAT-OA payload is an extension of RFC 2408 and 2409. It contains an IP address.

When the initiator of a Quick mode exchange sends a proposal utilizing UDP-Encapsulated-Transport mode, RFC 3947 requires the initiator to send two NAT-OA payload in message 1. The first NAT-OA payload contains the initiator's view of their IP address. The second NAT-OA payload contains the initiator's view of the responder's IP address.
When the responder of a Quick mode exchange accepts a proposal utilizing UDP-Encapsulated-Transport mode, RFC 3947 requires the responder to send two NAT-OA payloads in message 2. The first NAT-OA payload contains the responder’s view of the initiator’s address. The second NAT-OA payload contains the responder’s view of his address.

In pre-RFC 3947 drafts, only one NAT-OA payload can be sent in messages 1 and 2 of a Quick mode exchange. Sending this NAT-OA payload was recommended when sending a proposal utilizing UDP-Encapsulated-Transport encapsulation, but not required. In message 1, it contained the initiator’s view of his IP address. In message 2, it contained the responder’s view of his IP address.

**Impacts to IKEv2 phase 2**

RFC 5996 defines only two encapsulation modes: tunnel mode and transport mode. On z/OS, tunnel or transport mode of encapsulation for IKEv2 can be specified on the HowToEncapIKEv2 parameter of the IpDynVpnAction statement (see z/OS Communications Server: IP Configuration Reference). The decision to use UDP-Encapsulated-Transport or UDP-Encapsulated-Tunnel mode is made heuristically by the IKE daemon. When a NAT is detected between two IKEv2 peers, a child SA that negotiates transport mode will use UDP-Encapsulated-Transport mode for the traffic protected by the child SA. When a NAT is detected between two IKEv2 peers, a child SA that does not negotiate transport mode will use UDP-Encapsulated-Tunnel mode for the traffic protected by the child SA. The TCP/IP stack must process received UDP-encapsulated ESP packets even when no NAT is detected.

In order to facilitate incremental TCP and UDP checksum verification when using transport mode encapsulation, the original source and destination IP address are obtained from the Traffic Selector payloads. When a NAT is detected and the initiator proposes transport mode, the Traffic Selector payloads may only contain one unique IP address, which is then used as the original IP address. A given Traffic Selector payload may contain multiple Traffic Selectors provided each Traffic Selector has the same IP address.

When a NAT has been detected and the initiator proposes transport mode, the request includes the Traffic Selector payloads contains the initiator’s view of the initiator’s IP address in the TSi payload and includes the initiator’s view of responder’s IP address in the TSr payload. Likewise, if the responder accepts transport mode, the response that includes the Traffic Selector payloads includes the responder’s view of the initiator’s IP address in the TSi payload and includes the responder’s view of responder’s IP address in the TSr payload.

**Utilizing port UDP 4500**

To avoid any problems that could arise by IPSec-aware NAT devices, RFC 3947 and RFC 5996 both require the initiator to use UDP port 4500 to send and receive IKE traffic after the initiator detects the existence of a NAT device. RFC 3947 and RFC 5996 allow IKEv2 traffic to use port 4500 regardless of whether a NAT is detected, even when the initiator is sending the first phase 1 request. In Main mode, the initiator detects the existence of a NAT when processing message 4 and switches to source port UDP 4500 and destination port 4500 when the initiator is sending message 5. In Aggressive mode, the initiator detects the existence of a NAT when processing message 2 and switches to a source port of UDP 4500 and a destination port of UDP 4500 when sending message 3. In IKEv2, the initiator detects the existence of a NAT when processing the IKE_SA_INIT response. When the responder sends the initiator a message it must use the port values from the last message that was received from the initiator.

After the initiator switches to port 4500, which is known as port floating, all subsequent messages must use the floated ports. The initiator always expects to send and receive messages on source port 4500 and destination port 4500. For the responder, if the remote peer is located behind a NAPT, the source port may have been changed to a value other than 4500. If so, the responder receives a message on a random source port Y and destination port 4500. After receiving this message, the responder sends subsequent messages using a source port of 4500 and destination port of Y.

These ports are also used to send UDP-encapsulated ESP traffic. In order to be able to distinguish UDP encapsulated ESP traffic from IKE traffic, a non-ESP marker is added to each IKE message sent using the UDP encapsulation ports. A non-ESP marker is 4 bytes of 0.

Figure 130 on page 887 shows an IKE packet with and without the non-ESP marker.
Figure 130. IKE packet with and without the non-ESP marker
Appendix C. IBM Health Checker for z/OS

IBM Health Checker for z/OS is a z/OS component that installations can use to gather information about their system environment and system parameters to help identify potential configuration problems before they impact availability or cause outages. Individual products, z/OS components, or ISV software can provide checks that take advantage of the IBM Health Checker for z/OS framework.

