

z/OS Communications Server



# CMIP Services and Topology Agent Guide

*Version 2 Release 1*

**Note:**

Before using this information and the product it supports, be sure to read the general information under “Notices” on page 389.

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This edition applies to version 2, release 1, modification 0 of z/OS (5650-ZOS), and to subsequent releases and modifications until otherwise indicated in new editions.

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## About this document

This document describes programming concepts and CMIP API functions that help application programmers write Common Management Information Protocol (CMIP) application programs that use VTAM<sup>®</sup> CMIP services. The information in this document supports both IPv6 and IPv4. Unless explicitly noted, information describes IPv4 networking protocol. IPv6 support is qualified within the text.

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## Who should read this document

Use this document if you are planning to write a manager or agent application program that uses VTAM CMIP services or the VTAM topology agent application program.

Before using this document, you should be familiar with the basic concepts of telecommunication, SNA, and VTAM. You should also be familiar with the following:

- C language programming
- Object-oriented terminology
- OSI network management

You should be familiar with the information in the z/OS Communications Server: New Function Summary. The z/OS Communications Server: New Function Summary contains an overview of CMIP services and the VTAM topology agent, including information about what these functions enable you to do and how to plan for these functions. This document gives you the new and changed user interfaces that enable you to use each function.

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## How this document is organized

This document contains the following parts and chapters:

- Part 1, "VTAM CMIP services," on page 1 provides reference information you need to write CMIP application programs. It contains the following chapters:
  - Chapter 1, "Introduction to Object Orientation and CMIP services," on page 19
  - Chapter 2, "Sample CMIP application program," on page 19
  - Chapter 3, "Overview of CMIP services API functions," on page 41
  - Chapter 4, "CMIP services API function syntax and operands," on page 53
  - Chapter 5, "Read queue exit routine," on page 85
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  - Chapter 8, "Examples of standard CMIP strings," on page 121
  - Chapter 9, "Create and delete requests," on page 129
  - Chapter 10, "VTAM-specific requests and responses," on page 133
  - Chapter 11, "Application-program-to-application-program security," on page 145
- Part 2, "VTAM topology agent," on page 149 explains what VTAM topology agent sends across the CMIP interface. It contains the following chapters:
  - Chapter 12, "Introduction to VTAM topology agent," on page 151

- Chapter 13, “OSI object classes and VTAM resources,” on page 153
- Chapter 14, “OSI operations,” on page 163
- Chapter 15, “VTAM topology monitoring,” on page 175
- Chapter 16, “Requesting specific resource data,” on page 223
- The appendixes provide information that you might find helpful. This document contains the following appendixes:
  - Appendix A, “C language header file (ACYAPHDH),” on page 235
  - Appendix B, “ASN.1 specification of the basic CMIP strings,” on page 245
  - Appendix C, “Error codes sent by CMIP services,” on page 269
  - Appendix D, “VTAM CMIP services compliance with related standards and profiles,” on page 307
  - Appendix E, “VTAM topology agent object and attribute tables,” on page 309
  - Appendix F, “VTAM topology agent attributes definition,” on page 321
  - Appendix G, “VTAMTOPO filtering option reporting,” on page 359
  - Appendix H, “Related protocol specifications,” on page 363 lists the related protocol specifications for TCP/IP.
  - Appendix I, “Accessibility,” on page 387 describes accessibility features to help users with physical disabilities.
  - “Notices” on page 389 contains notices and trademarks used in this document.
  - “Bibliography” on page 399 contains descriptions of the documents in the z/OS<sup>®</sup> Communications Server library.

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## How to use this document

To use this document, you should be familiar with the basic concepts of telecommunications, SNA, and VTAM.

### Determining whether a publication is current

As needed, IBM<sup>®</sup> updates its publications with new and changed information. For a given publication, updates to the hardcopy and associated BookManager<sup>®</sup> softcopy are usually available at the same time. Sometimes, however, the updates to hardcopy and softcopy are available at different times. The following information describes how to determine if you are looking at the most current copy of a publication:

- At the end of a publication's order number there is a dash followed by two digits, often referred to as the dash level. A publication with a higher dash level is more current than one with a lower dash level. For example, in the publication order number GC28-1747-07, the dash level 07 means that the publication is more current than previous levels, such as 05 or 04.
- If a hardcopy publication and a softcopy publication have the same dash level, it is possible that the softcopy publication is more current than the hardcopy publication. Check the dates shown in the Summary of Changes. The softcopy publication might have a more recently dated Summary of Changes than the hardcopy publication.
- To compare softcopy publications, you can check the last 2 characters of the publication's file name (also called the book name). The higher the number, the



more recent the publication. Also, next to the publication titles in the CD-ROM booklet and the readme files, there is an asterisk (\*) that indicates whether a publication is new or changed.

## How to contact IBM service

For immediate assistance, visit this website: <http://www.software.ibm.com/network/commsserver/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 415.

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## Conventions and terminology that are used in this document

Commands in this book 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 document are *installation-wide exit routines*. The installation-wide exit routines also called installation-wide exits, exit routines, and exits throughout this document.

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 book 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 term RDMA network interface card (RNIC) that is used to refer to the IBM 10GbE RoCE Express feature.

For definitions of the terms and abbreviations that are used in this document, you can view the latest IBM terminology at the IBM Terminology website.

### Clarification of notes

Information traditionally qualified as Notes is further qualified as follows:

**Note** Supplemental detail

**Tip** Offers shortcuts or alternative ways of performing an action; a hint

**Guideline**

Customary way to perform a procedure

**Rule** Something you must do; limitations on your actions

**Restriction**

Indicates certain conditions are not supported; limitations on a product or facility

**Requirement**

Dependencies, prerequisites

**Result** Indicates the outcome

---

## 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 399, 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.

Titles	Order Number	Description
<i>IBM System z® Redbooks Collection</i>	SK3T-7876	The IBM Redbooks® publications selected for this CD series are taken from the IBM Redbooks inventory of over 800 books. All the Redbooks publications that are of interest to the zSeries® platform professional are identified by their authors and are included in this collection. The zSeries 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-03.ibm.com/systems/z/os/zos/zfavorites/">http://www-03.ibm.com/systems/z/os/zos/zfavorites/</a> .

### 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, including the z/OS Information Center, see [www.ibm.com/systems/z/os/zos/bkserv/](http://www.ibm.com/systems/z/os/zos/bkserv/).

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.

<b>Title</b>	<b>Number</b>
<i>DNS and BIND</i> , Fifth Edition, O'Reilly Media, 2006	ISBN 13: 978-0596100575
<i>Routing in the Internet</i> , Second Edition, Christian Huitema (Prentice Hall 1999)	ISBN 13: 978-0130226471
<i>sendmail</i> , Fourth Edition, Bryan Costales, Claus Assmann, George Jansen, and Gregory Shapiro, O'Reilly Media, 2007	ISBN 13: 978-0596510299
<i>SNA Formats</i>	GA27-3136
<i>TCP/IP Illustrated, Volume 1: The Protocols</i> , W. Richard Stevens, Addison-Wesley Professional, 1994	ISBN 13: 978-0201633467
<i>TCP/IP Illustrated, Volume 2: The Implementation</i> , Gary R. Wright and W. Richard Stevens, Addison-Wesley Professional, 1995	ISBN 13: 978-0201633542
<i>TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the UNIX Domain Protocols</i> , W. Richard Stevens, Addison-Wesley Professional, 1996	ISBN 13: 978-0201634952
<i>TCP/IP Tutorial and Technical Overview</i>	GG24-3376
<i>Understanding LDAP</i>	SG24-4986
z/OS Cryptographic Services System SSL Programming	SC24-5901
z/OS IBM Tivoli Directory Server Administration and Use for z/OS	SC23-6788
z/OS JES2 Initialization and Tuning Guide	SA32-0991
z/OS Problem Management	SC23-6844
z/OS MVS Diagnosis: Reference	GA32-0904
z/OS MVS Diagnosis: Tools and Service Aids	GA32-0905
z/OS MVS Using the Subsystem Interface	SA38-0679
z/OS Program Directory	GI11-9848
z/OS UNIX System Services Command Reference	SA23-2280
z/OS UNIX System Services Planning	GA32-0884
z/OS UNIX System Services Programming: Assembler Callable Services Reference	SA23-2281
z/OS UNIX System Services User's Guide	SA23-2279
z/OS XL C/C++ Runtime Library Reference	SC14-7314
zEnterprise 196, System z10, System z9 and eServer zSeries OSA-Express Customer's Guide and Reference	SA22-7935

## Redbooks publications

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

<b>Title</b>	<b>Number</b>
<i>IBM z/OS V1R13 Communications Server TCP/IP Implementation, Volume 1: Base Functions, Connectivity, and Routing</i>	SG24-7996
<i>IBM z/OS V1R13 Communications Server TCP/IP Implementation, Volume 2: Standard Applications</i>	SG24-7997

<b>Title</b>	<b>Number</b>
<i>IBM z/OS V1R13 Communications Server TCP/IP Implementation, Volume 3: High Availability, Scalability, and Performance</i>	SG24-7998
<i>IBM z/OS V1R13 Communications Server TCP/IP Implementation, Volume 4: Security and Policy-Based Networking</i>	SG24-7999
<i>IBM Communication Controller Migration Guide</i>	SG24-6298
<i>IP Network Design Guide</i>	SG24-2580
<i>Managing OS/390® TCP/IP with SNMP</i>	SG24-5866
<i>Migrating Subarea Networks to an IP Infrastructure Using Enterprise Extender</i>	SG24-5957
<i>SecureWay Communications Server for OS/390 V2R8 TCP/IP: Guide to Enhancements</i>	SG24-5631
<i>SNA and TCP/IP Integration</i>	SG24-5291
<i>TCP/IP in a Sysplex</i>	SG24-5235
<i>TCP/IP Tutorial and Technical Overview</i>	GG24-3376
<i>Threadsafe Considerations for CICS</i>	SG24-6351

## **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

[www.ibm.com/systems/z/os/zos/bkserv/](http://www.ibm.com/systems/z/os/zos/bkserv/)

### **IBM Communications Server product**

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

<http://www.software.ibm.com/network/commsserver/>

### **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/network/commsserver/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/atmastr.nsf>

## **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 III1334.

**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](mailto:bind-users-request@isc.org).
- Submit questions or answers to this forum by sending mail to [bind-users@isc.org](mailto:bind-users@isc.org).

#### **BIND 9 Users (This list might not be maintained indefinitely.)**

- Subscribe by sending mail to [bind9-users-request@isc.org](mailto:bind9-users-request@isc.org).
- Submit questions or answers to this forum by sending mail to [bind9-users@isc.org](mailto: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):  
<http://publib.boulder.ibm.com/infocenter/zos/basics/index.jsp>

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## Summary of changes

This section describes the release enhancements that were made.

### **New in z/OS Version 2 Release 1**

For specifics on the enhancements for z/OS Version 2, Release 1, see the following publications:

- z/OS Summary of Message and Interface Changes
- z/OS Introduction and Release Guide
- z/OS Planning for Installation
- z/OS Migration





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## **Part 1. VTAM CMIP services**



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## Chapter 1. Introduction to Object Orientation and CMIP services

VTAM Common Management Information Protocol (CMIP) services provides an open, standards-based access for network and systems management. Application programmers can use CMIP services to code manager and agent application programs to aid in systems management.

In pre-V4R3 releases of VTAM without CMIP, network application programs, such as the NetView<sup>®</sup> program, are frequently limited by two restrictions:

- They rely on the VTAMLST data set for information about the location of resources within the network.

The VTAMLST data set gives an incomplete picture of the network because VTAMLST includes only resources that are pre-defined. It does not include APPN or subarea resources that are dynamically defined.

- They must reside with VTAM on the host.

Because topology information cannot be gathered and sent to the NetView program at a remote location, the NetView program must reside with VTAM on the host.

With CMIP these two restrictions no longer apply for topology management. The VTAM topology agent is a part of VTAM that functions as a CMIP application program. Together with a manager application program, such as the NetView program, the topology agent provides data for the management of APPN and subarea topology. For a description of the VTAM topology agent, see Chapter 12, “Introduction to VTAM topology agent,” on page 151. A *manager* application program is any CMIP application program that sends requests to other objects. An *agent* application program is any CMIP application program that processes requests from other objects.

You can write your own manager or agent application program by using the CMIP services application program interface (API). These application programs are not restricted to system management, VTAM, or SNA resources. For example, you can write an agent application program for the MVS system.

---

### Object-Oriented view of resources

CMIP network management uses an object-oriented view of the resources in the network to simplify management.

This object-oriented system emphasizes the common properties of resources and reduces the requirement for a manager application program to understand all details of every type of resource in the network. Information about different network resources are represented by agent application programs in a common language, composed of CMIP strings. Manager application programs use this common language to communicate with agent application programs.

A user of a network management program issues commands to a manager application program, which sends CMIP requests to a network resource. Resources are represented by agent application programs, which accept the request and build

information about the network resource in the form of a CMIP response. The CMIP response is returned to the manager application program.

In VTAM CMIP services, managed network resources are called *objects*. An object is an *instance* of one or more *classes*. A CMIP class describes a type of resource in the network and specifies the properties that are common to instances of the class.

A CMIP class is described in GDMO templates. These templates are sets of declarations written in the GDMO language that describe one or more classes. The descriptions include properties of the objects in that class, such as:

- How the object is named
- What types of requests are valid for this object
- What attributes (characteristics) describe this object

*Inheritance* is the mechanism used in object-oriented systems to simplify interactions with objects by emphasizing common properties. A class can inherit characteristics or traits from one or more other classes. To inherit means to have all behaviors of another class. The class that inherits is a subclass of the class it inherits from. The class that is inherited from is the superclass of the class that inherits from it.

A subclass has all the behaviors of its superclass because it inherits from the superclass. In addition, a subclass has unique behaviors of its own.

---

## Relationship between CMIP services and local application programs

Local application programs are CMIP application programs that reside with CMIP services on the host.

Local agent and manager CMIP application programs use character strings to represent requests and responses that flow between manager application programs and agent application programs.

The formats of CMIP requests and responses are described by syntaxes that are written in the ASN.1 language. The ASN.1 language describes data formats.

All requests and responses sent between CMIP services and local application programs are EBCDIC strings formatted according to string syntaxes written in the ASN.1 language, as shown in this simple syntax example:

```
StringA ::= SEQUENCE
{
    level INTEGER,
    id CHARACTER
}
```

The syntax in the example is the rule for building a string of type StringA. Using that syntax and the ASN.1 standard, an application program can build a string of type StringA.

The following strings are examples of StringA strings:

```
(level 5, id 'A')
(level 1355, id 'Z')
(1244, M)
```

For more information on interpreting ASN.1 syntaxes, see Chapter 7, “Rules for constructing standard CMIP strings,” on page 93.

---

## Relationship between CMIP services and remote management systems

When CMIP requests and responses flow through the network, they are encoded in a hardware-independent format. CMIP services is available on machines with different word sizes (16-bit and 32-bit, for example) and different character string representations (ASCII and EBCDIC). This is hidden from application programs and from CMIP services because CMIP services encodes data from native format to a common format when it sends data across the network. It decodes data from the common format to native format when it receives data from the network.

Basic Encoding Rules (BER) is the common format that is used to encode CMIP information as it flows through the network. BER is not used between local agent application programs and manager application programs.

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## Overview of CMIP services

VTAM CMIP services is designed to provide information through VTAM to network and systems management application programs that conform to the OSI standards for systems management. CMIP services provides application writers a set of common functions that can be used to create CMIP agent and manager application programs more quickly than would otherwise be possible.

The relationship between CMIP agent and manager application programs is defined by the International Standards Organization (ISO) in terms of a managing system and a managed system. The managing system is the CMIP manager application program and the managed system is the CMIP agent application program.

With the functions provided by CMIP services, application programmers can write application programs that monitor resources in a network. Through CMIP services, a topology agent application program sends information about resources in the network to a topology manager application program that analyzes and displays the resources.

The VTAM topology agent, which resides on the VTAM host, is an agent application program that collects topology information to send to a manager application program through CMIP services. For information about the VTAM topology agent, see Chapter 12, “Introduction to VTAM topology agent,” on page 151. Communication between the manager and agent application programs that are on different systems is over APPC sessions using Open System Interconnection (OSI) Common Management Information Protocol (CMIP) and Systems Network Architecture (SNA). For more information on CMIP over SNA, see *IBM SystemView<sup>®</sup> Mapping of OSI Upper Layers to MDS for CMIP over SNA for APPN and SNA Subarea Management*.

CMIP services enables communication between application programs by performing several functions for the application programs. The following sections describe these CMIP services tasks:

- Locates objects
- Registers objects
- Coordinates traffic

- Replicates scoped requests
- Filters events and routes them to manager application programs
- Provides security
- Creates and ends associations
- Manages associations
- Manages protocol data units (PDUs)
- Supports CMIP verbs and parameters

## Locates objects

CMIP services allows your application program to target CMIP requests to local or remote objects without knowing where the objects reside, what their *application entity titles* are, or what their associations are. The directory resolves the object locations. Application programs can use the same code for local objects and for remote objects.

CMIP services maps an object instance, represented by its distinguished name, to the application entity title of the application entity that can be used to contact that object instance.

CMIP services performs the following tasks:

- Maps distinguished names to application entity titles by using a locally defined directory and either of the following methods:
  - Mappings (as defined by either the ACYDDF member of the SYS1.SISTCMIP data set or a CMIP algorithm) for distinguished names of specific formats to the application entity title that represents the distinguished name.
  - User-defined mappings for distinguished names of specific formats to the application entity title that represents the distinguished name and from application entity title to session address. See *z/OS Communications Server: SNA Network Implementation Guide* and *z/OS Communications Server: SNA Resource Definition Reference* for more information about user-defined mappings.
- Maps names to application entity titles by using a locally defined directory.

CMIP application programs can rely on CMIP services to provide this mapping. The application programs address the objects by their distinguished names only.

Only one mapping is allowed. You cannot define more than one application entity title for each distinguished name and cannot target more than one target system per application entity title.

## Registers objects

CMIP services supports both manager and agent application programs. Any application program can act as both manager and agent. Each application program must have at least one object that it registers with CMIP services.

VTAM implements an instance of a system object defined by ISO/IEC 10165-2. The system object can be used by an application program to register subordinate objects if the name binding defined for the subordinate objects allows this. CMIP services provides the distinguished name of the local system object on return from the MIBConnect function (the CMIP services connection function) so that application programs can register subordinate objects to this system.

This distinguished name is especially useful if you are registering objects that are in the managerApplication class. Any application program choosing not to register under this system object can either register its own root object or can register under any currently registered object. CMIP services does not accept registration under non-existent managed objects. Instances can be registered under directory objects, which are created dynamically, or they can be registered under the root object.

The local system object is created when VTAM CMIP services is initialized and is therefore registered so long as VTAM CMIP services is active. As a result, this object provides a predictable, reliable anchor for creating and registering objects. It is highly recommended that event filter discriminator (EFD) objects be created under this system object. EFD objects are described in more detail under “Filters and routes events” on page 8 and “Special considerations for topology manager application programs” on page 14.

CMIP services verifies proper names for object instances during object registration.

Because CMIP services is the only function that is aware of the tree structure for naming object instances, it processes scoped requests by replicating the incoming message for each object in the subtree specified by the scoping criteria. It does not filter messages.

When an object with multiple name bindings registers, CMIP services assigns it the first name binding it finds.

## Coordinates traffic

CMIP services coordinates CMIP traffic within a local system. It includes an application program interface (API) and a management information base (MIB).

The MIB includes objects. CMIP services allows the local MIB to be used by several application programs. Each application program can implement one or more objects that comprise the MIB. The complete MIB is made up of all of the objects registered by the application programs. The CMIP application programs that use the MIB are called the agents or managers for the system.

Manager application programs do not have to understand where objects are located because VTAM directs the requests to the objects. Responses are matched with the requests and returned to the originator.

## Replicates scoped requests

Requests that affect several application programs (or objects) within a particular scope are called **scoped requests**. Scoped requests are coordinated such that CMIP services provides the appropriate end responses when the affected objects have responded. CMIP services replicates scoped requests and directs them to the objects within each application program that fall within the scope of the request. Manager application programs on CMIP services can rely on CMIP services to find the base affected objects and deliver the request to the system containing that base object. At the receiving system, CMIP services delivers copies of the request to each affected object, coordinates the responses, and forwards the responses.

## Filters and routes events

CMIP services filters **events** to forward them to any manager application programs that have indicated they want to see these events. The event reports contain information sent by a managed object relating to an event that has occurred within the managed object, such as a threshold violation or a change in configuration status.

Notifications are the conceptual messages that are sent by object instances to CMIP services. They do not have a destination initially. Notifications are specified using the notification syntax contained in Appendix B, "ASN.1 specification of the basic CMIP strings," on page 245. These messages are processed by CMIP services and if there is an EFD object with a filter that matches that notification, they are converted into event reports that contain destinations.

In the case of inbound event reports destined for OSISMASE from CMIP services on products other than VTAM, CMIP services filters and routes event reports so that they can be forwarded to specific objects within the local system or to remote systems.

**OSISMASE** is the default application entity title for CMIP services. For information about OSISMASE, see *IBM SystemView Mapping of OSI Upper Layers to MDS for CMIP over SNA for APPN and SNA Subarea Management*. Inbound event reports targeted at application entities other than OSISMASE are routed directly to the object that registered the application entity.

VTAM CMIP services does not allow the creation of EFDs that reside in VTAM to specify OSISMASE as a destination. CMIP services on other products might allow OSISMASE as a destination.

Object instances do not have to be aware of destinations and filters for events because CMIP services does that.

CMIP services receives all notifications that are either sent by local object instances or received from other systems. CMIP services compares their attributes against matching criteria specified in each instance of the EFD managed object. For each EFD, if no match is found, the message is discarded. If a match is found, the destination specified in the event forwarding discriminator is attached to the message and it is processed further. The notification is converted to an unconfirmed event report. If eventTime was provided in the notification, it is copied to the event report, otherwise an eventTime is generated and included. The event report is sent to each destination in the destination list.

For a description of how a manager application program creates EFDs, see "Special considerations for topology manager application programs" on page 14.

CMIP services performs a set of functions common to all members of the EFD object class.

It also performs the functions defined in the IBM EFD subclass for allomorphic behavior of events. These functions are defined in *IBM SystemView Managed Resource Model Reference and Templates, Volume 1: Generic Definitions*. To support this additional behavior, each object instance that sends notifications must use the notification syntax to include with each notification the set of allomorphic superclasses that the object instance supports.



Confirmed event reports are not supported. When CMIP services receives a confirmed notification or a confirmed event report, CMIP services builds an ROER processing failure with no specific information.

EFD attributes that specify scheduling are ignored.

Objects can choose to register as individual application entities. If an application program registers as an application entity, then any event reports destined for that application entity are forwarded directly to that application program. Any event reports destined for the default application entity (OSISMASE) are routed to the local CMIP services. The creation of EFDs with a destination of OSISMASE is not valid and might be rejected by CMIP services.

To learn about registering application entity titles, see “Registering an application entity” on page 135.

## Provides security

CMIP services provides two kinds of security. One kind of security is between association partners. It verifies that association partners have proper authorization to be in communication with each other. This kind of security defines which manager and agent application programs can communicate with each other. The system administrator controls this access by defining either only those partners that are allowed to request management functions or those that are to be specifically excluded. Wildcards and defaults can be used.

See z/OS Communications Server: SNA Network Implementation Guide and z/OS Communications Server: SNA Resource Definition Reference for more information about this type of security.

The other kind of security is across the API. The API security restricts access to application program that are not authorized to act as manager application programs or agent application programs. This security is implemented by a password, similar to the passwords used by traditional VTAM application programs.

For information about where the password is passed to the MIBConnect function, see “MIBConnect—MIB connection function” on page 56.

## Creates and ends associations

An **association** is a logical connection between CMIP services on this host and CMIP services on another node or between CMIP services on this host and itself. An association between CMIP services on this host and itself is a local association. An association between CMIP services on this host and CMIP services on another node is a remote association.

### Creating associations

Associations can be created in two ways:

- CMIP services can establish the association when it recognizes the need for one.
- An application program can establish an association with the ACF.Associate request, which is described under “Starting associations” on page 137.

## Ending associations

An association can be ended by several methods:

- An application program can issue the ACF.Abort or ACF.Release request.
- CMIP services can end the association if it has been idle for 2 hours.
- The VTAM limited resources function (selective termination of idle LU 6.2 [APPC] sessions) sessions, can cause an association to be ended. For a description of the effect of selective termination on associations, see “Creating a dedicated association” on page 140.

## Manages associations

CMIP services chooses the association across which to carry a particular message unless the application program overrides the default association by specifying an association on the MIBSendRequest function or the MIBSendCmipRequest function.

CMIP services chooses the association based on the type of message, the application context tied to the association, and the destination of the message. CMIP services enforces the application context against inbound messages.

It controls the minute-by-minute operations of associations by:

- Determining the type of the message and routing it to the correct element of CMIP services
- Maintaining the capabilities of the associations that exist
- Negotiating the capabilities of the associations
- Determining the correct association for a message
- Initiating an association for messages that are directed to object instances located on systems with which there are no associations
- Establishing a default association for messages that are directed to object instances on the local system
- Allowing local objects or application programs to monitor the state of associations
- Routing incoming messages to the correct function within CMIP services

CMIP services establishes associations. When establishing associations, it negotiates the application context to be used for that association. It ensures that the parameters are correct.

To ensure secure associations, VTAM CMIP services checks the directory definition file to see whether data-encryption-standard (DES)-based security or application-program-to-application-program security is in effect.

For an overview of the security function in VTAM CMIP services, see Chapter 11, “Application-program-to-application-program security,” on page 145. See *z/OS Communications Server: SNA Network Implementation Guide* and *z/OS Communications Server: SNA Resource Definition Reference* for a description of the directory definition file.

## Manages PDUs

As a service to local application programs, CMIP services determines whether protocol data units (PDUs) are properly formed and exchanged in the proper order. This service frees application programs from having to verify the PDUs themselves.

A PDU can have several types of errors. These include:

- A value is out of the legal range for the data type. The message is rejected.
- A tag is unrecognized in a SET value or SEQUENCE value. The message is rejected.

If a PDU suffers from several of these errors at one time, the most severe errors are processed first. When the message fails to be decoded, CMIP services tries to decode the Remote Operations Service Element (ROSE) header for the message. If the header can be decoded, the message is rejected.

In some cases, if the header cannot be decoded, the association is ended. This should not happen unless the message is totally destroyed.

CMIP services understands the messages that are exchanged with object instances. It maintains the list of outstanding requests that require replies and enforces that the CMIP strings it receives are correct.

CMIP services does not always ensure that duplicate linked-replies are not received.

## Supports all CMIP verbs and most CMIP parameters

VTAM CMIP services supports the CMIP syntaxes as documented in Appendix B, "ASN.1 specification of the basic CMIP strings," on page 245 with certain exceptions. CMIP services supports all CMIP verbs:

- EVENT-REPORT
- GET
- SET
- ACTION
- CREATE
- DELETE
- CANCEL-GET

VTAM CMIP services does not support atomic synchronization. If atomic synchronization is specified, the CMIP request is responded to with a syncNotSupport error. VTAM CMIP services does not support the EFD scheduling attributes.

---

## Requirements for application programs

As described in previous sections, VTAM CMIP services provides many services that free application programs from having to code many of the common CMIP functions. The application program is therefore allowed to focus on functions specific to the object instances it represents. The application program implements the behavior of its objects. It must:

- Code an APPL definition statement to define the application program to VTAM. See *z/OS Communications Server: SNA Resource Definition Reference* for information about the APPL definition statement.

- Connect to VTAM CMIP services using the MIBConnect function. When using the MIBConnect function, the application program must provide the address of its read queue exit routine. The read queue exit routine is required for application programs to communicate with CMIP services.

It is highly recommended that you code a TPEND exit routine for VTAM to invoke when VTAM is terminating. If you code a TPEND exit routine, you must provide its address.

- Register at least one object instance using the MIBSendRegister function. An application program can register as many object instances as it represents. An object instance cannot be registered by more than one application program.
- Implement the behavior of the object instances it represents. CMIP services does not provide a repository for object attributes. Any CMIP operations targeting an object instance are delivered to the application program that registered that instance (or, in the case of a subtree manager, the application program that registered the subtree containing that instance).

For example, a CMIP GET request is forwarded to the application program representing the objects targeted in the request. Those application programs are responsible for collecting the requested attributes, building them into the proper response, and sending them using the MIBSendCmipResponse function.

For scoped requests that affect object instances across multiple application programs, no coordination is needed between the application programs. CMIP services coordinates the requests for the application program. Your application program simply indicates that it has finished its part of the response by setting the last-in-chain attribute when invoking the MIBSendCmipResponse function. For hints on coding subtree managers see “Subtree managers” on page 13. An application program can be both a manager and an agent, but it is helpful to separate them for the following discussion under “Types of application programs.”

- Issue the MIBDisconnect function to disconnect the application from CMIP services.

---

## Types of application programs

Different types of agent application programs have different rights and responsibilities. These types are defined by the capabilities that are requested when an object instance is registered. These types are:

- Basic application program, with no special capabilities
- Subtree manager application program
- Create handler application program

### Basic application programs

A basic application program is one that represents one or more object instances, all of which are registered to CMIP services. The registering allows CMIP services to provide the most service because it can scope requests to each affected instance. A basic application program does not receive CMIP create requests to have new instances generated, but it can create and register any number of object instances. The trigger for creating these instances is the responsibility of the application program and is often dictated by the resources the application program must represent.

## Subtree managers

A subtree manager is an application program that has assumed additional responsibilities. It supports any number of instances. It is not required to register any of them with CMIP services. It has requested and been granted ownership of a portion of the naming tree, which includes all instances contained within it.

All scoped indications that can include a member of the subtree owned by the subtree manager are passed to the subtree manager. It is responsible for managing scoping within its subtree and for creating all of the responses from its instances.

The subtree manager indicates to CMIP services that it has completed the responses from its supported instances. It cannot use the MIB variables &DN or &OC for any of its instances that are not registered. For information about MIB variables, see "MIB variable format" on page 96.

Once a subtree manager has registered itself, it establishes ownership of a subtree. At that point, no other application program can register objects within that subtree. Only the subtree manager can register additional objects within the subtree. For each leaf of the subtree that the subtree manager registers, it must first register all instances in that branch of the tree. An object cannot be registered unless its parent has been registered. Messages to an object within the subtree are assigned the local identifier of the subtree manager object. This is the local identifier that was explicitly requested.

A process that registers as a subtree manager can assume responsibility for one or more subtrees of the naming hierarchy. This capability allows the process to register only a small number of instances. A minimum of one instance is required. For each instance that it chooses not to register, the subtree manager must do the global-to-local name mapping and scoping functions that are provided by CMIP services for registered instances.

If many of the instances an application program represents are dynamic and changing frequently, it might be preferable for the application program to act as a subtree manager, instead of registering all of its instances. In that case, the overhead of registering the instances makes management too expensive to be practical.

Another example is when the application program chooses to control scoping itself. For example, if an agent application program is to receive scoped requests for a large number of objects, it might be better to receive a single scoped request. (A single scoped request is one that is not replicated by CMIP services.) A single scoped request might allow the request to be processed more efficiently internally.

Here we list one advantage and one disadvantage to registering as a subtree manager. The advantage is that a subtree manager can avoid registering some or all of its object instances and can control scoped operations. The disadvantage is that a subtree manager is required to assign names within the name space it owns. It must also ensure that the names are unique. It must perform all of the scoping function within its name space, a requirement that makes coding the application program more complicated.

When designing an application program, you must decide between writing additional code to provide these functions or registering all instances.

## Create handlers

A create handler is an application program that assumes additional responsibilities. It registers to receive create messages for instances of a specific class. Registering allows create messages to be sent to a process that is capable of handling them. For information about the API function that registers a create handler, see “MIBSendRegister—MIB asynchronous registration function” on page 76.

Only one create handler can be registered per object class.

## Special considerations for manager application programs

Manager application programs can have somewhat different requirements from agent application programs. A manager application program generally has no need to register any objects unless it needs to be the target of CMIP requests from other manager application programs. VTAM CMIP services requires that at least one object be registered. CMIP services does not require the object to be of a particular object class. The managerApplication object class has been defined for manager application programs that do not have a need for any specific class.

Manager application programs can base their management on the creation of EFDs so that they can receive CMIP event reports from managed systems. For a description of how to create the EFDs, see “Filters and routes events” on page 8. Such manager application programs must register to CMIP services as an application entity. The application entity title used must match the one specified in the destination list within the EFDs it creates on the managed systems. For information about how an application can register as an application entity to CMIP services, see “Registering an application entity” on page 135.

Manager application programs that rely on CMIP event reports for monitoring objects at remote systems might need a mechanism to help them determine when the connection to the managed system is down. CMIP services gives application programs the ability to subscribe to associations. For example, a manager might want to subscribe to each association that was used for creating an EFD. The handle for each such association is returned in the response to the create request for the EFDs. For information on how an application program can subscribe to an association, see “Subscribing to association information” on page 133.

## Special considerations for topology manager application programs

Usually, topology manager application programs need to know about specific resources or sets of resources, but do not want to receive event reports about all resources in a network. For CMIP services to know which resources the manager application program is interested in, the manager application program creates an EFD object and specifies a filter attribute for it to indicate which event reports are to be forwarded to the manager application program.

Therefore, to allow the VTAM topology agent to send only those notifications for resources that a topology manager application program is interested in, the following conditions must be met:

- VTAM must be started with the OSIEVENT=PATTERNS start option. See z/OS Communications Server: SNA Resource Definition Reference for a description of this start option.

- The manager application program must create EFD objects with filter attributes that follow the patterns that CMIP services recognizes. For a description of these patterns, see “Patterns of EFDs that CMIP services recognizes.”

If the OSIEVENT=ALL start option is specified, the VTAM topology agent generates all possible notifications, as long as at least one EFD has been created. If no EFDs have been created, no notifications are generated.

If the OSIEVENT=NONE start option is specified, the VTAM topology agent generates no notifications.

## Patterns of EFDs that CMIP services recognizes

If the filter attribute is specified according to the patterns described here and the OSIEVENT=PATTERNS start option is specified, CMIP services recognizes that the manager application program is interested in a particular resource or set of resources. CMIP services recognizes the following patterns:

- A filter specifies a certain object class but not a specific resource and the OSIEVENT=PATTERNS start option is specified.  
If the object class relates to VTAM topology, the VTAM topology agent forwards to CMIP services all notifications for all instances of that class. CMIP services then creates an event report and sends it to the manager application program if all criteria in the filter were met.
- A filter specifies a certain resource, with or without object class specified and the OSIEVENT=PATTERNS start option is specified.  
If the object class relates to VTAM topology, the VTAM topology agent forwards notifications for that instance to CMIP services. CMIP services then creates an event report and sends it to the manager application program if all criteria in the filter were met.
- A filter is created locally by some manager application program to collect remote notifications using a filter similar to the one shown:  

```
(item (equality (attributeId 1.3.18.0.0.1746, attributeValue
(mgr (distinguishedName '1.3.18.0.2.4.6=netid;2.9.3.2.7.4=(name
"cpname");1.3.18.0.0.2175=objectname')))))
```

 CMIP services assumes that such filters are not meant to collect topology information, so the presence of this EFD does not cause the topology agent to start generating notifications.

## Specific object classes that CMIP services recognizes

Here are the object identifiers for the recognized classes:

- 1.3.18.0.0.1829**  
logicalUnit
- 1.3.18.0.0.2281**  
crossDomainResource
- 1.3.18.0.0.1803**  
luGroup
- 1.3.18.0.0.2267**  
definitionGroup
- 1.3.18.0.0.2085**  
logicalLink

1.3.18.0.0.2089

port

1.3.18.0.0.1844

t4Node

---

## CMIP error handling

This section discusses the general VTAM CMIP error-handling scheme. It covers what types of errors can be detected and returned to invoking application programs and what types of general handling must occur when error conditions are returned.

The error handling scheme for the most part can be described in generic terms. Error handling specific to a given CMIP operation is described in the section that covers that operation.

### General error handling

This section discusses how the Systems Management Application Entity (SMAE) portion of CMIP services handles remote operations CMIP (RO/CMIP) errors. In general, the error reporting mechanism is dictated by the area of CMIP services that detects the error.

#### Errors found during outbound CMIP processing

An outbound CMIP string is a CMIP string that is being sent from an application program to some destination.

In general, any error found in a request (confirmed and unconfirmed) or response in the originating SMAE is reported to the invoking application program by an asynchronous CMIP services API error code as a service error.

In the case where the destination of the CMIP string is on the same system as the origin of the CMIP string, some differences apply. If the CMIP string arrives at the presentation layer of CMIP services before an error is detected, the CMIP error is not reported as an API error code. In this case, once the CMIP string has passed the presentation layer and is back in the SMAE, the SMAE does not distinguish between same-system errors and different-system errors. The error in this case is handled as specified in the following list for inbound CMIP strings received from other systems. Refer to Chapter 3, "Overview of CMIP services API functions," on page 41 for a list of these API error codes.

The system that originated the outbound request can also receive errors detected on the destination system in the form of RO-REJECT(U), RO-REJECT(P), and RO-ERROR. These error types are passed to the application program if enough information is available for routing.

#### Errors found during inbound CMIP processing

An inbound CMIP string is a CMIP string (either request or response) that is being received from some CMIP sender. The sender can be on a different system or on the same system.

When the SMAE portion of CMIP services is the destination system of the CMIP request or response, error handling is handled as follows:



- If the error is found in ROSE, an RO-REJECT(P) is sent to the originating system.  
This is true for responses and requests (both confirmed and unconfirmed).
- If the error is found in CMISE, an RO-REJECT(U) is sent to the originating system.  
This is true for responses and requests (both confirmed and unconfirmed).
- For errors found in requests above CMISE in CMIP services, an RO-ERROR is returned if the request is confirmed.  
If the request is not confirmed, the request is discarded.
- For responses, the code above CMISE in CMIP services does not have any known error checking.  
If an error is found at this level, CMIP services attempts to pass the response to the appropriate object or discard the message if the message cannot be routed.
- If an application program detects an error during CMIP request processing, an RO-ERROR is returned if the request is confirmed.  
If the request is not confirmed, the request is discarded.  
For confirmed requests, the actual errors returned are to be defined by the application program, such as the VTAM topology agent. Refer to “Responding to CMIP requests” on page 165 for more information on how the VTAM topology agent handles such errors.
- If an application program detects an error during CMIP response processing, the error handling processing is defined by the application program. Refer to “Responding to CMIP requests” on page 165 for more information on how the VTAM topology agent handles such errors.

---

## CMIP sequencing for separate CMIP operations

CMIP flows that relate to separate CMIP operations could flow between the agent application program and the manager application program in any order. The VTAM topology agent and CMIP services do not attempt to ensure that such CMIP strings, generated as the result of separate operations, are sequenced and delivered based on order of events or processing. For example, a notification that is generated by VTAM after a GET response is built could actually be received by the manager application program before the GET response.

Therefore, the manager application program should not rely on order of receipt as an indication of order of processing at the agent application program. There is no correlation between order of processing by the agent application program and time of receipt by the manager application program.



---

## Chapter 2. Sample CMIP application program

Many of the aspects of writing a CMIP application program can be explained using a sample application program. This chapter presents a CMIP application program that sends a simple CMIP request to another application program on any host.

The purpose of this application program is to determine whether or not CMIP services is active on a specific host in the network. In other words, this is a ping application program for CMIP over SNA much as APING is a ping application program for APPC. The sample program implements this by sending a CMIP GET request to the system object on that host. The system object should always exist, either as part of CMIP services or as part of a CMIP application program. If an error occurs bringing up an association to the remote CMIP services, then either the specified host is unreachable or CMIP services is not active on that host. Otherwise, the specified host is reachable and CMIP services is active. Errors returned by the remote system object itself are unimportant.

**Note:** The system object is implemented by VTAM as part of CMIP services, so it is always present if VTAM CMIP services is active.

The sample application program is comprised of the following source files:

### ACYCMS1C

This C language module is the main logic of the application program. It calls several different API functions to communicate with CMIP services.

### ACYCMS2A

This assembler language module is the read queue exit routine for the application program.

### ACYCMS3A

This assembler language module is used to obtain the address of an API function in LPALIB.

### ACYCMS4A

This assembler language module is used to switch the application program task into supervisor state.

### ACYCMS5A

This assembler language module is used to wait on an ECB.

### ACYCMS6A

This assembler language module is the TPEND exit routine for the CMIPPING application program.

### ACYCMS7A

This assembler language module is used to switch the application program task into problem state.

“ACYCMS1C source file” on page 22 is the main logic for the CMIPPING application program.

**Note:** To facilitate reading on any host terminal and printing on any host printer, trigraph sequences have been used for square brackets. These sequences are ??( for left square bracket and ??) for right square bracket.

An outline of processing in function main is listed here:

1. Make sure that the user has provided the required parameters to the program.
  - a. TargetNetid is the SNA netID of the host that will be pinged.
  - b. TargetNauname is the SNA NAU name (in this case, a CP name or SSCP name) of the host that will be pinged.
  - c. ApplName is the ACB name used by CMIPPING when issuing MIBConnect.
  - d. Password, if provided, is the ACB password as specified on the APPL statement.
2. Load the addresses of the API functions which are used.  
This program uses MIBConnect, MIBDisconnect, MIBSendCmipRequest, and MIBSendRegister. ACYCMS3A is used to find the addresses of all of the API functions.
3. Switch to supervisor state.  
The caller of API routines must be in supervisor state. ACYCMS4A is responsible for issuing the MODESET system macro to switch the task to supervisor state.
4. Connect to CMIP services.  
A CMIP Application must issue MIBConnect before calling any other MIB API functions. MIBConnect opens an ACB on behalf of the calling application program, initializes the connection with CMIP services, and returns various information to the caller.
5. Register a managerApplication object.  
Even though CMIPPING does not need to represent the behavior of any objects for the purposes of the application program, it must register an object nonetheless because CMIP services requires that requests be issued by an object that it knows about. The managerApplication object class was defined for manager application programs that use the registered object only as the source of requests.  
  