For more information about IBM Health Checker for z/OS, see IBM Health Checker for z/OS: User’s Guide.

z/OS Communications Server TCP/IP provides the following checks:

**CSAPP_FTPD_ANONYMOUS_JES**
Checks whether the following statements have been configured for an FTP server:

- ANONYMOUS
- ANONYMOUSLEVEL 3
- ANONYMOUSFILETYPEJES FALSE

When ANONYMOUS FTP is allowed on the FTP server, it is recommended that the value specified for ANONYMOUSLEVEL be 3 and that the value specified for ANONYMOUSFILETYPEJES be FALSE. Otherwise, anonymous users can submit jobs to run on the system.

**CSAPP_MVRSHD_RHOSTS_DATA**
Checks whether the MVRSHD server is active and if an RSH client has been detected using RHOSTS.DATa datasets for authentication. The MVRSHD server supports the RSH and REXEC protocols which transfer user ID and password information in the clear. There is also the potential of weak authentication for RSH clients that use RHOSTS.DATa datasets. This authentication method allows remote command execution without requiring the RSH client to supply a password.

**CSAPP_SNMPAGENT_PUBLIC_COMMUNITY**
Checks whether the SNMP agent has been configured with a community name of public. The community name of public is a well-known name and should not be used with community-based security due to security considerations.

**CSRES_AUTOQ_GLOBALTCPIPDATA**
Checks whether the AUTOQUIESCE operand has been specified on the UNRESPONSIVETHRESHOLD resolver setup statement and that the GLOBALTCPIPDATA resolver setup statement has not been specified in the resolver setup file.

**CSRES_AUTOQ_RESOLVEVIA**
Checks whether the RESOLVEVIA statement has been specified with the value TCP in the global TCPIP.DATa file when the autonomic quiescing of unresponsive name servers function is active.

**CSRES_AUTOQ_TIMEOUT**
Checks whether the configured resolver timeout value in the global TCPIP.DATa file exceeds the optimal setting when the autonomic quiescing of unresponsive name servers function is active. By default, this check is performed once when the resolver is initialized and whenever a MODIFY REFRESH command is issued. This default value can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command.

**CSTCP_CINET_PORTRNG_RSV_TCPIPstackname**
Checks whether the port range specified by INADDRANYPORT and INADDRANYCOUNT in the BPXPRMxx parmlib member is reserved for OMVS on this stack, when operating in a CINET environment. A port range is reserved on a TCP/IP stack using the PORTRANGE TCP/IP profile statement. By default, this check is performed once at stack initialization. This default can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command. The check name is suffixed by TCPIPstackname, which is the job name of each TCP/IP stack that is started, to define a separate check for each stack.
CSTCP_IPMAXRT4_TCPIPstackname
Checks whether the total number of IPv4 indirect routes in the TCP/IP stack routing table has exceeded the maximum threshold. When this threshold is exceeded, OMPROUTE and the TCP/IP stack can potentially experience high CPU consumption from routing changes. A large routing table is considered to be inefficient in network design and operation. By default, this check is performed at the following times:

- Whenever the total number of indirect routes exceeds the maximum threshold (default 2000)
- 30 minutes after stack initialization (provided that the maximum threshold has not been exceeded)
- Specified interval (default 168 hours for weekly)

The defaults for the maximum threshold and interval can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command. The check name is suffixed by TCPIPstackname, which is the job name of each TCP/IP stack that is started, to define a separate check for each stack.

CSTCP_IPMAXRT6_TCPIPstackname
Checks whether the total number of IPv6 indirect routes in the TCP/IP stack routing table has exceeded the maximum threshold. When this threshold is exceeded, OMPROUTE and the TCP/IP stack can potentially experience high CPU consumption from routing changes. A large routing table is considered to be inefficient in network design and operation. By default, this check is performed at the following times:

- Whenever the total number of indirect routes exceeds the maximum threshold (default 2000)
- 30 minutes after stack initialization (provided that the maximum threshold has not been exceeded)
- Specified interval (default 168 hours for weekly)

The defaults for the maximum threshold and interval can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command. The check name is suffixed by TCPIPstackname, which is the job name of each TCP/IP stack that is started, to define a separate check for each stack.