Before calling the MIBSendRegister function, it first builds the name of the managerApplication object. The name of the system object on this system, returned by MIBConnect, is used to build the name of this object.
6. Wait for the registration message from CMIP services.  
ACYCMS6A is called to wait on an ECB. This ECB will be posted by the read queue exit routine (ACYCMS2A) when it is called by CMIP services. The next message to arrive should be the registration response.
7. Parse the registration response message from CMIP services.  
If the msg\_type field in the APIhdr is API\_REG\_ACCEPT and the invokeId field in the APIhdr is the one returned by MIBSendRegister, then the registration succeeded.
8. Send a GET request to the system object on the target host.  
This first builds the name of the remote system object to which a GET request will be sent. It then builds the entire CMIP string representing the GET argument.  
  
The CMIP string is passed to MIBSendCmipRequest, which will send the GET request to CMIP services for processing.
9. Wait for the GET response message from CMIP services.  
ACYCMS6A is called again to wait until the read queue exit routine posts an ECB to wake up the main task. The next message should be the GET response.

10. Parse the GET response to determine whether or not CMIP services is active on the target host.  
If the `invokeId` field in the `APIHdr` is the one returned by `MIBSendCmipRequest` and the `msg_type` field in the `APIHdr` is `API_MSG`, then the request was received by a remote CMIP services. Determining whether or not the system object was available on the remote system and was able to processing the request would require parsing the string portion of the response. That is beyond the scope of this application program.
11. Disconnect from CMIP services. If `MIBConnect` succeeded, `MIBDisconnect` should be called — even if some other error happened in between.
12. Exit the application program.

“ACYCMS2A source file” on page 29 is the read queue exit routine for the CMIPPING application program. An outline of processing in the exit follows:

1. The VTAM reason code is always stored in the user data control block so that the main task of CMIPPING (`ACYCMS1C`) can find out why the read queue exit routine was driven.
2. If the reason code is zero, meaning that VTAM passed data to the read queue exit routine, that data will be copied to the buffer in the user data control block.
3. If the reason code is something other than zero, a message will be generated. The likely scenario is that CMIP services is terminating.
4. The read queue exit routine posts an ECB which is being waited on by the main task of CMIPPING in order to wake it up.
5. The read queue exit routine returns zero to VTAM, telling VTAM that it was able to successfully process the message.

**Note:** In a real CMIP application program read queue exit routine, you probably need additional buffer space to pass messages to the main task. Some CMIP requests can result in many messages being returned by CMIP services, one after another. It is unlikely that an application program designed like CMIPPING would see all of the messages, because they would arrive more quickly than the main task could be dispatched and process each one.

“ACYCMS3A source file” on page 31 is a utility module to load the addresses of the API functions on behalf of the CMIPPING application program. The only processing to perform is to load the address of each routine into a control block passed by the caller (`ACYCMS1C`).

**Note:** This module does not check return codes from the `LOAD` macro and always returns zero. This is not appropriate for a real application program, because those modules may not be installed in `LPALIB`.

“ACYCMS4A source file” on page 34 is a utility module to switch into supervisor state. The only processing to perform is to invoke the `MODESET` assembler macroinstruction.

**Note:** CMIPPING must be authorized for the `MODESET` to work.

“ACYCMS5A source file” on page 35 is a utility module to wait on a specified ECB. The only processing to perform is to invoke the `WAIT` assembler macroinstruction.

“ACYCMS6A source file” on page 36 is the TPEND exit routine for the CMIPPING application program. All it does is display the reason code passed by VTAM.

“ACYCMS7A source file” on page 38 is a utility module to switch into problem state. The only processing to perform is to invoke the MODESET assembler macroinstruction.

---

## ACYCMS1C source file

```

/*****/
/*                                     */
/* MEMBER NAME: ACYCMS1C               */
/*                                     */
/* DESCRIPTIVE NAME: Sample CMIP Application */
/*                                     */
/*                                     */
/*                                     */
/* COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM */
/*                                     */
/*          "RESTRICTED MATERIALS OF IBM" */
/*                                     */
/*          5695-117 (C) COPYRIGHT IBM CORP. 1994 */
/*                                     */
/* MEMBER CATEGORY: Sample CMIP application */
/*                                     */
/*                                     */
/*****/

/*
 * CMIPPING - Sample C language CMIP application
 *
 * This sample application can be used to determine if CMIP Services
 * is active on a specified host in the network.
 *
 * It illustrates some of the concepts involved in writing a CMIP
 * application for use with VTAM.
 *
 * Notes: To facilitate reading on any host terminal and printing on
 * any host printer, trigraph sequences have been used for
 * square brackets. These sequences are "??" for left square
 * bracket and "??" for right square bracket.
 */

#pragma csect(code, "ACYCMS1C")
#pragma csect(static, "SCYCMS1C")

/*****/
/* C Standard Library include files */
/*****/

#include #include #include
/*****/
/* VTAM include files */
/*****/

#include "acyaphdh.h" /* VTAM MIB API interface */

/*****/
/* type declarations */
/*****/

/*****/
/* An instance of MIBAddresses_t is passed to ACYCMS3A, which fills */
/* it in with actual addresses of the MIB API functions, which are */
/* loaded from LPALIB. */
/*****/

```

```

typedef struct MIBAddresses_tag
{
    MIBConnect_t          *MIBConnect;
    MIBDisconnect_t      *MIBDisconnect;
    MIBSendRegister_t     *MIBSendRegister;
    MIBSendDeleteRegistration_t *MIBSendDeleteRegistration;
    MIBSendRequest_t      *MIBSendRequest;
    MIBSendResponse_t     *MIBSendResponse;
    MIBSendCmipRequest_t  *MIBSendCmipRequest;
    MIBSendCmipResponse_t *MIBSendCmipResponse;
} MIBAddresses_t;

/*****
/* The address of an instance of ReadQueueExitData_t is passed to
/* MIBConnect. CMIP Services then passes that same address to the
/* Read Queue Exit each time it is called. That allows sharing of
/* data between the Read Queue Exit and this main task.
*****/

typedef struct ReadQueueExitData_tag
{
    int ECB;
    int ReasonCode;
    char Buffer ??(16384??);
} ReadQueueExitData_t;

/*****
/* external functions
*****/

/*****
/* ACYCMS2A is the Read Queue Exit for this sample CMIP application.
/* Only the address of this routine is needed in C.
*****/

extern void ACYCMS2A(void);

/*****
/* ACYCMS3A finds the addresses of routines in LPALIB via the LOAD
/* assembler macroinstruction.
*****/

extern int ACYCMS3A(MIBAddresses_t *);

/*****
/* ACYCMS4A switches to supervisor state via the MODESET assembler
/* macroinstruction.
*****/

extern void ACYCMS4A(void);

/*****
/* ACYCMS5A waits on an ECB via the WAIT assembler macroinstruction.
/* It will be passed the address of the same ECB which the Read
/* Queue Exit will post so that the Read Queue Exit can "wake up"
/* this task when data is available.
*****/

extern void ACYCMS5A(int *ECB);

/*****
/* ACYCMS6A is the TPEND exit for this application.
*****/

extern void ACYCMS6A(void);

```

```

/*****/
/* ACYCMS7A switches to problem state via the MODESET assembler */
/* macroinstruction. */
/*****/

extern void ACYCMS7A(void);

/*****/
/* constants */
/*****/

#define APPL_NAME "CMIPPING" /* name of this application as
                             used in messages */

/*****/
/* data types */
/*****/

typedef void *LocalId_t; /* Local identifiers, associated
                          with registered objects, must
                          have a size between 1 and 8
                          bytes. CMIPPING uses four-
                          byte local identifiers of type
                          void *. */

/*****/
/* Input parameters: */
/* (1) Netid of target CMIP Services */
/* (2) Nauname of target CMIP Services */
/* (3) Application name to use (valid ACB name) */
/* (4) Optional password */
/*****/

int main(int argc,const char **argv)
{
    APIhdr *APIhdr_ptr;
    char CMIP_StringArgument ??(512??);
    char MyObjectName ??(120??);
    char RemoteSystemObject ??(120??);
    char SMAE ??(100??);
    char SystemObject ??(100??);
    const char *AppName;
    const char *Password;
    const char *TargetNauname;
    const char *TargetNetid;
    char *VTAM_Release;
    int Connected, rc;
    int LinkId;
    MIBAddresses_t APIs;
    unsigned int InvokeId;
    ReadQueueExitData_t ReadQueueExitData;
    size_t SMAE_Size, SystemObjectSize;
    unsigned int ACB_Info;
    LocalId_t *MyObjectId;

    rc = 0;

    memset(&ReadQueueExitData,0,sizeof(ReadQueueExitData));

    if (argc != 4 && argc != 5)
    {
        fprintf(stderr,
            "Usage: " APPL_NAME " Netid Nauname Applname \n"
            "\n"
            " " APPL_NAME " is used to determine whether or not\n"
            " there is an active CMIP Services on a SNA host\n"
            " specified by Netid and Nauname.\n");
    }
}

```



```

        "\n"
        "        Applname is the ACB name used by this program.\n"
        "        Netid and Nauname specify the target SNA host.\n"
        "        Password (optional) is the ACB password.\n"
        "\n"
        "        " APPL_NAME " cannot continue.\n");
    rc = 1;
}

if (rc == 0)                /* If no errors so far... */
{
    TargetNetid = argv ??(1??); /* first parm passed to program */
    TargetNauname = argv ??(2??); /* second parm */
    ApplName = argv ??(3??); /* third parm */

    if (argc == 5)          /* If a password was provided... */
        Password = argv ??(4??); /* fourth parm */
    else
        Password = NULL;

    ACYCMS4A();             /* You must be in supervisor
                           state to call VTAM MIB API
                           routines. */

    SMAE_Size = sizeof(SMAE);
    SystemObjectSize = sizeof(SystemObject);
    MyObjectId = (void *)"Anything you want"; /* The local identifier
                                               for the object registered by
                                               this application is the
                                               address of this string. */
}

/*****
/* Obtain addresses of API routines used by this program.
*****/

if (rc == 0)                /* If no errors so far... */
{
    rc = ACYCMS3A(&APIs);

    if (rc != 0)
    {
        fprintf(stderr,
            "The address of an API routine could not be loaded\n"
            "from LPALIB.\n"
            "\n"
            "APPL_NAME " cannot continue.\n");
    }
}

if (rc == 0)                /* If no errors so far... */
{
    rc = APIs.MIBConnect(0, /* always zero for this release */
        &LinkId, /* MIBConnect will fill in LinkId
                  with a handle to the
                  connection. */
        65536, /* maximum number of outstanding
                requests */
        ApplName, /* ACB name */
        (void *)ACYCMS6A, /* TPEND exit */
        (void *)ACYCMS2A, /* address of the Read
                            Queue Exit */
        &SMAE_Size, /* On input, this is the size of
                     the SMAE buffer. On output,
                     this is the length of the SMAE
                     name. */
        SMAE, /* This is where MIBConnect will

```

```

        store the SMAE name (if there
        is enough room). */
    &SystemObjectSize, /* On input, this is the
        size of the System Object name
        buffer. On output, this is the
        length of the System Object
        name. */
    SystemObject, /* This is where MIBConnect will
        store the System Object name
        (if there is enough room). */
    (int)&ReadQueueExitData, /* This will be
        provided to this appl's Read
        Queue Exit by CMIP Services. */
    &ACB_Info, /* If an error occurs opening the
        ACB, this will contain the
        OPEN ACB error code. */
    &VTAM_Release, /* MIBConnect will store the
        address of the VTAM release
        level here. */
    Password, /* ACB password */
    0, /* dataspace not used */
    NULL, /* dataspace not used */
    sizeof(LocalId_t), /* size of local ids
        for all objects registered by
        this application */
    0); /* no special options specified */

Connected = rc == 0; /* Remember whether or not
    MIBConnect was successful. */

if (rc != 0)
{
    fprintf(stderr,
        "MIBConnect returned %d.\n"
        "\n"
        "APPL_NAME " cannot continue.\n",
        rc);
}

if (rc == 0) /* If no errors so far... */
{
    /******
    /* Build the distinguished name of the object that will be
    /* registered. It is named directly "under" the System Object,
    /* so its name is the system object name concatenated with one
    /* more RelativeDistinguishedName.
    /*
    /*
    /* A short form distinguished name (DN) will be built. Note
    /* that CMIP Services can handle distinguished names from
    /* applications in either short or long form. Applications can
    /* elect to receive distinguished names from CMIP Services in
    /* short form by specifying SHORT_NAMES as the last parameter to
    /* MIBConnect. By default, applications receive distinguished
    /* names in long form.
    /******

    strcpy(MyObjectName, SystemObject);
    strcat(MyObjectName, "1.3.18.0.0.2175=");
    strcat(MyObjectName, ApplName);

    puts("Here is the object being registered:");
    puts(MyObjectName);

    rc = APIs.MIBSendRegister(LinkId, /* This is the handle returned by
        MIBConnect. */
        &InvokeId, /* MIBSendRegister will store

```

```

        an invoke id, or correlator, for
        the registration request here.*/
    &MyObjectId, /* This is the address of
        the local id to be associated
        with this object. */
    "1.3.18.0.0.2155", /* This is the object
        class of this object. */
    DN_OF_INSTANCE, /* This parameter must
        have this value. */
    MyObjectName, /* This is the dist.
        name of this object. */
    NULL, /* Use default name binding. */
    0, /* no special capabilities */
    0, /* no allomorphs */
    NULL, /* no allomorphs */
    0, /* not a create handler for any
        class */
    NULL); /* not a create handler */

if (rc != 0)
{
    fprintf(stderr,
        "MIBSendRegister returned %d.\n"
        "\n"
        APPL_NAME " cannot continue.\n",
        rc);
}

if (rc == 0) /* If o.k. so far... */
{
    ReadQueueExitData.ECB = 0;
    ACYCMS5A(&ReadQueueExitData.ECB);
    if (ReadQueueExitData.ReasonCode == 0) /* If data was received...*/
        APIHdr_ptr = (APIHdr *)ReadQueueExitData.Buffer;
    else
        rc = ReadQueueExitData.ReasonCode;
}

/*****
/* Parse the response from registration to see if it was o.k. */
*****/

if (rc == 0) /* If o.k. so far... */
{
    if ((APIHdr_ptr->msg_type != API_REG_ACCEPT) ||
        (APIHdr_ptr->invokeId != InvokeId)) /* If an error
        occurred... */
    {
        rc = 1;
        fprintf(stderr,
            "An unexpected response was received from object\n"
            "registration.\n"
            "\n"
            APPL_NAME " cannot continue.\n");
    }
}

if (rc == 0) /* If o.k. so far... */
{
    /*****
    /* Build CMIP GET request string here using the netid and
    /* nauname of the target host.
    *****/

    strcpy(RemoteSystemObject, "1.3.18.0.2.4.6=");
    strcat(RemoteSystemObject, TargetNetid);
    strcat(RemoteSystemObject, ";2.9.3.2.7.4=(name ");

```

```

strcat(RemoteSystemObject,TargetNauname);
strcat(RemoteSystemObject,"");

strcpy(CMIP_StringArgument,
      "("
      "baseManagedObjectClass 2.9.3.2.3.13, "
      "baseManagedObjectInstance "
      "(distinguishedName '");
strcat(CMIP_StringArgument,RemoteSystemObject);
strcat(CMIP_StringArgument,')',"
      "attributeIdList "
      "(2.9.3.2.7.35,2.9.3.2.7.5)"
      ")");

rc = APIs.MIBSendCmipRequest(LinkId, /* handle returned by
                                MIBConnect
                                3, /* operation value is GET
                                CMIP_StringArgument,
                                &MyObjectId,
                                NULL,
                                DS_NOT_PROVIDED,
                                NULL,
                                &InvokeId);

if (rc != 0)
{
    fprintf(stderr,
            "MIBSendCmipRequest returned %d.\n"
            "\n"
            "APPL_NAME " cannot continue.\n",
            rc);
}
}

if (rc == 0) /* If o.k. so far...
{
    ReadQueueExitData.ECB = 0;
    ACYCMS5A(&ReadQueueExitData.ECB);
    if (ReadQueueExitData.ReasonCode == 0) /* If data was received...*/
        APIHdr_ptr = (APIHdr *)ReadQueueExitData.Buffer;
    else
        rc = ReadQueueExitData.ReasonCode;
}

if (rc == 0)
{
    /******
    /* Display whether or not the GET was successful.
    /******

    if ((APIHdr_ptr->msg_type == API_MSG) &&
        (APIHdr_ptr->invokeId == InvokeId))
    {
        /******
        /* Technically, the message can be a CMIP error message which
        /* could state that the system object doesn't exist or that
        /* the system object can't handle the request. Since this
        /* program only checks to see if the specified CMIP Services
        /* can be contacted, a CMIP error message will not be
        /* considered a problem.
        /******

        puts("The remote CMIP Services was contacted successfully.");
    }
    else
    {
        fprintf(stderr,
                "The remote CMIP Services could not be contacted.\n");
    }
}

```

```

        rc = 1;
    }
}

if (Connected)
{
    rc = APIs.MIBDisconnect(LinkId, /* This is the handle returned by
                                   MIBDisconnect. */
                           &ACB_Info); /* If an error occurs closing the
                                           ACB, MIBDisconnect will store
                                           the CLOSE ACB error code here.*/

    if (rc != 0)
    {
        fprintf(stderr,
                "MIBDisconnect returned %d.\n",
                rc);
    }
}

ACYCMS7A(); /* You must be in problem
            state to exit cleanly. */

fprintf(stderr,
        APPL_NAME " is exiting with return code %d.\n",
        rc);

return rc;
}

```

---

## ACYCMS2A source file

```

/******
**/
**/ MEMBER NAME: ACYCMS2A **/
**/ **/
**/ DESCRIPTIVE NAME: Read Queue Exit for sample CMIP **/
**/ application **/
**/ **/
**/ **/
**/ COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM **/
**/ **/
**/ "RESTRICTED MATERIALS OF IBM" **/
**/ **/
**/ 5695-117 (C) COPYRIGHT IBM CORP. 1994 **/
**/ **/
**/ MEMBER CATEGORY: Sample CMIP application **/
**/ **/
**/*****
      TITLE ' /*****00001000
          *****' 00002000
ACYCMS2A CSECT , 0001 00003000
ACYCMS2A AMODE 24 0001 00004000
ACYCMS2A RMODE 24 0001 00005000
@MAINENT DS 0H 0001 00006000
        USING *,@15 0001 00007000
        B @PROLOG 0001 00008000
        DC AL1(16) 0001 00009000
        DC C'ACYCMS2A 95.125' 0001 00010000
        DROP @15 0001 00011000
@PROLOG STM @14,@12,12(@13) 0001 00012000
        LR @12,@15 0001 00013000
@PSTART EQU ACYCMS2A 0001 00014000
        USING @PSTART,@12 0001 00015000
        ST @13,@SA00001+4 0001 00016000
        LA @14,@SA00001 0001 00017000
        ST @14,8(,@13) 0001 00018000
        LR @13,@14 0001 00019000

```

```

*                                                                 0014 00020000
*/******/ 00021000
*/*                MAINLINE */ 00022000
*/******/ 00023000
*                                                                 0014 00024000
*R10 = R1; /* Saves Pointer to Parameters */ 00025000
*                                                                 0014 00026000
*           LR R10,R1 0014 00027000
*GLB_DATA.GLB_ReasonCode = VTAM_REASON; /* Tell the main task why the 00028000
*                                           Read Queue Exit was driven. */ 00029000
*                                                                 0015 00030000
*           L @04,VTAM_REASON(,R10) 0015 00031000
*           ST @04,GLB_REASONCODE(,R06_USER_DATA) 0015 00032000
*IF (VTAM_REASON = 0) THEN /* If data is available to be 0016 00033000
*                           copied... */ 00034000
*           LTR @04,@04 0016 00035000
*           BNZ @RF00016 0016 00036000
* DO; 0017 00037000
*   R11 = VTAM_LENGTH; 0018 00038000
*   L @05,VTAM_LENGTH(,R10) 0018 00039000
*   LR R11,@05 0018 00040000
*   R3 = VTAM_LENGTH; 0019 00041000
*   LR R3,@05 0019 00042000
*   R2 = ADDR(GLB_Buffer); 0020 00043000
*   LA R2,GLB_BUFFER(,R06_USER_DATA) 0020 00044000
*   TMP_R10 = R10; 0021 00045000
*   LR @07_TMP_R10,R10 0021 00046000
*   R10 = VTAM_APIHDR_PTR; 0022 00047000
*   L R10,VTAM_APIHDR_PTR(,R10) 0022 00048000
*   MVCL(R2,R10); 0023 00049000
*   MVCL R2,R10 0023 00050000
*   R10 = TMP_R10; 0024 00051000
*   LR R10,@07_TMP_R10 0024 00052000
* END; 0025 00053000
*ELSE 0026 00054000
* DO; 0026 00055000
*   B @RC00016 0026 00056000
@RF00016 DS 0H 0027 00057000
* GEN (WTO 'CMIPPING: Read Queue Exit driven with reason <> 0!'); 00058000
@GS00027 DS 0H 0027 00059000
* WTO 'CMIPPING: Read Queue Exit driven with reason <> 0!' 00060000
@GE00027 DS 0H 0028 00061000
* END; 0028 00062000
* 0028 00063000
*/******/ 00064000
*/* Wake up the main task by posting the ECB which it is */ 00065000
*/* waiting on. */ 00066000
*/******/ 00067000
* 0029 00068000
*R1 = ADDR(GLB_ECB); 0029 00069000
@RC00016 LR R1,R06_USER_DATA 0029 00070000
*GEN; 0030 00071000
* 0030 00072000
@GS00030 DS 0H 0030 00073000
* POST (1),X'FFFF' 00074000
@GE00030 DS 0H 0031 00075000
*RETURN CODE(0); /* Return to VTAM. */ 00076000
* 0031 00077000
*           SLR @15,@15 0031 00078000
*           L @13,4(,@13) 0031 00079000
*           L @14,12(,@13) 0031 00080000
*           LM @00,@12,20(@13) 0031 00081000
*           BR @14 0031 00082000
*END ACYCMS2A; 0032 00083000
@DATA DS 0H 00084000
DS 0F 00085000
@SA00001 DS 18F 00086000

```

```

          DS      0F                      00087000
          LTORG                      00088000
          DS      0D                      00089000
@DYNSIZE EQU    0                      00090000
@00      EQU    0                      00091000
@01      EQU    1                      00092000
@02      EQU    2                      00093000
@03      EQU    3                      00094000
@04      EQU    4                      00095000
@05      EQU    5                      00096000
@06      EQU    6                      00097000
@07      EQU    7                      00098000
@08      EQU    8                      00099000
@09      EQU    9                      00100000
@10      EQU   10                      00101000
@11      EQU   11                      00102000
@12      EQU   12                      00103000
@13      EQU   13                      00104000
@14      EQU   14                      00105000
@15      EQU   15                      00106000
@07_TMP_R10 EQU @07                    00107000
R0       EQU    @00                    00108000
R1       EQU    @01                    00109000
R2       EQU    @02                    00110000
R3       EQU    @03                    00111000
R06_USER_DATA EQU @06                  00112000
R10      EQU    @10                    00113000
R11      EQU    @11                    00114000
VTAM_PARM_LIST EQU 0,20,C'C'          00115000
VTAM_REASON EQU VTAM_PARM_LIST,4,C'F' 00116000
VTAM_APIHDR_PTR EQU VTAM_PARM_LIST+4,4,C'A' 00117000
VTAM_LENGTH EQU VTAM_PARM_LIST+12,4,C'F' 00118000
VTAM_APIHDR EQU 0,,C'C'              00119000
GLB_DATA EQU 0,16392,C'C'            00120000
GLB_ECB EQU GLB_DATA,4,C'F'          00121000
GLB_REASONCODE EQU GLB_DATA+4,4,C'F' 00122000
GLB_BUFFER EQU GLB_DATA+8,16384,C'C' 00123000
          AGO    .UNREF                00124000
VTAM_MSG_TYPE EQU VTAM_PARM_LIST+16,4,C'F' 00125000
VTAM_STR_HEADER_PTR EQU VTAM_PARM_LIST+8,4,C'A' 00126000
          .UNREF ANOP                  00127000
          DS      0D                      00128000
@ENDDATA EQU    *                      00129000
@MODLEN EQU    @ENDDATA-ACYCMS2A      00130000
          END      ,(PL/X-370,0103,95125) 00131000

```

---

## ACYCMS3A source file

```

*/*****/
*/
** MEMBER NAME: ACYCMS3A                */
**                                     */
** DESCRIPTIVE NAME: Load addresses of MIB API functions */
**                                     for sample CMIP application */
**                                     */
**                                     */
** COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM    */
**                                     */
** "RESTRICTED MATERIALS OF IBM"          */
**                                     */
** 5695-117 (C) COPYRIGHT IBM CORP. 1994 */
**                                     */
** MEMBER CATEGORY: Sample CMIP application */
**                                     */
*/*****/
          TITLE ' /*****00001000
          *****'                      00002000

```

```

ACYCMS3A CSECT , 0001 00003000
ACYCMS3A AMODE 24 0001 00004000
ACYCMS3A RMODE 24 0001 00005000
@MAINENT DS 0H 0001 00006000
        USING *,@15 0001 00007000
        B @PROLOG 0001 00008000
        DC AL1(16) 0001 00009000
        DC C'ACYCMS3A 95.125' 0001 00010000
        DROP @15 0001 00011000
@PROLOG STM @14,@12,12(@13) 0001 00012000
        LRM @12,@15 0001 00013000
@PSTART EQU ACYCMS3A 0001 00014000
        USING @PSTART,@12 0001 00015000
* 0007 00016000
*/*****/ 00017000
** */ 00018000
**/ * MAINLINE */ 00019000
**/ * */ 00020000
*/*****/ 00021000
* 0007 00022000
*/*****/ 00023000
** MVS will abnormally terminate the task if a routine cannot be */ 00024000
** found. "Good" code would use the ERRET parameter on the LOAD */ 00025000
** macro to provide an exit to be called if the specified module */ 00026000
** cannot be found. Using that capability, this routine could */ 00027000
** return a bad return code instead of having the task terminated */ 00028000
** when a routine can't be found. */ 00029000
*/*****/ 00030000
* 0007 00031000
*R10 = R1; /* Free up R1 since LOAD will 0007 00032000
* clobber it. */ 00033000
* 0007 00034000
        LR R10,R1 0007 00035000
*RFY R1 UNRSTD; 0008 00036000
* 0008 00037000
*GEN CODE SETS(R0,R1) DEFS(ACYAPCNP) (LOAD EP=ACYAPCNP); 0009 00038000
@GS00009 DS 0H 0009 00039000
        LOAD EP=ACYAPCNP 00040000
@GE00009 DS 0H 0010 00041000
*MIBConnect = R0; 0010 00042000
* 0010 00043000
        L @11,PARM_PTR(,R10) 0010 00044000
        ST R0,MIBCONNECT(,@11) 0010 00045000
*GEN CODE SETS(R0,R1) DEFS(ACYAPD1P) (LOAD EP=ACYAPD1P); 0011 00046000
@GS00011 DS 0H 0011 00047000
        LOAD EP=ACYAPD1P 00048000
@GE00011 DS 0H 0012 00049000
*MIBDisconnect = R0; 0012 00050000
* 0012 00051000
        L @11,PARM_PTR(,R10) 0012 00052000
        ST R0,MIBDISCONNECT(,@11) 0012 00053000
*GEN CODE SETS(R0,R1) DEFS(ACYAPRGP) (LOAD EP=ACYAPRGP); 0013 00054000
@GS00013 DS 0H 0013 00055000
        LOAD EP=ACYAPRGP 00056000
@GE00013 DS 0H 0014 00057000
*MIBSendRegister = R0; 0014 00058000
* 0014 00059000
        L @11,PARM_PTR(,R10) 0014 00060000
        ST R0,MIBSENDREGISTER(,@11) 0014 00061000
*GEN CODE SETS(R0,R1) DEFS(ACYAPDRP) (LOAD EP=ACYAPDRP); 0015 00062000
@GS00015 DS 0H 0015 00063000
        LOAD EP=ACYAPDRP 00064000
@GE00015 DS 0H 0016 00065000
*MIBSendDeleteRegistration = R0; 0016 00066000
* 0016 00067000
        L @11,PARM_PTR(,R10) 0016 00068000
        ST R0,MIBSENDDLETEREGISTRATION(,@11) 0016 00069000

```



```

*GEN CODE SETS(R0,R1) DEFS(ACYAPQRP) (LOAD EP=ACYAPQRP);          0017 00070000
@GS00017 DS 0H                                                    0017 00071000
      LOAD EP=ACYAPQRP                                           00072000
@GE00017 DS 0H                                                    0018 00073000
*MIBSendRequest = R0;                                             0018 00074000
*                                                                    0018 00075000
      L @11,PARM_PTR(,R10)                                       0018 00076000
      ST R0,MIBSENDREQUEST(,@11)                                  0018 00077000
*GEN CODE SETS(R0,R1) DEFS(ACYAPRSP) (LOAD EP=ACYAPRSP);        0019 00078000
@GS00019 DS 0H                                                    0019 00079000
      LOAD EP=ACYAPRSP                                           00080000
@GE00019 DS 0H                                                    0020 00081000
*MIBSendResponse = R0;                                           0020 00082000
*                                                                    0020 00083000
      L @11,PARM_PTR(,R10)                                       0020 00084000
      ST R0,MIBSENDRESPONSE(,@11)                                0020 00085000
*GEN CODE SETS(R0,R1) DEFS(ACYAPQCP) (LOAD EP=ACYAPQCP);        0021 00086000
@GS00021 DS 0H                                                    0021 00087000
      LOAD EP=ACYAPQCP                                           00088000
@GE00021 DS 0H                                                    0022 00089000
*MIBSendCmipRequest = R0;                                         0022 00090000
*                                                                    0022 00091000
      L @11,PARM_PTR(,R10)                                       0022 00092000
      ST R0,MIBSENCMIPREQUEST(,@11)                              0022 00093000
*GEN CODE SETS(R0,R1) DEFS(ACYAPCPP) (LOAD EP=ACYAPCPP);        0023 00094000
@GS00023 DS 0H                                                    0023 00095000
      LOAD EP=ACYAPCPP                                           00096000
@GE00023 DS 0H                                                    0024 00097000
*MIBSendCmipResponse = R0;                                        0024 00098000
*                                                                    0024 00099000
      L @11,PARM_PTR(,R10)                                       0024 00100000
      ST R0,MIBSENCMIPRESPONSE(,@11)                             0024 00101000
*RETURN CODE(0); /* Assume that no error                          00102000
*                                                                    occurred. /* 00103000
*                                                                    0025 00104000
      SLR @15,@15                                                  0025 00105000
      L @14,12(,@13)                                               0025 00106000
      LM @00,@12,20(@13)                                          0025 00107000
      BR @14                                                       0025 00108000
*END ACYCMS3A;                                                    0026 00109000
@DATA DS 0H                                                        00110000
      DS 0F                                                         00111000
      DS 0F                                                         00112000
      LTORG                                                         00113000
      DS 0D                                                         00114000
@DYNSIZE EQU 0                                                     00115000
@00 EQU 0                                                           00116000
@01 EQU 1                                                           00117000
@02 EQU 2                                                           00118000
@03 EQU 3                                                           00119000
@04 EQU 4                                                           00120000
@05 EQU 5                                                           00121000
@06 EQU 6                                                           00122000
@07 EQU 7                                                           00123000
@08 EQU 8                                                           00124000
@09 EQU 9                                                           00125000
@10 EQU 10                                                          00126000
@11 EQU 11                                                          00127000
@12 EQU 12                                                          00128000
@13 EQU 13                                                          00129000
@14 EQU 14                                                          00130000
@15 EQU 15                                                          00131000
R0 EQU @00                                                          00132000
R1 EQU @01                                                          00133000
R10 EQU @10                                                         00134000
MIBADDRESSES_T EQU 0,32,C'C'                                       00135000
MIBCONNECT EQU MIBADDRESSES_T,4,C'A'                               00136000

```

```

MIBDISCONNECT EQU MIBADDRESSES_T+4,4,C'A'          00137000
MIBSENDREGISTER EQU MIBADDRESSES_T+8,4,C'A'         00138000
MIBSENDDELETEREGISTRATION EQU MIBADDRESSES_T+12,4,C'A' 00139000
MIBSENDREQUEST EQU MIBADDRESSES_T+16,4,C'A'         00140000
MIBSENDRESPONSE EQU MIBADDRESSES_T+20,4,C'A'        00141000
MIBSENDCMIPREQUEST EQU MIBADDRESSES_T+24,4,C'A'     00142000
MIBSENDCMIPRESPONSE EQU MIBADDRESSES_T+28,4,C'A'    00143000
PARM_PTR EQU 0,4,C'A'                                00144000
          DS 0D                                       00145000
@ENDDATA EQU *                                       00146000
@MODLEN EQU @ENDDATA-ACYCMS3A                        00147000
          END , (PL/X-370,0103,95125)                00148000

```

## ACYCMS4A source file

```

*/*****
*/
*/ MEMBER NAME: ACYCMS4A
*/
*/ DESCRIPTIVE NAME: Switch to supervisor state for sample
*/ CMIP application
*/
*/
*/ COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM
*/
*/ "RESTRICTED MATERIALS OF IBM"
*/
*/ 5695-117 (C) COPYRIGHT IBM CORP. 1994
*/
*/ MEMBER CATEGORY: Sample CMIP application
*/
*/*****
          TITLE ' /*****00001000
          *****' 00002000
ACYCMS4A CSECT , 0001 00003000
ACYCMS4A AMODE 24 0001 00004000
ACYCMS4A RMODE 24 0001 00005000
@MAINENT DS 0H 0001 00006000
          USING *,@15 0001 00007000
          B @PROLOG 0001 00008000
          DC AL1(16) 0001 00009000
          DC C'ACYCMS4A 95.125' 0001 00010000
          DROP @15 0001 00011000
@PROLOG STM @14,@12,12(@13) 0001 00012000
          LR @12,@15 0001 00013000
@PSTART EQU ACYCMS4A 0001 00014000
          USING @PSTART,@12 0001 00015000
* 0002 00016000
@GS00002 DS 0H 0002 00017000
          MODESET MODE=SUP 0002 00018000
@GE00002 DS 0H 0003 00019000
*END ACYCMS4A; 0003 00020000
@EL00001 DS 0H 0003 00021000
@EF00001 DS 0H 0003 00022000
@ER00001 LM @14,@12,12(@13) 0003 00023000
          BR @14 0003 00024000
@DATA DS 0H 0003 00025000
          DS 0F 0003 00026000
          DS 0F 0003 00027000
          LTORG 0003 00028000
          DS 0D 0003 00029000
@DYNsize EQU 0 0003 00030000
@00 EQU 0 0003 00031000
@01 EQU 1 0003 00032000
@02 EQU 2 0003 00033000
@03 EQU 3 0003 00034000
@04 EQU 4 0003 00035000

```

```

@05 EQU 5 00036000
@06 EQU 6 00037000
@07 EQU 7 00038000
@08 EQU 8 00039000
@09 EQU 9 00040000
@10 EQU 10 00041000
@11 EQU 11 00042000
@12 EQU 12 00043000
@13 EQU 13 00044000
@14 EQU 14 00045000
@15 EQU 15 00046000
      DS 0D 00047000
@ENDDATA EQU * 00048000
@MODLEN EQU @ENDDATA-ACYCMS4A 00049000
      END , (PL/X-370,0103,95125) 00050000

```

---

## ACYCMS5A source file

```

*/******/
*/*/
*/*/ MEMBER NAME: ACYCMS5A */
*/*/ */
*/*/ DESCRIPTIVE NAME: WAIT on ECB for sample CMIP application */
*/*/ */
*/*/ */
*/*/ COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM */
*/*/ */
*/*/ "RESTRICTED MATERIALS OF IBM" */
*/*/ */
*/*/ 5695-117 (C) COPYRIGHT IBM CORP. 1994 */
*/*/ */
*/*/ MEMBER CATEGORY: Sample CMIP application */
*/*/ */
*/******/
      TITLE ' /*****' 00001000
      *****' 00002000
ACYCMS5A CSECT , 0001 00003000
ACYCMS5A AMODE 24 0001 00004000
ACYCMS5A RMODE 24 0001 00005000
@MAINENT DS 0H 0001 00006000
      USING *,@15 0001 00007000
      B @PROLOG 0001 00008000
      DC AL1(16) 0001 00009000
      DC C'ACYCMS5A 95.125' 0001 00010000
      DROP @15 0001 00011000
@PROLOG STM @14,@12,12(@13) 0001 00012000
      LR @12,@15 0001 00013000
@PSTART EQU ACYCMS5A 0001 00014000
      USING @PSTART,@12 0001 00015000
* 0009 00016000
*/******/ 0001 00017000
*/*/ */ 0001 00018000
*/*/ MAINLINE */ 0001 00019000
*/*/ */ 0001 00020000
*/******/ 0001 00021000
* 0009 00022000
*R2 = R1; 0009 00023000
* 0009 00024000
      LR R2,R1 0009 00025000
*R1 = ADDR( THE_ECB ); 0010 00026000
* 0010 00027000
      L R1, THE_ECB_PTR(,R2) 0010 00028000
*GEN EXIT; 0011 00029000
* 0011 00030000
@GS00011 DS 0H 0011 00031000
      WAIT 1, ECB=(1) 0003 00032000
@GE00011 DS 0H 0012 00033000

```

```

*RETURN CODE(0);          0012 00034000
*                          0012 00035000
      SLR   @15,@15        0012 00036000
      L    @14,12(,@13)   0012 00037000
      LM   @00,@12,20(@13) 0012 00038000
      BR   @14            0012 00039000
*END ACYCMS5A;           0013 00040000
@DATA   DS    0H          00041000
        DS    0F          00042000
        DS    0F          00043000
        LTORG          00044000
        DS    0D          00045000
@DYNsize EQU   0          00046000
@00     EQU   0          00047000
@01     EQU   1          00048000
@02     EQU   2          00049000
@03     EQU   3          00050000
@04     EQU   4          00051000
@05     EQU   5          00052000
@06     EQU   6          00053000
@07     EQU   7          00054000
@08     EQU   8          00055000
@09     EQU   9          00056000
@10     EQU  10          00057000
@11     EQU  11          00058000
@12     EQU  12          00059000
@13     EQU  13          00060000
@14     EQU  14          00061000
@15     EQU  15          00062000
R0      EQU @00          00063000
R1      EQU @01          00064000
R2      EQU @02          00065000
R14     EQU @14          00066000
R15     EQU @15          00067000
THE_ECB EQU  0,4,C'F'    00068000
THE_ECB_PTR EQU 0,4,C'A' 00069000
        DS    0D          00070000
@ENDDATA EQU   *          00071000
@MODLEN EQU @ENDDATA-ACYCMS5A 00072000
        END    ,(PL/X-370,0103,95125) 00073000

```

---

## ACYCMS6A source file

```

*/******/
*/**
** MEMBER NAME: ACYCMS6A **
** **
** DESCRIPTIVE NAME: TPEND exit for sample CMIP application **
** **
** **
** **
** COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM **
** **
** "RESTRICTED MATERIALS OF IBM" **
** **
** 5695-117 (C) COPYRIGHT IBM CORP. 1994 **
** **
** MEMBER CATEGORY: Sample CMIP application **
** **
*/******/
        TITLE ' /*****00001000
        *****' 00002000
ACYCMS6A CSECT , 0001 00003000
ACYCMS6A AMODE 24 0001 00004000
ACYCMS6A RMODE 24 0001 00005000
@MAINENT DS    0H 0001 00006000
        USING *,@15 0001 00007000
        B    @PROLOG 0001 00008000

```

```

          DC    AL1(16)                                0001 00009000
          DC    C'ACYCMS6A 95.125'                    0001 00010000
          DROP  @15                                    0001 00011000
@PROLOG  LR    @12,@15                                0001 00012000
@PSTART  EQU   ACYCMS6A                               0001 00013000
          USING @PSTART,@12                           0001 00014000
*                                                0005 00015000
*                                                0005 00016000
*/*****/ 00017000
*/**/ 00018000
*/**/          MAINLINE                             0001 00019000
*/**/ 00020000
*/*****/ 00021000
*                                                0005 00022000
*SELECT (REASON_CODE);          /* Issue message based on reason 00023000
*                                code                               */ 00024000
          L    @02,REASON_CODE(,R1)                   0005 00025000
          LTR  @02,@02                                 0005 00026000
          BM   @RT00014                                0005 00027000
          BE   @RT00006                                0005 00028000
          LA   @00,12                                  0005 00029000
          CR   @02,@00                                 0005 00030000
          BH   @RT00014                                0005 00031000
          BE   @RT00012                                0005 00032000
          IC   @02,@CB00064(@02)                       0005 00033000
          SLL  @02,2                                    0005 00034000
          B    @GL00001(@02)                            0005 00035000
@GL00001 B    @RT00014                                0005 00036000
          B    @RT00008                                0005 00037000
          B    @RT00010                                0005 00038000
*WHEN (0)                                           0006 00039000
@RT00006 DS   0H                                     0007 00040000
* GEN;                                               0007 00041000
*                                                   0007 00042000
@GS00007 DS   0H                                     0007 00043000
          WTO '                                     ' 00044000
          WTO 'CMIPPING TPEND DRIVEN: REASON CODE=00' 00045000
          WTO '                                     ' 00046000
@GE00007 DS   0H                                     0008 00047000
*WHEN (4)                                           0008 00048000
          B    @RC00005                                0008 00049000
@RT00008 DS   0H                                     0009 00050000
* GEN;                                               0009 00051000
*                                                   0009 00052000
@GS00009 DS   0H                                     0009 00053000
          WTO '                                     ' 00054000
          WTO 'CMIPPING TPEND DRIVEN: REASON CODE=04' 00055000
          WTO '                                     ' 00056000
@GE00009 DS   0H                                     0010 00057000
*WHEN (8)                                           0010 00058000
          B    @RC00005                                0010 00059000
@RT00010 DS   0H                                     0011 00060000
* GEN;                                               0011 00061000
*                                                   0011 00062000
@GS00011 DS   0H                                     0011 00063000
          WTO '                                     ' 00064000
          WTO 'CMIPPING TPEND DRIVEN: REASON CODE=08' 00065000
          WTO '                                     ' 00066000
@GE00011 DS   0H                                     0012 00067000
*WHEN (12)                                          0012 00068000
          B    @RC00005                                0012 00069000
@RT00012 DS   0H                                     0013 00070000
* GEN;                                               0013 00071000
*                                                   0013 00072000
@GS00013 DS   0H                                     0013 00073000
          WTO '                                     ' 00074000
          WTO 'CMIPPING TPEND DRIVEN: REASON CODE=12' 00075000