CSTCP_IWQ_IPSEC_TCPIPstackname
Checks whether a QDIO interface defined on a TCP/IP stack has support for inbound workload queueing (IWQ) of IPSec traffic (this is supported by OSA-Express6S and beyond), and whether the TCP/IP stack is configured to have IPSec enabled. If these conditions are met, an additional ancillary input queue (AIQ) is established for IPSec inbound traffic. Each AIQ increases fixed storage utilization. It should be ensured that there is sufficient fixed storage for the AIQ for IPSec traffic. See IP services: Ensure storage availability for IWQ IPSec traffic in z/OS Migration for information on how much storage is needed for IWQ for IPSec.

By default, this check will be performed once at stack initialization. The check name is suffixed by TCPIPstackname, which is the job name of each TCP/IP stack that is started, to define a separate check for each stack.

CSTCP_SYSTCPIP_CTRACE_TCPIPstackname
Checks whether TCP/IP Event Trace (SYSTCPIP) is active with options other than the default options (MINIMUM, INIT, OPCMDs, or OPMGS). By default, this check will be performed once at stack initialization and then will be repeated once every 24 hours. This default can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command. The check name is suffixed by TCPIPstackname, which is the job name of each TCP/IP stack that is started, to define a separate check for each stack.

CSTCP_SYSPLEXMON_RECOV_TCPIPstackname
Checks whether the IPCONFIG DYNAMICXCF or IPCONFIG6 DYNAMICXCF parameters have been specified and the GLOBALCONFIG SYSPLEXMONITOR RECOVERY parameter has been specified. This check produces an exception message if the IPCONFIG DYNAMICXCF or IPCONFIG6 DYNAMICXCF parameters were specified, but the GLOBALCONFIG SYSPLEXMONITOR NORECOVERY parameter is in effect. By default, this check is performed once at stack initialization. This default can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command. The
check name is suffixed by `TCPIPstackname`, which is the job name of each TCP stack that is started, to define a separate check for each stack.

**CSTCP_TCPMAXRCVBUFRSIZE_TCPPIPstackname**
Checks whether the configured TCP maximum receive buffer size is sufficient to provide optimal support to the z/OS Communications Server FTP Server. By default, this check is performed once at stack initialization and whenever a VARY TCPIP,,OBEYFILE command changes the TCPMAXRCVBUFRSIZE parameter. By default, it checks that TCPMAXRCVBUFRSIZE is at least 180K. These defaults can be overridden on either a POLICY statement in the HZSPRMxx parmlib member or on a MODIFY command. The check name is suffixed by `TCPPIPstackname`, which is the job name of each TCP stack that is started, to define a separate check for each stack.

**ZOSMIGV2R4PREV_CS_IWQSC_TCPPIPstackname**
This is a migration health check. It checks whether the TCP/IP stack has IWQ and IPSec enabled, and whether any of the QDIO interfaces configured on the stack do not support IWQ IPSec. If IWQ and IPSec are enabled, but a QDIO interface does not support IWQ IPSec, then this check will trigger an exception. In case of migration to an OSA-Express6S, IWQ IPSec support will automatically turn on, and an additional ancillary input queue (AIQ) will be established for IPsec inbound traffic. Each AIQ increases fixed storage utilization. It should be ensured that there is sufficient fixed storage for the AIQ for IPsec traffic. See IP services: Ensure storage availability for IWQ IPSec traffic in z/OS Migration for information on how much storage is needed for IWQ for IPSec.

The check name is suffixed by `TCPPIPstackname`, which is the job name of each TCP/IP stack that is started, to define a separate check for each stack.
Appendix D. Related protocol specifications

This appendix lists the related protocol specifications (RFCs) for TCP/IP. The Internet Protocol suite is still evolving through requests for comments (RFC). New protocols are being designed and implemented by researchers and are brought to the attention of the Internet community in the form of RFCs. Some of these protocols are so useful that they become recommended protocols. That is, all future implementations for TCP/IP are recommended to implement these particular functions or protocols. These become the de facto standards, on which the TCP/IP protocol suite is built.


Draft RFCs that have been implemented in this and previous Communications Server releases are listed at the end of this topic.

Many features of TCP/IP Services are based on the following RFCs:

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<thead>
<tr>
<th>RFC</th>
<th>Title and Author</th>
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</thead>
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<tr>
<td>RFC 652</td>
<td>Telnet output carriage-return disposition option D. Crocker</td>
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<tr>
<td>RFC 653</td>
<td>Telnet output horizontal tabstops option D. Crocker</td>
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<tr>
<td>RFC 654</td>
<td>Telnet output horizontal tab disposition option D. Crocker</td>
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<td>Telnet output formfeed disposition option D. Crocker</td>
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<td>RFC 657</td>
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<td>Telnet output linefeed disposition D. Crocker</td>
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<td>RFC 698</td>
<td>Telnet extended ASCII option T. Mock</td>
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<tr>
<td>RFC 726</td>
<td>Remote Controlled Transmission and Echoing Telnet option J. Postel, D. Crocker</td>
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<td>RFC 727</td>
<td>Telnet logout option M.R. Crispin</td>
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<td>RFC 732</td>
<td>Telnet Data Entry Terminal option J.D. Day</td>
</tr>
<tr>
<td>RFC 733</td>
<td>Standard for the format of ARPA network text messages D. Crocker, J. Vittal, K.T. Pogran, D.A. Henderson</td>
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<tr>
<td>RFC 734</td>
<td>SUPDUP Protocol M.R. Crispin</td>
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<tr>
<td>RFC 735</td>
<td>Revised Telnet byte macro option D. Crocker, R.H. Gumpertz</td>
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<td>RFC 736</td>
<td>Telnet SUPDUP option M.R. Crispin</td>
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<tr>
<td>RFC 749</td>
<td>Telnet SUPDUP—Output option B. Greenberg</td>
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<td>RFC 765</td>
<td>File Transfer Protocol specification J. Postel</td>
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</table>
RFC 768  
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RFC 779  
  Telnet send-location option E. Killian

RFC 791  
  Internet Protocol J. Postel

RFC 792  
  Internet Control Message Protocol J. Postel

RFC 793  
  Transmission Control Protocol J. Postel

RFC 820  
  Assigned numbers J. Postel

RFC 823  
  DARPA Internet gateway R. Hinden, A. Sheltzer

RFC 826  
  Ethernet Address Resolution Protocol: Or converting network protocol addresses to 48-bit Ethernet address for transmission on Ethernet hardware D. Plummer

RFC 854  
  Telnet Protocol Specification J. Postel, J. Reynolds

RFC 855  
  Telnet Option Specification J. Postel, J. Reynolds

RFC 856  
  Telnet Binary Transmission J. Postel, J. Reynolds

RFC 857  
  Telnet Echo Option J. Postel, J. Reynolds

RFC 858  
  Telnet Suppress Go Ahead Option J. Postel, J. Reynolds

RFC 859  
  Telnet Status Option J. Postel, J. Reynolds

RFC 860  
  Telnet Timing Mark Option J. Postel, J. Reynolds

RFC 861  
  Telnet Extended Options: List Option J. Postel, J. Reynolds

RFC 862  
  Echo Protocol J. Postel

RFC 863  
  Discard Protocol J. Postel

RFC 864  
  Character Generator Protocol J. Postel

RFC 865  
  Quote of the Day Protocol J. Postel

RFC 868  
  Time Protocol J. Postel, K. Harrenstien

RFC 877  
  Standard for the transmission of IP datagrams over public data networks J.T. Korb

RFC 883  
  Domain names: Implementation specification P.V. Mockapetris

RFC 884  
  Telnet terminal type option M. Solomon, E. Wimmers
RFC 885
Telnet end of record option J. Postel

RFC 894
Standard for the transmission of IP datagrams over Ethernet networks C. Hornig

RFC 896
Congestion control in IP/TCP internetworks J. Nagle

RFC 903
Reverse Address Resolution Protocol R. Finlayson, T. Mann, J. Mogul, M. Theimer

RFC 904
Exterior Gateway Protocol formal specification D. Mills

RFC 919
Broadcasting Internet Datagrams J. Mogul

RFC 922
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Default Router Preferences and More-Specific Routes R. Draves, D. Thaler

RFC 4217  
Securing FTP with TLS P. Ford-Hutchinson

RFC 4292  
IP Forwarding Table MIB B. Haberman

RFC 4293  
Management Information Base for the Internet Protocol (IP) S. Routhier

RFC 4301  
Security Architecture for the Internet Protocol S. Kent, K. Seo

RFC 4302  
IP Authentication Header S. Kent

RFC 4303  
IP Encapsulating Security Payload (ESP) S. Kent

RFC 4304  
Extended Sequence Number (ESN) Addendum to IPsec Domain of Interpretation (DOI) for Internet Security Association and Key Management Protocol (ISAKMP) S. Kent

RFC 4307  
Cryptographic Algorithms for Use in the Internet Key Exchange Version 2 (IKEv2) J. Schiller

RFC 4308  
Cryptographic Suites for IPsec P. Hoffman

RFC 4434  
The AES-XCBC-PRF-128 Algorithm for the Internet Key Exchange Protocol P. Hoffman

RFC 4443  
Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification A. Conta, S. Deering