```

```

      WTO '
@GE00013 DS 0H 00076000
*OTHERWISE 0014 00077000
      B @RC00005 0014 00078000
@RT00014 DS 0H 0014 00079000
* GEN; 0015 00080000
* 0015 00081000
* 0015 00082000
@GS00015 DS 0H 0015 00083000
      WTO ' 00084000
      WTO 'CMIPPING TPEND DRIVEN: UNEXPECTED REASON CODE!' 00085000
      WTO ' 00086000
@GE00015 DS 0H 0016 00087000
*END; 0016 00088000
* 0016 00089000
@RC00005 DS 0H 0017 00090000
*RETURN CODE(RC); /* return to VTAM */ 00091000
* 0017 00092000
@EL00001 DS 0H 0017 00093000
@EF00001 DS 0H 0017 00094000
@ER00001 BR @14 0017 00095000
*END ACYCMS6A; 0018 00096000
@DATA DS 0H 00097000
      DS 0F 00098000
      DS 0F 00099000
      LTORG 00100000
      DS 0D 00101000
@CB00064 DC XL12'000000000100000002000000' 00102000
@DYNsize EQU 0 00103000
@00 EQU 0 00104000
@01 EQU 1 00105000
@02 EQU 2 00106000
@03 EQU 3 00107000
@04 EQU 4 00108000
@05 EQU 5 00109000
@06 EQU 6 00110000
@07 EQU 7 00111000
@08 EQU 8 00112000
@09 EQU 9 00113000
@10 EQU 10 00114000
@11 EQU 11 00115000
@12 EQU 12 00116000
@13 EQU 13 00117000
@14 EQU 14 00118000
@15 EQU 15 00119000
R1 EQU @01 00120000
RC EQU @15 00121000
TPEND_PARM_LIST EQU 0,8,C'C' 00122000
REASON_CODE EQU TPEND_PARM_LIST+4,4,C'F' 00123000
      AGO .UNREF 00124000
ACB_PTR EQU TPEND_PARM_LIST,4,C'A' 00125000
.UNREF ANOP 00126000
      DS 0D 00127000
@ENDDATA EQU * 00128000
@MODLEN EQU @ENDDATA-ACYCMS6A 00129000
      END ,(PL/X-370,0103,95125) 00130000

```

---

## ACYCMS7A source file

```

*/******/
*/
** MEMBER NAME: ACYCMS7A **
**
** DESCRIPTIVE NAME: Switch to problem state for sample CMIP **
** application **
**
**
** COPYRIGHT: LICENSED MATERIALS - PROPERTY OF IBM **

```

```

**/
**/          "RESTRICTED MATERIALS OF IBM"          **/
**/
**/          5695-117 (C) COPYRIGHT IBM CORP. 1994  **/
**/
**/ MEMBER CATEGORY: Sample CMIP application        **/
**/
**/*****/
          TITLE ' /*****'
          *****'
ACYCMS7A CSECT ,                                0001 00001000
ACYCMS7A AMODE 24                               0001 00002000
ACYCMS7A RMODE 24                               0001 00003000
@MAINENT DS 0H                                  0001 00004000
          USING *,@15                            0001 00005000
          B @PROLOG                               0001 00006000
          DC AL1(16)                              0001 00007000
          DC C'ACYCMS7A 95.125'                   0001 00008000
          DROP @15                                 0001 00009000
@PROLOG STM @14,@12,12(@13)                     0001 00010000
          LR @12,@15                               0001 00011000
@PSTART EQU ACYCMS7A                             0001 00012000
          USING @PSTART,@12                       0001 00013000
*
@GS00002 DS 0H                                  0002 00014000
          MODESET MODE=PROB                       0002 00015000
@GE00002 DS 0H                                  0002 00016000
*END ACYCMS7A;                                  0002 00017000
@EL00001 DS 0H                                  0003 00018000
@EF00001 DS 0H                                  0003 00019000
@ER00001 LM @14,@12,12(@13)                     0003 00020000
          BR @14                                   0003 00021000
@DATA DS 0H                                      0003 00022000
          DS 0F                                    0003 00023000
          DS 0F                                    0003 00024000
          LTORG                                    0003 00025000
          DS 0D                                    0003 00026000
@DYN SIZE EQU 0                                  0003 00027000
@00 EQU 0                                        0003 00028000
@01 EQU 1                                        0003 00029000
@02 EQU 2                                        0003 00030000
@03 EQU 3                                        0003 00031000
@04 EQU 4                                        0003 00032000
@05 EQU 5                                        0003 00033000
@06 EQU 6                                        0003 00034000
@07 EQU 7                                        0003 00035000
@08 EQU 8                                        0003 00036000
@09 EQU 9                                        0003 00037000
@10 EQU 10                                       0003 00038000
@11 EQU 11                                       0003 00039000
@12 EQU 12                                       0003 00040000
@13 EQU 13                                       0003 00041000
@14 EQU 14                                       0003 00042000
@15 EQU 15                                       0003 00043000
          DS 0D                                    0003 00044000
@ENDDATA EQU *                                  0003 00045000
@MODLEN EQU @ENDDATA-ACYCMS7A                   0003 00046000
          END , (PL/X-370,0103,95125)             0003 00047000

```





---

## Chapter 3. Overview of CMIP services API functions

VTAM provides a set of API functions for management application programs to use when interfacing with CMIP services. CMIP operations are performed through this interface.

This chapter covers the following topics that relate to the API:

- Decisions an application programmer needs to make before coding
- “Requirements for CMIP application programs” on page 45
- “Format of API messages” on page 45

---

### Decisions to make before coding

You must decide among the following options before you begin coding your application program:

- Do you want to use the common storage area (CSA) interface of the data space interface?
- What form of distinguished name does your application program require from CMIP services?
- Is your application program to be a manager application program or an agent application program?

The following sections describe each of these decisions.

#### Common storage area storage or data space storage?

The API interface provides either of two mechanisms for receiving messages. These two mechanisms are through the following:

- Common storage area (CSA) interface
- Data space interface

Some differences exist between using CMIP services with the CSA interface and using CMIP services with the data space interface.

#### Common storage area interface

In the CSA interface, the read queue exit routine is called for each message. Each message is passed in common storage. The CSA interface is intended to be used by low-volume users.

The following exit routines and functions run under the same task:

- Read queue exit routine
- TPEND exit routine, if there is one
- MIBConnect function
- MIBDisconnect function

Figure 1 on page 42 shows the relationship between the application program and CMIP services for an application program using the CSA interface.

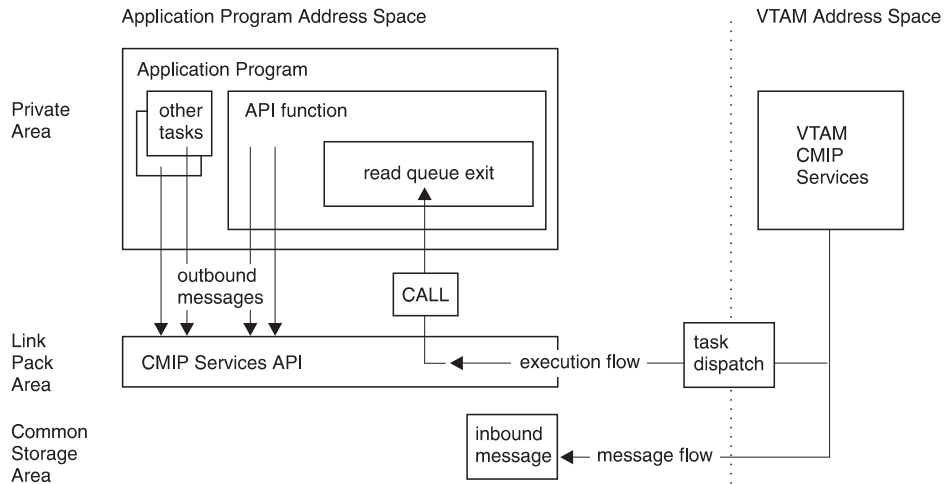


Figure 1. Using CMIP services with the common storage area interface

## Data space interface

Application programs that expect to receive a large volume of messages should use the data space interface. For this interface, messages remain in the data space until they are freed by the application program or until the data space fills, whichever occurs first.

The following exit routines and functions run under the same task:

- Read queue exit routine
- TPEND exit routine, if there is one
- MIBConnect function
- MIBDisconnect function

Figure 2 on page 43 describes the relationship between the application program and CMIP services for an application program using the data space interface.

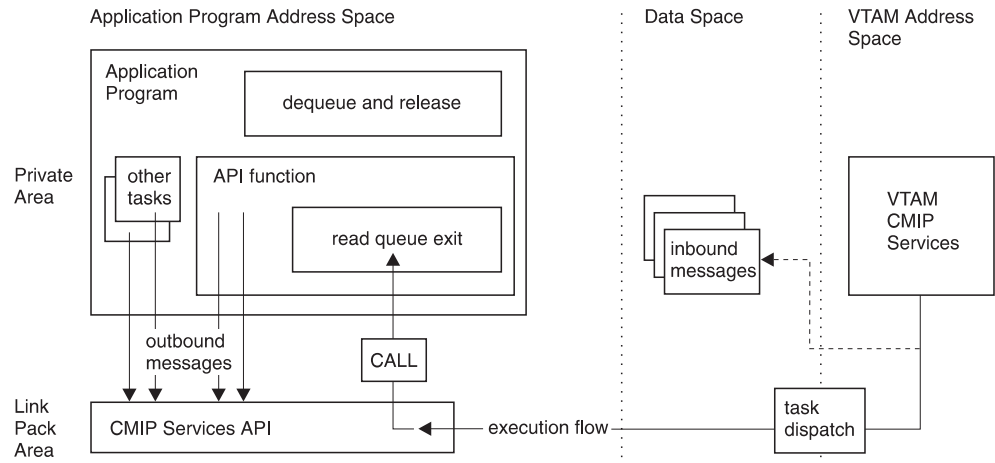


Figure 2. Using CMIP services with the data space interface

An application program that uses one or more of the individual API functions must load the entry point for that function from LPALIB. All modules are placed in LPALIB when the operating system is initialized. Once the entry points for the APIs are known, the application program can call an API function directly. See Table 2 on page 53 for the module names of each API function. Application programs can have any tasking structure. The functions for reading and freeing messages in the data space are serially reusable only.

### Advantages of CSA interface and data space interface

Message strings can be transferred from CMIP services to the application program through either CSA storage or data space storage.

In general, application programs that use the CSA interface are simpler to code. Application programs that use the data space interface are faster.

The data space interface has the following other advantages over the CSA interface:

- Messages can be buffered. They do not have to be retrieved immediately from the data space. With the CSA interface, the application program must copy its message when the read queue exit routine is called. CMIP services frees the CSA storage containing the message on return from the read queue exit routine.
- There are fewer task switches with the data space support. The read queue exit routine is called only when the count of messages waiting in the data space goes from zero to one. The CSA interface, by contrast, calls the read queue exit routine for every message. Each time the read queue exit routine is called, it causes a dispatch of the application program's TCB.
- CSA can be a critical resource in some configurations. The data space interface uses no CSA for inbound messages.

To display the amount of data space storage in use by an application program, use the D NET,STORUSE command. See z/OS Communications Server: SNA Operation for more information about this command.

An application program using the data space interface must not allow the messages to back up in the data space to the point where the data space fills. If

this occurs, CMIP services stops forwarding messages to the application program until the application program calls the MIBDisconnect function and calls the MIBConnect function again.

Differences between the CSA interface and the data space interface are described throughout this section.

The API and the read queue exit routine handle all details of the message flow between the application program and CMIP services. The application program invokes the API when it needs to send a message. CMIP services returns information to the application program according to the following methods:

- **If using the CSA interface**, information is returned by calling the read queue exit routine for each message. For more information about the exit routine, see “Read queue exit routine for the CSA interface” on page 86.
- **If using the data space interface**, information is returned by copying each message to the data space and notifying the application program through the read queue exit routine if the number of buffers in the data space goes from zero to one. For more information about the exit routine, see “Read queue exit routine for data space storage” on page 87.

**Note:** When the application program is notified, the application program receives notification again only when the number of buffers returns to zero and goes to one buffer again. The application program must call the routine to dequeue buffers from the data space storage until this routine indicates that there are no more buffers to receive. See “Dequeuing a buffer with the dequeue routine” on page 90 for details.

The read queue exit routine runs in TCB mode in the application program's address space.

## What form of distinguished name?

Your application program can choose between two forms of distinguished names: short form and long form. Here is a distinguished name written in short form:

```
1.3.18.0.2.4.6=NETA;2.9.3.2.7.4=(name AAAAAA)
```

Here is the same distinguished name written in long form:

```
(RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 2.9.3.2.7.4, attributeValue (name "AAAAAA"))))
```

Application programs can build distinguished names in either form to send to CMIP services. Application programs specify to CMIP services on the connection options parameter passed to the MIBConnect function which form of distinguished names they wish to receive. For a description of the MIBConnect function, see “MIBConnect—MIB connection function” on page 56.

## What type of application program—manager or agent?

An agent application program represents resources and processes CMIP requests sent to those resources. A manager application program gathers information by sending CMIP requests to resources.

---

## Requirements for CMIP application programs

An application program that uses the API must fulfill the following requirements:

- The API must be called from the home address space.
- The application program must be authorized.
- The application program must use a task mode of the task control block (TCB).

The read queue exit routine is called under the same TCB that issued the MIBConnect function. An application program with multiple tasks can issue the following API functions from any of its tasks:

- MIBSendRequest
- MIBSendResponse
- MIBSendRegister
- MIBSendDeleteRegister
- MIBSendCmipRequest
- MIBSendCmipResponse

However, the application program must be prepared to handle the invoking of the read queue exit routine from the task that originated the MIBConnect function.

- The MIBConnect and MIBDisconnect functions must be called from the same task.
- The application program must define the APPL definition statement and specify the name that is to be used on the MIBConnect function. See *z/OS Communications Server: SNA Resource Definition Reference* for more information about the APPL definition statement.
  - A separate APPL definition statement is needed for each MIBConnect function that the application program is expected to perform. The application program cannot call the MIBConnect function again without calling the MIBDisconnect function first.
  - Each successful call to the MIBConnect function that specifies the data space vector parameter causes a new data space to be created. For more information about the MIBConnect function, see “MIBConnect—MIB connection function” on page 56.
- No API functions can be issued from the TPEND exit routine or the read queue exit routine.

Calls to API functions can be made from more than one subtask. However, the application program is assumed to be terminated when the subtask that issued the MIBConnect function terminates. When the task that issued the MIBConnect function terminates, the ACB for the application program is closed automatically.

The ACB is not closed automatically if multiple tasks are used and a subtask that meets the following conditions terminates:

- The subtask is using the API.
- The subtask did not open the connection with the MIBConnect function.

---

## Format of API messages

API messages have the following format:

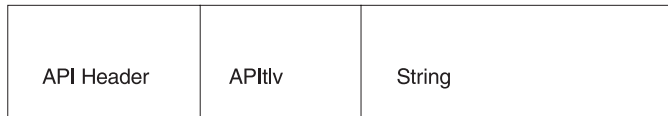


Figure 3. Format of API messages

The type of message is determined by the first field in the API header. The string follows the API header. The syntax of the string includes optional source information, optional destination information, and a required message.

## Description and example of the API header

The API header is built for the application program when the application program calls API functions that send messages to CMIP services. It is returned to the application program when the message is sent from CMIP services to the application program.

The API header begins in the first byte of the message. The length of the header varies according to the size of the local identifier. If the message contains data in addition to the API header, the data begins immediately following the API header.

The C language definition of the API header follows. Note that actual local identifiers vary in size from one to eight bytes in length and can be of any data type. It is declared as an eight-character array for simplicity.

**Note:** To facilitate reading on any host terminal and printing on any host printer, trigraph sequences have been used for square brackets. These sequences are “??(” for left square bracket and “??)” for right square bracket.

```
typedef struct APIhdr_tag
{
    unsigned char msg_type;
    unsigned char api_version;
    unsigned char origin;
    unsigned char RESERVED1;          /* Application programs must not
                                     use or depend on the value of
                                     this field in any way. */

    unsigned int invokeId;
    unsigned int connectId;
    unsigned int numLocalIds;
    time_t timestamp;
    unsigned short resultCode;
    unsigned char RESERVED2??(??); /* Application programs must not
                                     use or depend on the value of
                                     this field in any way. */

    unsigned int RESERVED3;         /* Application programs must not
                                     use or depend on the value of
                                     this field in any way. */

    unsigned char localIds??(8??);
} APIhdr;
```

The actual size of the API header associated with a particular message received from CMIP services is determined by the size of the fixed part (all fields up to but not including the localIDs field) plus the number of attached local identifiers times the size of each local identifier. For this release, the number of attached local identifiers is always one.

The actual size is a useful quantity because the string portions of the message start immediately after the API header.

To make it easier to calculate the actual size, the `APIHdrSize` macro is provided in the language header file, `ACYAPHDH`. Given the name of an `APIHdr` and the size of the application's local identifiers, it returns the actual size of an API header. The following example shows the `APIHdrSize` macro:

```
#define MY_LOCAL_ID_SIZE 7

APIHdr *APIHdr1;
APIHdr APIHdr2;
size_t Size1, Size2;

Size1 = APIHdrSize(*APIHdr1,MY_LOCAL_ID_SIZE);
Size2 = APIHdrSize( APIHdr2,MY_LOCAL_ID_SIZE);
```

## API header fields

A description of each field in the API header follows:

### **msg\_type**

Indicates the type and format of message to which this header is attached. An API message can be an indication, a confirmation, or an OSI error. Messages of type `API_MSG`, `API_REG_ACCEPT`, `API_SVC_COMPLETE`, or `API_SVC_ERROR` contain a formatted string immediately following the API header. This formatted string ends with `X'00'`.

`API_TERMINATE_INSTANCE` does not have a string, but `X'00'` is stored after the local identifier for the convenience of the application program.

CMIP services uses additional values internally for the `msg_type` field. These values can appear in buffer trace records generated when an application program calls a API function to send data to CMIP services.

Each of the possible `msg_type` values for `APIHdr` structure that can be received by an application program is described in the following list.

### **API\_MSG**

A CMIP string or a response to a VTAM-specific request or response. An example of a response to a VTAM-specific request is `ACF.SubscribeRsp`. `API_MSG` is defined in `ACYAPHDH`. For a listing, see Appendix A, "C language header file (`ACYAPHDH`)," on page 235.

### **API\_REG\_ACCEPT**

Sent by CMIP services to indicate that the `MIBSendRegister` request succeeded. `API_REG_ACCEPT` is defined in `ACYAPHDH`. For a listing, see Appendix A, "C language header file (`ACYAPHDH`)," on page 235.

### **API\_SVC\_COMPLETE**

Sent by CMIP services to indicate that the associated request was processed correctly. This message is returned for unconfirmed CMIP requests. `API_SVC_COMPLETE` is defined in `ACYAPHDH`. For a listing, see Appendix A, "C language header file (`ACYAPHDH`)," on page 235.

### **API\_SVC\_ERROR**

Sent by CMIP services to indicate that the associated request could not be processed. Examples of why it could not be processed are that the string was incorrectly formatted or that there is no network path available to the destination. A specific error code is provided in the message to assist in diagnosing the problem.

In many cases, CMIP services records additional diagnostic information in CMER VIT entry of the VTAM internal trace. See z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps and the VIT for information about the CMER VIT entry. See z/OS Communications Server: SNA Diagnosis Vol 1, Techniques and Procedures for information about how to use the VTAM internal trace.

API\_SVC\_ERROR is defined in ACYAPHDH. For a listing, see Appendix A, "C language header file (ACYAPHDH)," on page 235.