RFC 4552  
Authentication/Confidentiality for OSPFv3 M. Gupta, N. Melam

RFC 4678  
Server/Application State Protocol v1 A. Bivens

RFC 4753  
ECP Groups for IKE and IKEv2 D. Fu, J. Solinas

RFC 4754  
IKE and IKEv2 Authentication Using the Elliptic Curve Digital Signature Algorithm (ECDSA) D. Fu, J. Solinas

RFC 4809  

RFC 4835  
Cryptographic Algorithm Implementation Requirements for Encapsulating Security Payload (ESP) and Authentication Header (AH) V. Manral
RFC 4862
IPv6 Stateless Address Autoconfiguration S. Thomson, T. Narten, T. Jinmei

RFC 4868
Using HMAC-SHA-256, HMAC-SHA-384, and HMAC-SHA-512 with IPsec S. Kelly, S. Frankel

RFC 4869
Suite B Cryptographic Suites for IPsec L. Law, J. Solinas

RFC 4941
Privacy Extensions for Stateless Address Autoconfiguration in IPv6 T. Narten, R. Draves, S. Krishnan

RFC 4945
The Internet IP Security PKI Profile of IKEv1/ISAKMP, IKEv2, and PKIX B. Korver

RFC 5014
IPv6 Socket API for Source Address Selection E. Nordmark, S. Chakrabarti, J. Laganier

RFC 5095
Deprecation of Type 0 Routing Headers in IPv6 J. Abley, P. Savola, G. Neville-Neil

RFC 5175
IPv6 Router Advertisement Flags Option B. Haberman, Ed., R. Hinden

RFC 5282
Using Authenticated Encryption Algorithms with the Encrypted Payload of the Internet Key Exchange version 2 (IKEv2) Protocol D. Black, D. McGrew

RFC 5996
Internet Key Exchange Protocol Version 2 (IKEv2) C. Kaufman, P. Hoffman, Y. Nir, P. Eronen

Internet drafts
Internet drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Other groups can also distribute working documents as Internet drafts. You can see Internet drafts at http://www.ietf.org/ID.html.
Appendix E. Accessibility

Publications for this product are offered in Adobe Portable Document Format (PDF) and should be compliant with accessibility standards. If you experience difficulties when using PDF files, you can view the information through the z/OS Internet Library website http://www.ibm.com/systems/z/os/zos/library/bkserv/ or IBM Knowledge Center http://www.ibm.com/support/knowledgecenter/. If you continue to experience problems, send a message to Contact z/OS web page (www.ibm.com/systems/z/os/zos/webqs.html) or write to:

IBM Corporation
Attention: MHVRCFS Reader Comments
Department H6MA, Building 707
2455 South Road
Poughkeepsie, NY 12601-5400
USA

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully. The major accessibility features in z/OS enable users to:

• Use assistive technologies such as screen readers and screen magnifier software
• Operate specific or equivalent features using only the keyboard
• Customize display attributes such as color, contrast, and font size

Using assistive technologies

Assistive technology products, such as screen readers, function with the user interfaces found in z/OS. Consult the assistive technology documentation for specific information when using such products to access z/OS interfaces.

Keyboard navigation of the user interface

Users can access z/OS user interfaces using TSO/E or ISPF. See z/OS TSO/E Primer, z/OS TSO/E User’s Guide, and z/OS ISPF User’s Guide Vol I for information about accessing TSO/E and ISPF interfaces. These guides describe how to use TSO/E and ISPF, including the use of keyboard shortcuts or function keys (PF keys). Each guide includes the default settings for the PF keys and explains how to modify their functions.

z/OS information

One exception is command syntax that is published in railroad track format, which is accessible using screen readers with IBM Knowledge Center, as described in #accessibility/ddsd.

Dotted decimal syntax diagrams

Syntax diagrams are provided in dotted decimal format for users accessing IBM Knowledge Center using a screen reader. In dotted decimal format, each syntax element is written on a separate line. If two or more syntax elements are always present together (or always absent together), they can appear on the same line, because they can be considered as a single compound syntax element.
Each line starts with a dotted decimal number; for example, 3 or 3.1 or 3.1.1. To hear these numbers correctly, make sure that your screen reader is set to read out punctuation. All the syntax elements that have the same dotted decimal number (for example, all the syntax elements that have the number 3.1) are mutually exclusive alternatives. If you hear the lines 3.1 USERID and 3.1 SYSTEMID, you know that your syntax can include either USERID or SYSTEMID, but not both.

The dotted decimal numbering level denotes the level of nesting. For example, if a syntax element with dotted decimal number 3 is followed by a series of syntax elements with dotted decimal number 3.1, all the syntax elements numbered 3.1 are subordinate to the syntax element numbered 3.

Certain words and symbols are used next to the dotted decimal numbers to add information about the syntax elements. Occasionally, these words and symbols might occur at the beginning of the element itself. For ease of identification, if the word or symbol is a part of the syntax element, it is preceded by the backslash (\) character. The * symbol can be used next to a dotted decimal number to indicate that the syntax element repeats. For example, syntax element *FILE with dotted decimal number 3 is given the format 3 \* FILE. Format 3* FILE indicates that syntax element FILE repeats. Format 3* \* FILE indicates that syntax element * FILE repeats.

Characters such as commas, which are used to separate a string of syntax elements, are shown in the syntax just before the items they separate. These characters can appear on the same line as each item, or on a separate line with the same dotted decimal number as the relevant items. The line can also show another symbol giving information about the syntax elements. For example, the lines 5.1*, 5.1 LASTRUN, and 5.1 DELETE mean that if you use more than one of the LASTRUN and DELETE syntax elements, the elements must be separated by a comma. If no separator is given, assume that you use a blank to separate each syntax element.

If a syntax element is preceded by the % symbol, this indicates a reference that is defined elsewhere. The string following the % symbol is the name of a syntax fragment rather than a literal. For example, the line 2.1 %OP1 means that you should see separate syntax fragment OP1.

The following words and symbols are used next to the dotted decimal numbers:

- A question mark (?) means an optional syntax element. A dotted decimal number followed by the ? symbol indicates that all the syntax elements with a corresponding dotted decimal number, and any subordinate syntax elements, are optional. If there is only one syntax element with a dotted decimal number, the ? symbol is displayed on the same line as the syntax element, (for example 5? NOTIFY). If there is more than one syntax element with a dotted decimal number, the ? symbol is displayed on a line by itself, followed by the syntax elements that are optional. For example, if you hear the lines 5 ?, 5 NOTIFY, and 5 UPDATE, you know that syntax elements NOTIFY and UPDATE are optional; that is, you can choose one or none of them. The ? symbol is equivalent to a bypass line in a railroad diagram.

- An exclamation mark (!) means a default syntax element. A dotted decimal number followed by the ! symbol and a syntax element indicate that the syntax element is the default option for all syntax elements that share the same dotted decimal number. Only one of the syntax elements that share the same dotted decimal number can specify a ! symbol. For example, if you hear the lines 2? FILE, 2.1! (KEEP), and 2.1 (DELETE), you know that (KEEP) is the default option for the FILE keyword. In this example, if you include the FILE keyword but do not specify an option, default option KEEP will be applied. A default option also applies to the next higher dotted decimal number. In this example, if the FILE keyword is omitted, default FILE(KEEP) is used. However, if you hear the lines 2? FILE, 2.1, 2.1.1! (KEEP), and 2.1.1 (DELETE), the default option KEEP applies only to the next higher dotted decimal number, 2.1 (which does not have an associated keyword), and does not apply to 2? FILE. Nothing is used if the keyword FILE is omitted.

- An asterisk (*) means a syntax element that can be repeated 0 or more times. A dotted decimal number followed by the * symbol indicates that this syntax element can be used zero or more times; that is, it is optional and can be repeated. For example, if you hear the line 5.1* data area, you know that you can include one data area, more than one data area, or no data area. If you hear the lines 3*, 3 HOST, and 3 STATE, you know that you can include HOST, STATE, both together, or nothing.

Notes:

1. If a dotted decimal number has an asterisk (*) next to it and there is only one item with that dotted decimal number, you can repeat that same item more than once.
2. If a dotted decimal number has an asterisk next to it and several items have that dotted decimal number, you can use more than one item from the list, but you cannot use the items more than once each. In the previous example, you could write HOST STATE, but you could not write HOST HOST.

3. The * symbol is equivalent to a loop-back line in a railroad syntax diagram.

• + means a syntax element that must be included one or more times. A dotted decimal number followed by the + symbol indicates that this syntax element must be included one or more times; that is, it must be included at least once and can be repeated. For example, if you hear the line 6.1+ data area, you must include at least one data area. If you hear the lines 2+, 2 HOST, and 2 STATE, you know that you must include HOST, STATE, or both. Similar to the * symbol, the + symbol can only repeat a particular item if it is the only item with that dotted decimal number. The + symbol, like the * symbol, is equivalent to a loop-back line in a railroad syntax diagram.
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Minimum supported hardware

The minimum supported hardware for z/OS releases identified in z/OS announcements can subsequently change when service for particular servers or devices is withdrawn. Likewise, the levels of other software products supported on a particular release of z/OS are subject to the service support lifecycle of those products. Therefore, z/OS and its product publications (for example, panels, samples, messages, and product documentation) can include references to hardware and software that is no longer supported.