**API\_TERMINATE\_INSTANCE**

Sent by CMIP services to indicate that the object has been deregistered.

API\_TERMINATE\_INSTANCE is defined in ACYAPHDH. For a listing, see Appendix A, "C language header file (ACYAPHDH)," on page 235.

**api\_version**

Reserved for use by CMIP services.

**origin**

Indicates where the message was generated and how the message should be used. Each of the possible origin field values is described in the following list:

**ORIGIN\_OBJ**

Response to a request that was previously submitted by the object receiving the message. The receiving object can use the invoke identifier to look up the previous request.

**ORIGIN\_REMOTE**

Generated by another object and is a form of unsolicited request or linked reply. The object receiving this message should use the invoke identifier from the API header and the association data from the string to respond to the message.

**invokeId**

Can be used to correlate requests and responses. If the origin field is set to ORIGIN\_OBJ, the invoke identifier field was generated by the application program when a previous request was sent to CMIP services. If the origin field is set to ORIGIN\_REMOTE, the invoke identifier field was generated by a remote object and must be returned in a response along with the association handle so that the remote object can use it for correlation.

**connectId**

The connect identifier field is reserved for use by the API.

**timestamp**

Set by the API when a message is sent to CMIP services.

**numLocalIds**

Specifies the number of local identifiers following the fixed-size portion of the API header. This field is always zero or one.

**resultCode**

For API\_SVC\_ERROR messages, the error code is stored here. The same error code also appears in the string.

**localIds**

Can contain a local identifier. A local identifier is a unique identifier for an object and was provided to MIBSendRegister when that object was registered. If a local identifier is present, it ranges in size from 1 to 8 bytes. The number of bytes is determined by the application program and is specified in a parameter



passed to MIBConnect. This local identifiers field is passed back to the application program unchanged by CMIP services.

## Description and example of the string

Strings that are included in API\_MSG messages begin with the following fields, some of which are optional, depending on whether the API\_MSG is a request, indication, response, or confirmation, as shown in Table 1.

Table 1. Destination and source fields in string headers

Type of CMIP message	src-type field	src field	dest-type field	dest field
<b>Request</b>	Optional for subtree managers, only. This is choice (2), if included.  This is never included for application programs other than subtree managers.	Optional. This is the distinguished name, if included.	Optional. This can be any choice.	Optional. This can be any choice.
<b>Indication</b>	1	assoc-handle	Never included	Never included
<b>Response</b>	Optional for subtree managers, only. This is choice (2), if included.  This is never included for application programs other than subtree managers.	Optional. This is the distinguished name, if included.	1	assoc-handle
<b>Confirmation</b>	1	assoc-handle	Never there	Never there

The message field is the only field that must be provided on requests. Responses and linked replies must be formatted with the association data that was provided on the indication. (The indication is the request being answered.) The caller of the MIBSendRequest function or MIBSendResponse function must build the string with all fields. Other API functions do not require the caller to build the string with all fields.

For API functions that build the string automatically, for example, the MIBSendCmipRequest function, separate fields are provided to pass individual fields that are placed in the string by the API function.

The syntax of the string header follows, in ASN.1 notation:

```
Header ::= SEQUENCE
{
  src-type INTEGER           -- source type
  {
    assoc-handle(1)         -- association handle
  } OPTIONAL,
  src GraphicString OPTIONAL, -- source
  dest-type INTEGER         -- destination type
  {
    assoc-handle(1),       -- association handle
    full-dn(2),           -- distinguished name
    ae-title(3)           -- AE title
  }
}
```

```

    } OPTIONAL,
    dest GraphicString OPTIONAL,    -- destination
    msg GraphicString                -- the message itself
}

```

The format of the required msg field in the string header is dictated by the syntax of the message sent or received by the application program. The following example shows a CMIP string, as received by an application program from CMIP services. This string immediately follows the localIds field of the APIhdr structure.

```

src-type 1, src a1,msg CMIP-1.R0IVapdu (invokeID 327686, operation-v
alue 3, argument (baseManagedObjectClass 1.3.18.0.0.1829, baseManage
dObjectInstance (distinguishedName (RelativeDistinguishedName (Attri
buteValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "MY
NETID")), RelativeDistinguishedName (AttributeValueAssertion (attrib
uteType 1.3.18.0.0.2032, attributeValue "MYCPNAME")), RelativeDistin
guishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.1984,
attributeValue "APPL1")))), synchronization bestEffort, scope (basi
cScope 0), filter (and ())))

```

## Rules for the source and destination fields in the string

When messages are received from CMIP services through the API (on indications and confirmations), the following rules apply:

- If the msg\_type field in the API header is API\_MSG, the src-type field in the string header is set to 1 (assoc-handle) and the src field contains the association handle over which the message arrived.
- If the msg\_type field in the API header is not API\_MSG, the source data is not present.
- If the local identifier in the API header refers to a subtree manager and the message is not targeted for that subtree manager, the dest-type field in the string is full-dn and the dest field contains the distinguished name of the object instance that is supposed to receive the message.

The application program does not normally build the src-type, src, dest-type, and dest portions of the string, but instead relies on MIBSendCmipRequest and MIBSendCmipResponse functions to build this portion of the string.

The src-type and src fields in the string header need to be provided only if the object needs to override the distinguished name associated with the registered object that is building the message.

The only acceptable src-type is distinguished name (0), which is the default. If the src field is provided and it contains a distinguished name that is different from the provider, the message contains a source override. Only a subtree manager can specify a source name to override the source name in the string header. If an application program that is not a subtree manager specifies a source, the message is flagged with an error.

The dest-type and dest fields are not required. However, these fields can be used to explicitly address messages when the syntax of the message does not contain routing information or when the routing information is not understood by CMIP services. If the CMIP standard is being used, explicit destination information is not required because the destination is given in the managedObjectInstance field.

The same does not apply, however, to OSI responses prompted by an indication and containing the same invoke identifier as the indication. When an object sends a response, it must provide the association handle from the indication that prompted the response.

Messages received by an object instance do not contain the dest-type and dest fields.

The msg field in the string header contains the formatted string. The string must begin with an ASN.1 module name and an ASN.1 syntax name. For all CMIP flows, the module name is CMIP-1 because CMIP-1 is the name of the ASN.1 module that defines the syntaxes used for CMIP flows.

Following the module name is the type name. The module name and type name must be separated by exactly one period; no other characters can be placed between these names. The remainder of the message is defined by the ASN.1 syntax for the module and type specified.



---

## Chapter 4. CMIP services API function syntax and operands

This chapter describes all of the VTAM CMIP services API functions. Function descriptions are arranged alphabetically.

For each function, an example of its use is given. These examples are not intended to show the sequence of operations that an application program must perform as a management application program. They merely show the syntax of calling the API function.

---

### Overview of API functions

Table 2 lists the API functions and indicates the name of the module that must be loaded before invoking an API function. Although logical names such as MIBConnect and MIBSendRegister are used in the table, the physical names of the API functions are the module entry point names.

The abbreviation N/A in the Module Entry Point column indicates that these are the data space modules used for dequeuing or releasing the messages from the data space. The addresses of these modules are returned on the MIBConnect function. Refer to the data space vector format and the interface control block (ISTNMICB) format in the “MIBConnect—MIB connection function” on page 56.

The Type column indicates whether the function is synchronous or asynchronous. For a description of these types, see “Synchronous and asynchronous functions” on page 55.

*Table 2. API functions: module entry point, type, and where to find more information*

API function	Module entry point	Type	More information
MIBConnect	ACYAPCNP	Synchronous	Page “MIBConnect—MIB connection function” on page 56
MIBDisconnect	ACYAPD1P	Synchronous	Page “MIBDisconnect—MIB disconnection function” on page 66
MIBSendRegister	ACYAPRGP	Asynchronous	Page “MIBSendRegister—MIB asynchronous registration function” on page 76
MIBSendDeleteRegistration	ACYAPDRP	Asynchronous	Page “MIBSendDeleteRegistration—Deregistration function” on page 74
MIBSendRequest	ACYAPQRP	Asynchronous	Page “MIBSendRequest—MIB queue request function” on page 79
MIBSendCmipRequest	ACYAPQCP	Asynchronous	Page “MIBSendCmipRequest—CMIP request function” on page 68
MIBSendResponse	ACYAPRSP	Asynchronous	Page “MIBSendRequest—MIB queue request function” on page 79
MIBSendCmipResponse	ACYAPCPP	Asynchronous	Page “MIBSendCmipResponse—CMIP response function” on page 71
Data space dequeue routine	N/A	Synchronous	Page “Dequeuing a buffer with the dequeue routine” on page 90
Data space release routine	N/A	Synchronous	Page “Releasing a buffer with the release routine” on page 91

---

## How the functions are coded

The functions are coded in the same format as C language functions. Parameters are positional, and a value must be specified for each parameter to the function. For some parameters, NULL (a pointer with value zero) may be specified instead of some other value. Such parameters might be described as optional input under the Declarations section for each API function.

Parameters are separated by commas. Parameter values must be specified in the format listed in the declarations section.

For example, in the declarations section of the MIBConnect function, the following line indicates that the API level must be specified as an unsigned integer:

```
unsigned int,    /* API level - input                */
```

In the parameter descriptions, the phrase “null-terminated string” means a sequence of EBCDIC characters terminated by a byte containing zero, for example:

```
char *s1 = "Hello";  
char s2[6] = {'H','e','l','l','o','\0'}
```

Refer to the appropriate C language publication for your operating system for more information on operand formats.

---

## How the functions are described

For each function, the following information is included:

- Purpose of the function
- Declarations for the function
- Descriptions of the parameters
- A list of return codes
- An example of how the function is coded in an application program

---

## Completion information

If errors occur in CMIP services while processing a request or response, CMIP services sends a MIB.ServiceError message to the object that originated the request or response.

All of the functions have a return code that should be examined by the application program. A value of zero means that the function was successful. Other values alert the application program to incorrect parameters, resource shortages (for example, memory allocation errors), and other problems.

The return codes for each API function are listed under Return codes in the section for each function.

These return codes are used by VTAM CMIP services and appear in the CMER VIT entry and in messages sent from VTAM CMIP services to the application programs. See *z/OS Communications Server: SNA Diagnosis Vol 2, FFST Dumps* and the VIT for information about the CMER VIT entry.

Table 3 on page 55 shows which VIT entries are for each API function.

Table 3. VIT entries for each API function

API function	VIT entry
MIBConnect	MC01 and MC02
MIBDisconnect	MDIS
MIBSendCmipResponse	MQRS
MIBSendCmipRequest	MQRQ
MIBSendDeleteRegistration	MDEL
MIBSendRegister	MREG
MIBSendResponse	MQRS
MIBSendRequest	MQRQ

---

## Synchronous and asynchronous functions

The return codes from synchronous functions indicate whether the function completed successfully. MIBConnect and MIBDisconnect are synchronous functions.

The return codes from asynchronous functions indicate only whether CMIP services received the request or response. All API functions, except MIBConnect and MIBDisconnect, are asynchronous functions.

All of the API functions that return an invoke identifier are asynchronous functions. The invoke identifier can be used to correlate the response to the original request. A return code of zero from the API function indicates that the request was successfully sent to CMIP services. The confirmation from the target of the request serves as the acknowledgement.

On confirmed requests, the object sending the request receives a MIB.ServiceError message or a CMIP message (ROIvapdu, RORSapdu, or ROERapdu). On unconfirmed requests, the object sending the request receives a MIB.ServiceAccept message or a MIB.ServiceError message.

Because responses are never confirmed, the object sending the response receives a MIB.ServiceAccept message or a MIB.ServiceError message.

Return codes are integers. A value of 0 always indicates success with no errors to report. The actual confirmation or error report is returned by CMIP services by one of the following methods:

- If using CSA storage, information is returned through the read queue exit routine. See “Read queue exit routine for the CSA interface” on page 86 for details.
- If using data space storage, information is returned by calling the dequeue and release routines returned in the data space vector field. For more information about these routines, see Chapter 6, “Dequeue and release routines for data space storage,” on page 89.

---

## MIBConnect—MIB connection function

### Purpose

The MIBConnect function returns a link identifier that is used to refer to the connection in future calls to the API.

The MIBConnect function is a synchronous function. The return code from the MIBConnect function indicates whether the function completed successfully.

The MIBConnect function opens an ACB on behalf of the caller. The ACB is closed when the caller calls the MIBDisconnect function or when the task that called the MIBConnect function terminates. The ACB is not closed when CMIP services terminates or when VTAM terminates.

### Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBConnect_t(  
    unsigned int, /* API level - input */  
    int *, /* link identifier - output */  
    unsigned int, /* maximum outstanding invoke  
                 identifiers - input */  
    const char *, /* application ACB name - input */  
    void *, /* TPEND routine pointer - optional input */  
    void *, /* read queue exit routine pointer - input */  
    unsigned int *, /* SMAE name buffer size - input/output */  
    char *, /* SMAE name buffer - output */  
    unsigned int *, /* System Object name buffer size -  
                  input/output */  
    char *, /* System Object name buffer - output */  
    int, /* user data - input */  
    unsigned int *, /* OPEN ACB error value - output */  
    char **, /* VTAM release level - output */  
    const char *, /* password - optional input */  
    unsigned int, /* data space vector length - optional input */  
    ISTRIV10_t *, /* data space vector - optional input */  
    unsigned int, /* local identifier length - input */  
    unsigned int); /* connection options - input */
```

### Parameters

#### API level

This parameter must be 0.

#### link identifier

MIBConnect returns a value in this field. The application program must provide this value in subsequent API calls.

#### maximum outstanding invoke identifiers

This parameter determines how many unique invoke identifiers can be generated locally by the API. Invoke identifiers are generated on all requests that are sent to CMIP services and can be reused once the response has been received by the requestor. API functions generate and clear invoke identifiers. The caller of the API function does not need to generate or keep track of outstanding invoke identifiers except where needed for its own request/response correlation.

**Note:** Valid values are 256 to 65535. Input values are changed to meet the minimum or maximum range.



**application ACB name**

This parameter is a pointer to a null-terminated string that represents the unique name associated with application. The name must be unique among VTAM resources and must be defined on the APPL definition statement. It must follow the naming rules that apply to application programs that open an ACB.

The following APPL definition statement defines TOPOMGR as the application program's ACB name.

```
TOPOMGR APPL ACBNAME=TOPOMGR
```

See *z/OS Communications Server: SNA Resource Definition Reference* for information about the ACBNAME operand on the APPL definition statement.

**Note:** The value of this parameter is converted to uppercase before being passed to OPEN ACB.

**TPEND routine pointer**

This parameter is the address of an application assembler routine to be called by VTAM if VTAM terminates before the application program terminates or issues the MIBDisconnect function. Specify NULL if you do not wish to provide a termination exit routine.

See *z/OS Communications Server: SNA Programming* for information about the TPEND exit routine.

As with other TPEND exit routines, the application program should clean up in an orderly manner for a normal HALT command. The application program should deregister objects, discard EFDs, and disconnect.

In response to a HALT QUICK or HALT CANCEL command, the application program should not attempt to clean up. It should only issue the MIBDisconnect function.

**Note:** The ACBUSER field are set to the value of the user data parameter supplied on the MIBConnect function when the TPEND exit routine is scheduled.

**read queue exit routine pointer**

This parameter is the address of an application assembler routine to be called by CMIP services when messages are to be received. See Chapter 5, "Read queue exit routine," on page 85 for information about the read queue exit.

**SMAE name buffer size**

This is the size of the buffer provided by the application for the SMAE name. 100 bytes is the recommended size for this buffer.

MIBConnect is set the value to the actual length (including the terminating zero) on output.

If the buffer provided is not long enough, MIBConnect returns the MB\_ERR\_STORAGE\_TOO\_SMALL return code. The application should allocate a new buffer using the updated value of this parameter and call MIBConnect again.

**SMAE name buffer**

MIBConnect places a pattern for building SMAE names in the storage pointed to by this parameter. The application program can use this pattern with the C Standard Library function sprintf to build the name of a SMAE name on this host.

The following example SMAE name format as returned by MIBConnect:

```
1.3.18.0.2.4.6=NETA;2.9.3.2.7.4=(name SSCP1A);1.3.18.0.2.4.12=%s
```

Assuming that format is the name of a character array containing the format string and AE is the name of a character array to hold the resulting SMAE name, the following code will build a SMAE name that could be used for the RegisterAE special CMIP Services request.

```
sprintf(AE,format,"MyApplName");
```

The name of the default SMAE provided by CMIP Services has OSISMASE as the final attribute value in the distinguished name.

#### **System Object name buffer size**

This is the size of the buffer provided by the application for the System Object. The recommended size for this buffer is 100 bytes.

MIBConnect sets the value to the actual length (including the terminating zero) on output.

If the buffer provided is not long enough, MIBConnect returns MB\_ERR\_STORAGE\_TOO\_SMALL. The application program should then allocate a new buffer using the updated value of this parameter and call MIBConnect again.

#### **System Object name buffer**

MIBConnect places the name of the System Object into this buffer.

The System Object name should be used when creating local EFDs; EFDs are named "under" the System Object.

#### **user data**

This four-byte field is provided to the application program on entry to the read queue and to the TPEND exit routines.

#### **OPEN ACB error value**

When control is returned to the application program and the return code is MB\_ERR\_CONNECT, the OPEN ACB error value parameter needs to be evaluated.

The following list shows the OPEN ACB error values returned in the OPEN ACB error value parameter.

#### **ERROR Field**

##### **Meaning**

**0 (X'00')**

OPEN successfully opened this ACB.

**4 (X'04')**

The ACB has been opened.

**20 (X'14')**

OPEN cannot be processed because of a temporary shortage of storage.

**36 (X'24')**

The OPEN ACB failed for one of the following reasons:

- The password specified by the ACB did not match the corresponding password in the APPL entry.
- The ACB did not specify a password and the APPL contains one.
- The security management product determined that the user is not authorized to open the ACB.

**70 (X'46')**

OPEN was issued in an exit routine.

**80 (X'50')**

VTAM has not been included as part of the operating system. The fault lies in the system definition procedures.

**82 (X'52')**

VTAM is included as part of the operating system, but the VTAM operator issued a HALT command, and VTAM has shut down. You cannot attempt to establish a session or communicate with any LUs.

**84 (X'54')**

Either the address supplied in the ACB's APPLID field lies beyond the addressable range of your application program, or no entry is found in the VTAM configuration tables that matches the name indicated by the ACB's APPLID field (or supplied by the operating system). If the OPEN macroinstruction is specified correctly, your system programmer might have:

- Failed to include your application program's symbolic name during VTAM definition
- Improperly handled the symbolic name

Refer to the description of the APPLID operand in the ACB macroinstruction.

**86 (X'56')**

A match for your application program's symbolic name is found, but it is for an entry other than an APPL. If you specified this name in the ACB's APPLID field, verify that you have the correct name and handled this name properly (see the APPLID operand of the ACB macroinstruction). If the symbolic name is supplied by the operating system, the supplied name is suspect.

**88 (X'58')**

Another ACB, already opened by VTAM, indicates the same application program symbolic name that this ACB does. The system programmer might have assigned the same symbolic name to two application programs. This is valid only if the programs are not open concurrently. Possibly the system operator initiated your program at the wrong time.

**90 (X'5A')**

No entry is found in the VTAM configuration tables that matches the name indicated by the ACB's APPLID field (or supplied by the operating system). This error might have occurred for one of the following reasons:

- The VTAM operator deactivated the APPL entry.
- The APPL entry was never created.
- If VTAM is trying to recover for persistent sessions, the application is not in pending recovery state.

**92 (X'5C')**

VTAM is included as part of the operating system but inactive.

**94 (X'5E')**

The address supplied in the ACB's APPLID field lies beyond the addressable range of your application program.

- 95 (X'5F')**  
The VTAM transient being used by the application for an OPEN ACB does not match the level of VTAM.
- 96 (X'60')**  
An apparent system error occurred. Either there is a logic error in VTAM, or there is an error in your use of OPEN or CLOSE that VTAM did not properly detect. Save all applicable program listings and storage dumps, and consult IBM Service.
- 98 (X'62')**  
The APPLID length byte is incorrectly specified.
- 100 (X'64')**  
The address supplied in the ACB's PASSWD field lies beyond the addressable range of your application program.
- 102 (X'66')**  
The PASSWD length byte is incorrectly specified.
- 104 (X'68')**  
The APPLID field in the ACB identifies an application program that is defined with AUTH=PPO in its APPL definition statement. Another program with the same authorization is active. Only one program defined with AUTH=PPO can be active at a time.
- 106 (X'6A')**  
The address supplied in the ACB's vector list field lies beyond the addressable range of your application program.
- 108 (X'6C')**  
The VTAM ACB vector list length byte is incorrectly specified.
- 112 (X'70')**  
You attempted to open an ACB that is in the process of being closed. This can occur when a VTAM application program job step or subtask is canceled or terminates abnormally. The process of closing the ACB can continue after the job step or subtask has actually terminated. Subsequently, if the job step is restarted or the subtask is reattached before the ACB closing process has been completed, an OPEN macroinstruction that is then issued for that ACB fails.
- 114 (X'72')**  
This code occurs when an OPEN ACB fails for an LU 6.2 application with VERIFY=OPTIONAL or VERIFY=REQUIRED for one of the following reasons:
- The security management product is not installed.
  - The security management product is not active.
  - The security management product resource class APPCLU is not active.
  - The application represented by the ACB is not in the security management product Started Procedures Table.
- 116 (X'74')**  
VTAM rejected the takeover by an alternate application because the original application did not enable persistence, although it is capable of persistence.
- 118 (X'76')**  
OPEN failed because the specified application is in a recovery pending

state and PERSIST=YES is not specified on the ACB that is being opened. The OPEN may also fail if the application is in pending terminate state and an active CDRSC with the same name has been found in the sysplex.

**120 (X'78')**

ACB option mismatch between original application and opening takeover or recovery application. One or more of the following can apply:

- MACRF mismatch—both values must be either LOGON or NLOGON; they cannot differ.
- NQNAMES mismatch—both applications must be specified as NQNAMES=YES or NQNAMES=NO; they cannot differ.
- PERSIST mismatch—both applications must be specified as PERSIST=YES.
- FDX mismatch—both applications must be specified as FDX=YES or FDX=NO; they cannot differ.
- ISTVAC81 mismatch—the application capabilities vector provided by the recovering application does not match that of the original application.

**140 (X'8C')**

PERFMON=YES is coded on the ACB but the application is not CNM and POA authorized.

**188 (X'BC')**

The ACB is in the process of being opened or closed by another request.

**244 (X'F4')**

The application program is not authorized for SRBEXIT=YES. A request to open an ACB whose corresponding APPL definition statement specifies SRBEXIT=YES is rejected unless the application program is APF authorized, or using key 0-7, or in supervisor state.

**246 (X'F6')**

NIB storage address not valid. A CNM authorized application program either failed to supply an NIB pointer in the NIB field of the ACB, or the NIB address supplied lies beyond the addressable range of the application program.

**250 (X'FA')**

NIB options not valid. Either an application program without CNM authorization (specified in its associated VTAM resource definition) supplied an NIB pointer in its ACB; or, if CNM authorized, the application program failed to supply valid NIB options on the NIB macroinstruction.

**254 (X'FE')**

Duplicate unsolicited RU routing requested. The CNM routing table indicated that this application program was to receive the same unsolicited formatted requests that were already being routed to another active CNM authorized application program. Only one application program can be actively receiving a particular type of RU (for example, RECFMS) at a time.

### **VTAM release level**

Indicates the address of VTAM release-level vector. See z/OS Communications Server: SNA Programming for more information about the format of this vector.

### **password**

Specifies a pointer to a null-terminated string. The application program should specify NULL if no password is to be supplied. If a password is specified on PRTCT operand of the APPL definition statement, MIBConnect fails unless a matching password is provided in the password parameter. Password protection is to prevent a program from running as a predefined application program without authorization.

The value of the password is specified on the PRTCT operand of the APPL definition statement. The value must conform to the rules for coding this operand described in the z/OS Communications Server: SNA Resource Definition Reference. The maximum length is 8 bytes. Valid passwords contain only alphanumeric characters.

If application program's ACB name is TOPOMGR, the APPL definition statement with a password is similar to the following example:

```
TOPOMGR APPL ACBNAME=TOPOMGR,PRTCT=password
```

**Note:** The value of this parameter is converted to uppercase before being passed to OPEN ACB. This is because VTAM converts the related definition to uppercase but does not convert OPEN ACB parameters to uppercase. Without the conversion to uppercase by MIBConnect, this function would fail if the application provided a lowercase value for this parameter.

### **data space vector length**

If using data space storage, specify a value that is at least the size of (ISTRIV10\_t), which is the length of the data space vector. If you are using common storage area storage, specify 0. For an explanation of these types of storage, see "Common storage area storage or data space storage?" on page 41.

### **data space vector**

If you are using data space storage, specify the address of the data space vector (ISTRIV10\_t). If you are using the CSA interface, specify NULL. If the MIBConnect function is successful, the fields in this control block are set by VTAM.

The format of the data space vector is:

#### **Offset Meaning**

**0 (X'00')**

Vector Length

**1 (X'01')**

Vector identifier = X'10'

**2 (X'02')**

Name of data space. (The field is 8 bytes long.)

**10 (X'0A')**

Address of interface control block (ISTNMICB)

**14 (X'0E')**

STOKEN for data space interface. This value is used in ALESERV MVS macro to obtain the ALET value.

22 (X'16')  
Reserved

26 (X'1A')  
Address of the dequeue routine

30 (X'1E')  
Address of the release routine

The ISTNMICB structure is allocated in the data space. The user application must copy this structure into private storage for any future references because the data space can be deleted at any time if VTAM is terminated. Referring to the original after the data space has been deleted results in an abend. By contrast, calling the dequeue and release routines using private copies of their addresses causes an error indication to be returned. It is not valid to refer directly to the data space through a means other than the dequeue or release routine. Those routines should not be called after VTAM is terminated or after issuing the MBDDisconnect function.

The format of the interface control block (ISTNMICB) is:

**Offset Meaning**

0 (X'00')  
Reserved

4 (X'04')  
Address of the dequeue routine

8 (X'08')  
Address of the release routine

**local identifier length**

Indicates the size of the local identifiers for this application program. The range is 1—8.

**connection options**

Specify one of the following values:

**NO\_CONNECT\_OPTIONS**

Indicates that the application program is to use default behaviors for the connection with CMIP services.

**SHORT\_NAMES**

Indicates that CMIP services is to send distinguished names to the application program in the short form. Otherwise, CMIP services sends distinguished names to the application program in the long form. In either case, the application program can format distinguished names in strings sent through the API functions in either short or long form.

For a description of short and long names, see “What form of distinguished name?” on page 44.

**Return codes**

0 The MIBConnect function was successful, but warning messages might have been issued. Check the OPEN ACB error value parameter for warning messages.

See the list of OPEN ACB error values on 58.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding

REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_ERR\_CONNECT**

The MIBConnect was not successful. If the error condition indicated by the OPEN ACB error value parameter can be eliminated, another MIBConnect can be issued.

**MB\_ERR\_INVALID\_DS\_VECTOR**

The value specified for the data space vector length parameter is valid, but the data space vector parameter is not provided.

**MB\_ERR\_INVALID\_API\_LEVEL**

An incorrect value for the API level parameter was passed.

**MB\_ERR\_INVALID\_APPL\_NAME**

The value specified for the application name parameter is longer than 8 characters.

**MB\_ERR\_INVALID\_CONNECT\_OPTIONS**

The value specified on the connection options parameter is not valid. Specify either NO\_CONNECT\_OPTIONS or SHORT\_NAMES as the value for the connection options parameter.

**MB\_ERR\_INVALID\_DS\_VECTOR\_SIZE**

If the data space vector parameter is specified, the data space vector length must be at least the size of (ISTRIV10\_t), which is the length of the data space vector.

**MB\_ERR\_INVALID\_ENVIRONMENT**

Data space storage was specified on the data space vector length parameter, but the environment does not support data spaces.

**MB\_ERR\_INVALID\_ERROR\_FLAG**

The OPEN ACB error value parameter does not point to a valid storage location.

**MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

**MB\_ERR\_INVALID\_LOCAL\_ID\_SIZE**

The value specified on the local identifier length parameter is outside the acceptable range of 1–8.

**MB\_ERR\_INVALID\_MAX\_INVOKE\_IDS**

The value specified for the maximum outstanding requests parameter is not valid.

**MB\_ERR\_INVALID\_PASSWORD**

The value specified for the password parameter is not between 0 and 8 characters.

**MB\_ERR\_INVALID\_READ\_QUEUE\_EXIT**

The read queue exit routine was not provided.



**MB\_ERR\_INVALID\_RELEASE\_LEVEL**

The value specified for the VTAM release level parameter is not valid.

**MB\_ERR\_INVALID\_SMAE\_NAME**

The value specified for the SMAE name buffer parameter is not valid.

**MB\_ERR\_INVALID\_SMAE\_NAME\_SIZE**

The buffer sent to the MIBConnect function is too small to accommodate the name of the SMAE. The actual amount of storage required is returned in the SMAE name length parameter.

**MB\_ERR\_INVALID\_SYSTEM\_NAME**

The value specified for the system object name buffer parameter is not valid.

**MB\_ERR\_INVALID\_SYSTEM\_NAME\_SIZE**

The buffer sent to the MIBConnect function is too small to accommodate the name of the system object. The actual amount of storage required is returned in the system object name buffer size parameter.

**MB\_ERR\_INVALID\_TPEND\_EXIT**

The TPEND exit routine is not valid.

**MB\_ERR\_INVALID\_USER\_DATA**

The user data parameter was not provided.

**MB\_ERR\_VTAM\_INACTIVE**

VTAM is inactive.

**Example of function in an application program**

The following example shows how the MIBConnect function can be coded in an application program.

```
typedef struct ReadQueueExitData_tag
{
    int ECB;
    int ReasonCode;
    char Buffer ??(16384??);
} ReadQueueExitData_t;

typedef void *LocalId_t;

char SMAE                ??(100??);
char SystemObject        ??(100??);
char *VTAM_Release;
const char *App1Name;
const char *Password;
int LinkId;
int rc;
ReadQueueExitData_t ReadQueueExitData;
size_t SMAE_Size, SystemObjectSize;
unsigned int ACB_Info;
extern void ACYCMS2A(void);
extern void ACYCMS6A(void);

rc = APIs.MIBConnect(0,          /* always zero for this release */
                    &LinkId,    /* MIBConnect will fill in LinkId
                               with a handle to the
                               connection. */
                    65536,      /* maximum number of outstanding
                               requests */
                    App1Name,   /* ACB name */
                    (void *)ACYCMS6A, /* TPEND exit */
                    (void *)ACYCMS2A, /* address of the Read
```

```

Queue Exit */
&SMAE_Size, /* On input, this is the size of
             the SMAE buffer. On output,
             this is the length of the SMAE
             name. */
SMAE, /* This is where MIBConnect will
       store the SMAE name (if there
       is enough room). */
&SystemObjectSize, /* On input, this is the
                    size of the System Object
                    name buffer. On output, this is the
                    length of the System Object
                    name. */
SystemObject, /* This is where MIBConnect will
              store the System Object name
              (if there is enough room). */
(int)&ReadQueueExitData, /* This will be provided
                        to this application's read
                        queue exit by CMIP Services. */
&ACB_Info, /* If an error occurs opening the
            ACB, this will contain the
            OPEN ACB error code. */
&VTAM_Release, /* MIBConnect will store the
                address of the VTAM release
                level here. */
Password, /* ACB password */
0, /* dataspace not used */
NULL, /* dataspace not used */
sizeof(LocalId_t), /* size of local ids
                  for all objects registered by
                  this application */
0); /* no special options specified */

```

---

## MIBDisconnect—MIB disconnection function

### Purpose

The MIB disconnection function sends a message to the API to terminate the session and clear all outstanding requests on the connection. There might be many objects registered under one MIB connection and all outstanding requests for those objects are cleared by the MIB disconnect service. The application program using the CMIP services connection should not terminate the connection unless all outstanding requests might be lost without damage to the registered objects.

MIBDisconnect is a synchronous service. The return code from the MIBDisconnect function indicates whether the function completed successfully.

If you want to call a MIBConnect function with the same application ACB name as the ACB name used on a previous MIBConnect function, you must call the MIBDisconnect function before calling the MIBConnect function.

The MIBConnect function opens an ACB on behalf of the caller. The ACB is closed when the caller calls the MIBDisconnect function or when the task that called the MIBConnect function terminates. The ACB is not closed when CMIP services terminates or when VTAM terminates.

If using data space storage, the data space is freed by VTAM. The application program must not call the data space storage dequeue and release routines after it calls the MIBDisconnect function, because the results are unpredictable and the application program might abend.

## Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBDisconnect_t(  
    int, /* link identifier - input */  
    unsigned int *); /* CLOSE ACB error value - output */
```

## Parameters

### link identifier

Specifies the link identifier returned by the MIBConnect function.

### CLOSE ACB error value

When control is returned to the application program and the return code is MB\_ERR\_MIBDISCONNECT, this flag needs to be evaluated.

The following list shows the CLOSE ACB error values returned in the CLOSE ACB error value parameter.

### ERROR Field

#### Meaning

#### 0 (X'00')

CLOSE successfully closed the ACB.

#### 4 (X'04')

A CLOSE macroinstruction has been successfully issued for this ACB (or the ACB has never been opened in the first place).

#### 20 (X'14')

CLOSE cannot be processed because of a temporary shortage of storage.

#### 64 (X'40')

Outstanding OPNDST OPTCD=ACQUIRE is not released.

#### 66 (X'42')

The ACB has been closed, but an apparent system error has prevented the successful termination of one or more of the sessions that the application program has. There is a logic error in VTAM; consult IBM Service. The LUs that have not had their sessions terminated are not available to other application programs, and LUs with which you were requesting a session when the CLOSE macroinstruction was issued are likewise unavailable. You can notify the VTAM operator (while the program is running) of the situation so that the operator can make the LUs available to other application programs.

#### 70 (X'46')

CLOSE was not issued in the mainline program. OPEN and CLOSE cannot be issued in any exit routine.

#### 76 (X'4C')

This application program is authorized to issue VTAM operator commands and receive VTAM messages. A CLOSE was issued, but messages are still queued for it, or VTAM is waiting for a reply, or both. See z/OS Communications Server: SNA Programming for more information.

#### 80 (X'50')

VTAM is no longer included as part of the operating system.

#### 96 (X'60')

An apparent system error occurred. Either there is a logic error in

VTAM; or there is an error in your use of OPEN or CLOSE that VTAM did not properly detect. Save all applicable program listings and storage dumps, and consult IBM Service.

**112 (X'70')**

CLOSE was issued while the program was in the process of terminating abnormally. The CLOSE is not necessary because the ACB is closed by VTAM when the task terminates.

**188 (X'BC')**

The ACB is in the process of being opened or is in the process of being closed by another request.

## Return codes

**0** The MIBDisconnect was successful, but warning messages might have been issued. Check the CLOSE ACB error value parameter for warning messages.

See the list of CLOSE ACB error values on page 67.

### **MB\_ERR\_MIBDISCONNECT**

The MIBDisconnect function was not successful. If the error condition indicated by the CLOSE ACB error value parameter can be eliminated, another MIBDisconnect can be issued.

### **MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

### **MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

### **MB\_ERR\_INVALID\_ERROR\_FLAG**

The CLOSE ACB error value parameter does not point to a valid storage location.

## Example of function in an application program

The following example shows how the MIBDisconnect function can be coded in an application program.

```
int LinkId;
int rc;
unsigned int ACB_Info;

rc = APIs.MIBDisconnect(LinkId, /* This is the handle returned by
                               MIBDisconnect. */
                       &ACB_Info); /* If an error occurs closing the
                               ACB, MIBDisconnect will store
                               the CLOSE ACB error code here.*/
```

---

## MIBSendCmipRequest—CMIP request function

### Purpose

Use this function when an application program or object is sending a CMIP request.

The MIBSendCmipRequest function queues a request to CMIP services. Use the MIBSendCmipRequest function for CMIP requests instead of the MIBSendRequest function, to allow consistent manipulation of messages.

## Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBSendCmipRequest_t(  
    int,                /* link identifier - input    */  
    unsigned int,       /* argument type - input     */  
    const char *,       /* argument - input          */  
    const void *,       /* local identifier - input  */  
    const char *,       /* source - input            */  
    unsigned int,       /* destination type - input  */  
    const char *,       /* destination - input       */  
    unsigned int *);    /* returned invoke identifier -  
                        output */
```

## Parameters

### link identifier

Specifies the link identifier returned by the MIBConnect function.

### argument type

This should be the CMIP operation value of the operation being requested.

The operation values are given in ACYIDCMS.

### argument

This null-terminated string contains the bulk of the request. The ASN.1 type is determined by the CMIP operation value of the request, and is found in the ANY DEFINED BY table for the operation value in ACYIDCMS.

### local identifier

Pointer to the local identifier of the object that generated this request. The same local identifier appears in a subsequent response.

### source

The distinguished name of the originator of the request. This can be used to override the source of the message. This is used to resolve any appearance of the MIB variable distinguished name. Specify NULL if you do not choose to specify a value.

### destination type

This specifies the type of destination data that is being proved in the destination argument. The valid values are DS\_NOT\_PROVIDED, DS\_FULL\_DN, DS\_ASSOC\_HANDLE, and DS\_AE\_TITLE.

If this field is set to DS\_NOT\_PROVIDED, then the stack uses the object name in the CMIP parameter as the destination object name.

### destination

This specifies the destination of a CMIP string. Specify NULL if the destination type parameter is DS\_NOT\_PROVIDED. Otherwise, specify the pointer to a distinguished name, association handle, or application entity title.

### returned invoke identifier

Specifies the invoke identifier. The invoke identifier is used to correlate this request with a response that arrives subsequently.

## Return codes

0        The function was successful.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

**MB\_ERR\_INVALID\_ARGUMENT**

The argument parameter was not provided.

**MB\_ERR\_INVALID\_ARGUMENT\_TYPE**

An incorrect argument type parameter was provided.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_WARN\_DATA\_SPACE\_FULL**

If using a data space and the data space is out of storage, this warning is returned to remind the application program that no messages will be returned to this application program. This message will still be routed to CMIP services.

**MB\_ERR\_INVALID\_DEST**

The value of the destination parameter is inconsistent with the value of the destination type parameter. This return code is returned if, for example, destination type is DS\_ASSOC\_HANDLE, but destination is NULL.

**MB\_ERR\_INVALID\_DEST\_TYPE**

An incorrect destination type parameter was passed.

**MB\_WARN\_EXIT\_FAILURE**

If using common storage area storage and the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine, this warning is returned to remind the application program that no messages will be returned to the application program. This message will still be routed to CMIP services.

**MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

**MB\_ERR\_INVALID\_INVOKE\_ID**

The invoke identifier parameter was not provided.

**MB\_ERR\_LOCAL\_ID\_MISSING**

A local identifier was not provided.

**MB\_ERR\_INVALID\_MAX\_INVOKE\_IDS**

The value specified for the maximum outstanding requests parameter is not valid.

**MB\_ERR\_MSG\_MISSING**

The message parameter was not provided.

**MB\_ERR\_TRANSMIT**

An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

**MB\_ERR\_VTAM\_INACTIVE**

VTAM is inactive.

## Example of function in an application program

The following example shows how the MIBSendCmipRequest function can be coded in an application program.

```
char CMIP_StringArgument ??(512??);
int LinkId;
int rc;
LocalId_t *MyObjectId;
unsigned int InvokeId;

rc = APIs.MIBSendCmipRequest(LinkId, /* handle returned by
                                MIBConnect          */
                             3,      /* operation value is GET  */
                             CMIP_StringArgument,
                             &MyObjectId,
                             NULL,
                             DS_NOT_PROVIDED,
                             NULL,
                             &InvokeId);
```

---

## MIBSendCmipResponse—CMIP response function

### Purpose

Use this function when an application program or object is sending a CMIP response. MIBSendCmipResponse queues responses to CMIP services associated with requests that were previously received by the application program from CMIP services.

### Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBSendCmipResponse_t(
    int, /* link identifier - input */
    unsigned int, /* invoke identifier - input */
    unsigned int, /* last in chain - input */
    unsigned int, /* success - input */
    unsigned int, /* argument type - input */
    const char *, /* argument - input */
    const void *, /* local identifier input */
    const char *, /* source - input */
    const char *, /* association handle - input */
    unsigned int *); /* returned invoke identifier -
                    output */
```

### Parameters

#### link identifier

Specifies the link identifier returned by the MIBConnect function.

#### invoke identifier

This is the invoke identifier of the request which is being responded to with this API call.

#### last in chain

This indicates to CMIP services whether this message is the last response that is generated by this application program for this request. This allows CMIP services to construct the correct message (linked reply or response). A nonzero value indicates that the response is the last in a chain of responses (RORSapdu or ROERapdu). A zero value indicates that the response is not the last in a chain of responses (ROIVapdu—linked reply).

**success**

This indicates whether the response is positive or negative. This indicates to CMIP services how to interpret the next parameter. A nonzero value indicates that the response represents a positive, successful response. A zero value indicates that the response is negative.

**Note:** If the last in chain parameter is zero, the success parameter must be nonzero. A linked reply cannot be sent as an error.

**argument type**

For linked-replies (messages with the last in chain parameter set to zero), this should be two, the CMIP operation value for a linked-reply.

For RORSapdu messages, this should be the CMIP operation value of the operation being responded to.

For ROERapdu messages, this should be the CMIP error value.

The operation values and error values are given in ACYIDCMS.

**argument**

This null-terminated string contains the bulk of the CMIP string which is built by CMIP services, on behalf of the application program, for this API function.

For ROIVapdu messages (when the last in chain parameter is zero), this string is used for the value of the argument parameter.