- For information about software support lifecycle, see: IBM Lifecycle Support for z/OS (www.ibm.com/software/support/systemsz/lifecycle)
- For information about currently-supported IBM hardware, contact your IBM representative.
Programming interface information

This publication documents information NOT intended to be used as Programming Interfaces of z/OS Communications Server.

Policy for unsupported hardware

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This bibliography contains descriptions of the documents in the z/OS Communications Server library.

z/OS Communications Server documentation is available online at the z/OS Internet Library web page at http://www.ibm.com/systems/z/os/zos/library/bkserv/.

z/OS Communications Server library updates

Updates to documents are also available on RETAIN and in information APARs (info APARs). Go to http://www.software.ibm.com/support to view information APARs.

- z/OS V2R1 Communications Server New Function APAR Summary
- z/OS V2R2 Communications Server New Function APAR Summary
- z/OS V2R3 Communications Server New Function APAR Summary

z/OS Communications Server information

z/OS Communications Server product information is grouped by task in the following tables.

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<td>Title</td>
<td>Number</td>
<td>Description</td>
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<tr>
<td>z/OS Communications Server: New Function Summary</td>
<td>GC27-3664</td>
<td>This document is intended to help you plan for new IP or SNA functions, whether you are migrating from a previous version or installing z/OS for the first time. It summarizes what is new in the release and identifies the suggested and required modifications needed to use the enhanced functions.</td>
</tr>
<tr>
<td>z/OS Communications Server: IPv6 Network and Application Design Guide</td>
<td>SC27-3663</td>
<td>This document is a high-level introduction to IPv6. It describes concepts of z/OS Communications Server's support of IPv6, coexistence with IPv4, and migration issues.</td>
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<th>Resource definition, configuration, and tuning</th>
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<tbody>
<tr>
<td>Title</td>
<td>Number</td>
<td>Description</td>
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<tr>
<td>z/OS Communications Server: IP Configuration Guide</td>
<td>SC27-3650</td>
<td>This document describes the major concepts involved in understanding and configuring an IP network. Familiarity with the z/OS operating system, IP protocols, z/OS UNIX System Services, and IBM Time Sharing Option (TSO) is recommended. Use this document with the z/OS Communications Server: IP Configuration Reference.</td>
</tr>
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</table>
### Title

<table>
<thead>
<tr>
<th>Title</th>
<th>Number</th>
<th>Description</th>
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</table>
| z/OS Communications Server: IP Configuration Reference | SC27-3651| This document presents information for people who want to administer and maintain IP. Use this document with the z/OS Communications Server: IP Configuration Guide. The information in this document includes:  
  • TCP/IP configuration data sets  
  • Configuration statements  
  • Translation tables  
  • Protocol number and port assignments                      |
| z/OS Communications Server: SNA Network Implementation Guide | SC27-3672| This document presents the major concepts involved in implementing an SNA network. Use this document with the z/OS Communications Server: SNA Resource Definition Reference. |
| z/OS Communications Server: SNA Resource Definition Reference | SC27-3675| This document describes each SNA definition statement, start option, and macroinstruction for user tables. It also describes NCP definition statements that affect SNA. Use this document with the z/OS Communications Server: SNA Network Implementation Guide. |
| z/OS Communications Server: SNA Resource Definition Samples | SC27-3676| This document contains sample definitions to help you implement SNA functions in your networks, and includes sample major node definitions. |
| z/OS Communications Server: IP Network Print Facility | SC27-3658| This document is for systems programmers and network administrators who need to prepare their network to route SNA, JES2, or JES3 printer output to remote printers using TCP/IP Services.  |
| z/OS Communications Server: IP User's Guide and Commands | SC27-3662| This document describes how to use TCP/IP applications. It contains requests with which a user can log on to a remote host using Telnet, transfer data sets using FTP, send electronic mail, print on remote printers, and authenticate network users. |
| z/OS Communications Server: IP System Administrator's Commands | SC27-3661| This document describes the functions and commands helpful in configuring or monitoring your system. It contains system administrator's commands, such as TSO NETSTAT, PING, TRACERTE and their UNIX counterparts. It also includes TSO and MVS commands commonly used during the IP configuration process. |
| z/OS Communications Server: SNA Operation | SC27-3673| This document serves as a reference for programmers and operators requiring detailed information about specific operator commands. |
| z/OS Communications Server: Quick Reference | SC27-3665| This document contains essential information about SNA and IP commands.  |
## Customization

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| z/OS Communications Server: SNA Customization | SC27-3666 | This document enables you to customize SNA, and includes the following information:  
- Communication network management (CNM) routing table  
- Logon-interpret routine requirements  
- Logon manager installation-wide exit routine for the CLU search exit  
- TSO/SNA installation-wide exit routines  
- SNA installation-wide exit routines |

## Writing application programs

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<tr>
<td>z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference</td>
<td>SC27-3660</td>
<td>This document describes the syntax and semantics of program source code necessary to write your own application programming interface (API) into TCP/IP. You can use this interface as the communication base for writing your own client or server application. You can also use this document to adapt your existing applications to communicate with each other using sockets over TCP/IP.</td>
</tr>
<tr>
<td>z/OS Communications Server: IP CICS Sockets Guide</td>
<td>SC27-3649</td>
<td>This document is for programmers who want to set up, write application programs for, and diagnose problems with the socket interface for CICS using z/OS TCP/IP.</td>
</tr>
<tr>
<td>z/OS Communications Server: IP IMS Sockets Guide</td>
<td>SC27-3653</td>
<td>This document is for programmers who want application programs that use the IMS TCP/IP application development services provided by the TCP/IP Services of IBM.</td>
</tr>
<tr>
<td>z/OS Communications Server: IP Programmer's Guide and Reference</td>
<td>SC27-3659</td>
<td>This document describes the syntax and semantics of a set of high-level application functions that you can use to program your own applications in a TCP/IP environment. These functions provide support for application facilities, such as user authentication, distributed databases, distributed processing, network management, and device sharing. Familiarity with the z/OS operating system, TCP/IP protocols, and IBM Time Sharing Option (TSO) is recommended.</td>
</tr>
<tr>
<td>z/OS Communications Server: SNA Programming</td>
<td>SC27-3674</td>
<td>This document describes how to use SNA macroinstructions to send data to and receive data from (1) a terminal in either the same or a different domain, or (2) another application program in either the same or a different domain.</td>
</tr>
<tr>
<td>z/OS Communications Server: SNA Programmer’s LU 6.2 Guide</td>
<td>SC27-3669</td>
<td>This document describes how to use the SNA LU 6.2 application programming interface for host application programs. This document applies to programs that use only LU 6.2 sessions or that use LU 6.2 sessions along with other session types. (Only LU 6.2 sessions are covered in this document.)</td>
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<tr>
<td>z/OS Communications Server: SNA Programmer's LU 6.2 Reference</td>
<td>SC27-3670</td>
<td>This document provides reference material for the SNA LU 6.2 programming interface for host application programs.</td>
</tr>
<tr>
<td>z/OS Communications Server: CSM Guide</td>
<td>SC27-3647</td>
<td>This document describes how applications use the communications storage manager.</td>
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### Diagnosis

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<tr>
<td>z/OS Communications Server: IP Diagnosis Guide</td>
<td>GC27-3652</td>
<td>This document explains how to diagnose TCP/IP problems and how to determine whether a specific problem is in the TCP/IP product code. It explains how to gather information for and describe problems to the IBM Software Support Center.</td>
</tr>
<tr>
<td>z/OS Communications Server: ACF/TAP Trace Analysis Handbook</td>
<td>GC27-3645</td>
<td>This document explains how to gather the trace data that is collected and stored in the host processor. It also explains how to use the Advanced Communications Function/Trace Analysis Program (ACF/TAP) service aid to produce reports for analyzing the trace data information.</td>
</tr>
<tr>
<td>z/OS Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures and z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps and the VIT</td>
<td>GC27-3667 GC27-3668</td>
<td>These documents help you identify an SNA problem, classify it, and collect information about it before you call the IBM Support Center. The information collected includes traces, dumps, and other problem documentation.</td>
</tr>
<tr>
<td>z/OS Communications Server: SNA Data Areas Volume 1 and z/OS Communications Server: SNA Data Areas Volume 2</td>
<td>GC31-6852 GC31-6853</td>
<td>These documents describe SNA data areas and can be used to read an SNA dump. They are intended for IBM programming service representatives and customer personnel who are diagnosing problems with SNA.</td>
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### Messages and codes

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| z/OS Communications Server: SNA Messages | SC27-3671 | This document describes the ELM, IKT, IST, IUT, IVT, and USS messages. Other information in this document includes:  
- Command and RU types in SNA messages  
- Node and ID types in SNA messages  
- Supplemental message-related information |
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