For RORSapdu messages (when the last in chain parameter is nonzero and the success parameter is nonzero), this string is used for the value of the result parameter.

For ROERapdu messages (when the last in chain parameter is nonzero and the success parameter is zero), this string is used for the value of the parameter.

**local identifier**

Pointer to the local identifier of the object that is responding. Specify the same identifier as the one specified in the request.

**source**

The distinguished name of the originator of the request. This can be used to override the source of the message. This is used to resolve any appearance of the MIB variable distinguished name. Specify NULL if you do not choose to specify a value.

**association handle**

This is the association identifier of the association that is to be used to send the response. It is required and must be the same as the association handle that was received on the message that is being answered.

**returned invoke identifier**

Specifies the invoke identifier. The invoke identifier is used to correlate this request with a response that arrives subsequently. This will be filled in only for linked replies. For linked replies, the last in chain parameter is zero.

**Return codes**

**0** The function was successful.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.



**MB\_ERR\_ARGUMENT\_MISSING**

The argument parameter was not provided.

**MB\_ERR\_ARGUMENT\_TYPE\_MISSING**

An argument type parameter was not provided.

**MB\_ERR\_ARGUMENT\_TYPE\_INVALID**

An incorrect argument type parameter was provided.

**MB\_ERR\_ASSOC\_HANDLE\_MISSING**

The association handle parameter was not provided.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_WARN\_DATA\_SPACE\_FULL**

If using a data space and the data space is out of storage, this warning is returned to remind the application program that no messages will be returned to this application program. This message will still be routed to CMIP services.

**MB\_ERR\_DEST\_TYPE\_INVALID**

An incorrect destination type parameter was passed.

**MB\_WARN\_EXIT\_FAILURE**

If using common storage area storage and the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine, this warning is returned to remind the application program that no messages will be returned to the application program. This message will still be routed to CMIP services.

**MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

**MB\_ERR\_INVOKEID\_MISSING**

The invoke identifier parameter was not provided.

**MB\_ERR\_LAST\_IN\_CHAIN\_MISSING**

The last in chain parameter was not provided.

**MB\_ERR\_LOCAL\_ID\_MISSING**

A local identifier was not provided.

**MB\_ERR\_MAX\_OUTSTANDING**

The value specified for the maximum outstanding requests parameter is not valid.

**MB\_ERR\_SUCCESS\_MISSING**

The success argument parameter was not provided.

**MB\_ERR\_TRANSMIT**

An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

**MB\_ERR\_VTAM\_INACTIVE**

VTAM is inactive.

## Example of function in an application program

The following example shows how the MIBSendCmipResponse function can be coded in an application program.

```
#include "acyaphdh"

#define FALSE 0
#define TRUE 1

extern void *MyLocalId_ptr;
int rc;
int LinkId;
unsigned int InvokeId;
MIBSendCmipResponse_t *MIBSendCmipResponse;

/*****
/* Send accessDenied ROERapdu. */
*****/

rc = MIBSendCmipResponse(LinkId,
                          InvokeId, /* the invoke identifier from the request */
                          TRUE,     /* last in chain (not linked reply) */
                          FALSE,    /* not successful (i.e., ROERapdu) */
                          7,
                          "(invokeID 1179660, error-value 2)",
                          MyLocalId_ptr,
                          NULL,
                          "a1", /* association handle of the request
                                being answered */
                          NULL); /* no new invoke identifier since
                                last-in-chain is TRUE */
```

---

## MIBSendDeleteRegistration—Deregistration function

### Purpose

The MIBSendDeleteRegistration deletes a registered object. Any objects registered under the object being deleted are also deleted. An object's registration can be removed by local identifier or by distinguished name. Only one of them is required. Both can be provided.

A non-NULL value in the distinguished name parameter indicates that a valid distinguished name was provided.

### Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBSendDeleteRegistration_t(
    int, /* link identifier - input */
    unsigned int *, /* returned invoke
                    identifier - output */
    const void *, /* local identifier - optional
                  input */
    const char *); /* distinguished name - optional
                  input */
```

### Parameters

#### link identifier

Specifies the link identifier returned by the MIBConnect function.

**returned invoke identifier**

Specifies the invoke identifier. The invoke identifier is used to correlate this request with a response that arrives subsequently.

**local identifier**

Pointer to the local identifier of the object that is to be deleted. Specify NULL for the local identifier parameter if only the distinguished name is provided.

**distinguished name**

This is the distinguished name of the object instance being deleted. If you provide a local identifier, the distinguished name is optional. Specify NULL if you do not provide a distinguished name.

If you specify a name for this parameter, CMIP services uses the name to look up the object instance to be deleted or to verify that the object instance selected with the local identifier has a matching name.

**Return codes**

0 The function was successful.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_WARN\_DATA\_SPACE\_FULL**

If using a data space and the data space is out of storage, this warning is returned to remind the application program that no messages will be returned to this application program. This message will still be routed to CMIP services.

**MB\_WARN\_EXIT\_FAILURE**

If using common storage area storage and the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine, this warning is returned to remind the application program that no messages will be returned to the application program. This message will still be routed to CMIP services.

**MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

**MB\_ERR\_TRANSMIT**

An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

**MB\_ERR\_VTAM\_INACTIVE**

VTAM is inactive.

## Example of function in an application program

The following example shows how the MIBSendDeleteRegistration function can be coded in an application program.

```
#include "acyaphdh.h"

int rc;
int LinkId;
MIBSendDeleteRegistration_t *MIBSendDeleteRegistration;

/*****
/* Delete a registration for the object with local      */
/* identifier MyLocalId.                               */
*****/

rc = MIBSendDeleteRegistration(LinkId,
                               &InvokeId,
                               &MyLocalId,
                               NULL);
```

---

## MIBSendRegister—MIB asynchronous registration function

### Purpose

The MIB registration function must be called at least once in order for an application to access CMIP services or receive unsolicited messages. The MIB registration function can be called many times on any given MIB connection. For each call to the MIB registration function a unique local identifier must be provided by the caller. The local identifier can be used to distribute messages to the appropriate objects as they arrive over the connection. Because the local identifier must be provided on the registration call, it could be a pointer to a control block that could be directly referred to from the API header. The application program might also provide a handle for secondary routing. The size of the local identifiers is specified on the local identifier length parameter of the MIBConnect function.

A registered object can be a create handler for zero or more object classes. In other words, it can be responsible for handling CMIP create requests for instances of certain classes.

An application program specifies this property for an object by providing a list of classes on the call to MIBSendRegister when registering the object that is a create handler.

The responsibilities of a create handler are described in “Create handlers” on page 14, which describes create processing.

A registered object is an instance of one specific object class. However, it can act like an instance of other classes if appropriate. Allomorphy is the term used to describe an object which can act like an instance of more than one class. The usual reason for allomorphy is when an object acts like an instance of the classes of which its class is a subclass.

An application program specifies this property for an object by providing a list of classes on the call to MIBSendRegister when registering the object which acts allomorphic to other classes.

A response will be generated by CMIP services for each call to the CMIP services registration function. The invoke identifier field in the API header can be used to correlate the response to the initial registration request. The response can be of two possible types. If the registration was successful the response is of type MIB.RegisterAccept, otherwise the response is of type MIB.ServiceError.

The application program must correlate the response from CMIP services to the registration request, using the invoke identifier, and determine by the message type in the API header whether or not the registration completed successfully.

## Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBSendRegister_t(
    int, /* link identifier - input */
    unsigned int *, /* returned invoke identifier -
        output */
    const void *, /* local identifier - input */
    const char *, /* object class - input */
    int, /* name type - input */
    const char *, /* distinguished name - input */
    const char *, /* name binding object
        identifier - input */
    unsigned int, /* capability flags - input */
    unsigned int, /* allomorphs count - input */
    char **, /* allomorphs array - input */
    unsigned int, /* create handlers count - input */
    char **); /* create handlers array - input */
```

## Parameters

### link identifier

Specifies the link identifier returned by the MIBConnect function.

### returned invoke identifier

Specifies the invoke identifier. The invoke identifier is used to correlate this request with a response that arrives subsequently.

### local identifier

Pointer to the local identifier of the object that is to be registered. Specify NULL for the local identifier parameter if only the distinguished name is provided.

### object class

This parameter is the registered class of the object being registered. The class is required on all registration calls.

### name type

This must be DN\_OF\_INSTANCE.

### distinguished name

This is the distinguished name of the object instance being registered. To use the distinguished name in future calls to CMIP services, the &DN MIB variable can be used to refer to the distinguished name associated with the object instance (see "MIB variable format" on page 96).

### name binding object identifier

This is the object identifier for the name binding to be used. If NULL is specified for this parameter, CMIP services chooses a name binding.

### capability flags

A parameter used to specify special properties of the object being registered.

The value should be NO\_CAPABILITIES if no special properties are desired or SUBTREE\_MANAGER if the object being registered should be a manager of the subtree with its distinguished name as the root.

**allomorphs count**

This is the number of classes to which this object is allomorphic.

**allomorphs array**

This is an array of pointers to character strings, each of which is the object identifier of a class to which this object is allomorphic.

**create handlers count**

This is the number of classes for which this object is a create handler.

**create handlers array**

This is an array of pointers to character strings, each of which is the object identifier of a class for which this object is a create handler.

**Return codes**

0 The function was successful.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

**MB\_ERR\_INVALID\_CAPABILITY\_FLAGS**

The value specified for the capability flags parameter is not valid.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_ERR\_DISTINGUISHED\_MISSING**

The distinguished name parameter was not provided.

**MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

**MB\_ERR\_INVALID\_INVOKE\_ID**

The invoke identifier parameter was not provided.

**MB\_ERR\_LOCAL\_ID\_MISSING**

A local identifier was not provided.

**MB\_ERR\_MAX\_OUTSTANDING**

The value specified for the maximum outstanding requests parameter is not valid.

**MB\_ERR\_NOT\_REGISTERED**

For common storage area storage, the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine or that the data space is out of storage. The registration will not be allowed.

**MB\_ERR\_OBJECT\_CLASS\_MISSING**

The object class name parameter was not provided.

## MB\_ERR\_TRANSMIT

An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

## MB\_ERR\_VTAM\_INACTIVE

VTAM is inactive.

## Example of function in an application program

The following example shows how the MIBSendRegister function can be coded in an application program.

```
char MyObjectName      ??(120??);
int LinkId;
int rc;
LocalId_t *MyObjectId;
unsigned int InvokeId;

rc = APIs.MIBSendRegister(LinkId, /* This is the handle returned by
                                   MIBConnect. */
                          &InvokeId, /* MIBSendRegister will store an
                                   invoke id, or correlator, for
                                   the registration request here.*/
                          &MyObjectId, /* This is the address of
                                   the local id to be associated
                                   with this object. */
                          "1.3.18.0.0.2155", /* This is the object
                                   class of this object. */
                          DN_OF_INSTANCE, /* This parameter must
                                   have this value. */
                          MyObjectName, /* This is the distinguished
                                   name of this object. */
                          NULL, /* Use default name binding. */
                          0, /* no special capabilities */
                          0, /* no allomorpha */
                          NULL, /* no allomorpha */
                          0, /* not a create handler for any
                                   class */
                          NULL); /* not a create handler */
```

---

## MIBSendRequest—MIB queue request function

### Purpose

Use this function when an application program needs to send VTAM-specific requests. For a list of these requests, see Chapter 10, “VTAM-specific requests and responses,” on page 133.

### Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBSendRequest_t(
    int, /* link identifier - input */
    unsigned int *, /* returned invoke identifier -
                    output */
    const void *, /* local identifier - input */
    const char *); /* message - input */
```

### Parameters

#### link identifier

Specifies the link identifier returned by the MIBConnect function.

**returned invoke identifier**

Specifies the invoke identifier. The invoke identifier is used to correlate this request with a response that arrives subsequently.

**local identifier**

Pointer to the local identifier of the object that is issuing the request.

**message**

This is a pointer to a formatted string which contains the string header and the request data.

**Return codes**

0 The function was successful.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_WARN\_DATA\_SPACE\_FULL**

If using a data space and the data space is out of storage, this warning is returned to remind the application program that no messages will be returned to this application program. This message will still be routed to CMIP services.

**MB\_WARN\_EXIT\_FAILURE**

If using common storage area storage and the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine, this warning is returned to remind the application program that no messages will be returned to the application program. This message will still be routed to CMIP services.

**MB\_ERR\_INVALID\_INVOKE\_ID**

The invoke identifier parameter was not provided.

**MB\_ERR\_LOCAL\_ID\_MISSING**

A local identifier was not provided.

**MB\_ERR\_INVALID\_MAX\_INVOKE\_IDS**

The value specified for the maximum outstanding requests parameter is not valid.

**MB\_ERR\_MSG\_MISSING**

The message parameter was not provided.

**MB\_ERR\_TRANSMIT**

An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

**MB\_ERR\_VTAM\_INACTIVE**

VTAM is inactive.



## Example of function in an application program

The following example shows how the MIBSendRequest function can be coded in an application program.

```
int LinkId;
unsigned int InvokeId;
MIBSendRequest_t *MIBSendRequest;

/*****
/* Retrieve information on the association with handle a1. */
*****/

rc = MIBSendRequest(LinkId,
                    &InvokeId,
                    &MyLocalId,
                    "msg ACF.GetAssociationInfo("
                    "handle 'a1', info 11111111)");
```

---

## MIBSendResponse—MIB queue response function

### Purpose

Use this function when an application program needs to send a VTAM-specific response to CMIP services. This function is not used to send ROIVapdu, RORSapdu, or ROERapdu responses.

One message that is sent by MIBSendResponse is MIB.DeleteResponse. For a list of these responses, see Chapter 10, “VTAM-specific requests and responses,” on page 133.

### Declarations

The following declarations indicate the order of the parameters for this function.

```
typedef int MIBSendResponse_t(
    int, /* link identifier - input */
    unsigned int, /* invoke identifier - output */
    const void *, /* local identifier - input */
    const char *, /* source - input */
    const char *, /* destination association */
    const char *, /* handle - input */
    const char *); /* message - input */
```

### Parameters

#### link identifier

Specifies the link identifier returned by the MIBConnect function.

#### invoke identifier

This is the invoke identifier of the request which is being responded to with this API call.

#### local identifier

Pointer to the local identifier of the object that is responding. Specify the same identifier as the one specified in the request.

#### source

The distinguished name of the originator of the request. This can be used to override the source of the message. This is used to resolve any appearance of the MIB variable distinguished name. Specify NULL if you do not choose to specify a value.

**destination association handle**

This is the association identifier of the association that is to be used to send the response. It is required and must be the same as the association handle that was received on the message that is being answered.

**message**

This is a pointer to a formatted string which contains the string header and the response data.

**Return codes**

0 The function was successful.

**MB\_ERR\_ALLOC**

An error occurred allocating storage. If MB\_ERR\_ALLOC is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

**MB\_ERR\_ASSOC\_HANDLE\_MISSING**

The association handle parameter was not provided.

**MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**MB\_WARN\_DATA\_SPACE\_FULL**

If using a data space and the data space is out of storage, this warning is returned to remind the application program that no messages will be returned to this application program. This message will still be routed to CMIP services.

**MB\_WARN\_EXIT\_FAILURE**

If using common storage area storage and the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine, this warning is returned to remind the application program that no messages will be returned to the application program. This message will still be routed to CMIP services.

**MB\_ERR\_INVALID\_LINK\_ID**

The value specified on the link identifier parameter does not refer to a valid connection.

**MB\_ERR\_INVALID\_INVOKE\_ID**

The invoke identifier parameter was not provided.

**MB\_ERR\_LOCAL\_ID\_MISSING**

A local identifier was not provided.

**MB\_ERR\_MSG\_MISSING**

The message parameter was not provided.

**MB\_ERR\_TRANSMIT**

An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

**MB\_ERR\_VTAM\_INACTIVE**

VTAM is inactive.

## Example of function in an application program

The following example shows how the MIBSendResponse function can be coded in an application program.

```
const char *AssocHandle;  
int LinkId;  
int rc;  
void *LocalId;  
unsigned int InvokeId;  
  
rc = MIBSendResponse(LinkId,InvokeId,  
                    LocalId,NULL,AssocHandle,,  
                    "MIB.DeleteResponse(1,processingFailure)");
```



---

## Chapter 5. Read queue exit routine

For the common storage area (CSA) interface, the read queue exit routine is entered when VTAM CMIP services needs to notify or send data to the application program.

For the data space interface, the read queue exit routine is entered when VTAM CMIP services needs to notify the application program that:

- There are messages on the data space to be read
- CMIP services is terminating
- The data space is full

The requirements for callers of the read queue exit routine are:

**Location**

User private

**Key** Same key that was used when the MIBConnect function was called

**State** Supervisor state

**AMODE**

31-bit

**Residency mode**

Any

**ASC mode**

Primary

**Interrupt status**

Enabled

**Dispatchable unit mode**

TCB

**Locks** No locks held

**ENQs** No ENQs held

**@space**

Same address space from which MIBConnect was issued

The data passed to the read queue exit routine is located in CSA storage and is allocated in the same key that was used when the MIBConnect function was called. The data is not fetch protected, so any key can be used to copy it. The read queue exit routine should not attempt to free any storage passed to it. Storage is freed automatically when the exit routine terminates. Application programs can vary depending on product data and queuing structures. The following list gives recommendations for the read queue exit routine:

- Use the contents of the user data field located in register 6 to set up the environment. This field can be the address of an autodata area to improve performance, or it can be NULL.
- Save the calling application program's registers in the provided save area.
- Check the VTAM reason codes to determine why the exit routine was called and what action should be taken. For a list of reason codes, see "VTAM reason codes (for data space)" on page 87 and "VTAM reason codes (for CSA)" on page 86.

---

## Read queue exit routine for the CSA interface

This section describes how the read queue exit routine is called for the application program when CSA storage is used for receiving data from CMIP services.

### VTAM reason codes (for CSA)

#### Reason code

#### Explanation

0 Data is being passed to the read queue exit routine.

#### MB\_ERR\_CMIP\_SERVICES\_INACTIVE

CMIP services has terminated. Signal the application program main task to issue the MIBDisconnect function. No data is passed for this reason code.

**Note:** Your read queue exit routine should be coded to ignore unrecognized reason codes and set the return code to 0.

For a reason code of zero, copy any data presented from CSA storage to private storage. Then queue the copied data to the appropriate task. CMIP services examines the return code only if the read queue exit routine is driven with a reason code of 0. Set register 15 as follows:

#### Return code

#### Explanation

0 The read queue exit routine was successful.

8 The read queue exit routine had a temporary internal processing failure; for example, it is out of storage.

CMIP services builds an ROER if the message passed to the exit is a confirmed request of type ROIVapdu. The read queue exit routine continues to function.

16 The read queue exit routine had a permanent internal processing failure.

CMIP services builds an ROER if the message passed to the exit routine is a confirmed request of type ROIVapdu. It also builds these ROERs for any subsequent confirmed ROIV requests until the application program disconnects from the API. The read queue exit routine does not continue to receive data. It is driven again only if CMIP services terminates or if application program calls the MIBDisconnect function and then calls the MIBConnect function again.

### Registers upon entry (for CSA)

The following list shows the registers upon entering the read queue exit routine.

#### Register

#### Contents

1 Address of variable length parameter list. The end of the parameter list is indicated by the number 1 in the high-order bit of the last word. For details about the parameter list, see "Parameter list (for CSA)" on page 87.

6 Contents of the user data field that was passed on the MIBConnect function.

13 Address of an 18 fullword save area.

- 14 Return address.
- 15 Entry point address of the exit routine.

## Registers upon termination (for CSA)

The following list shows the registers upon terminating the read queue exit routine.

Register	Contents
0-14	Unchanged, restored to values on entry.
15	Return code:
0	Successful; input data processed.
8	Unsuccessful; storage failure.
16	Unsuccessful; terminate the exit routine.

## Parameter list (for CSA)

The following list shows the parameter list for the read queue exit routine. The decimal value is first, followed by the hexadecimal value in parentheses.

Offset	Description
0 (0)	VTAM reason code. For a list, see “VTAM reason codes (for CSA)” on page 86.
4 (4)	Address of API header.
8 (8)	Address of string header. Refer to “Description and example of the string” on page 49 for details.
12 (C)	Length of API header + string header + CMIP string. Four-byte field that represents the length of the total data to be copied.

---

## Read queue exit routine for data space storage

This section describes how the read queue exit routine is called for the application program when data space storage is used for receiving data from CMIP services.

## VTAM reason codes (for data space)

Reason code	Explanation
<b>MB_DATA_ON_DATA_SPACE</b>	CMIP services has placed one or more messages in the data space.
<b>MB_WARN_DATA_SPACE_FULL</b>	Data space storage is full. Signal the appropriate application task to issue the MIBDisconnect function.
<b>MB_ERR_CMIP_SERVICES_INACTIVE</b>	CMIP services has terminated. Signal the appropriate application task to issue the MIBDisconnect function.

**Note:** Your read queue exit routine should be coded to ignore unrecognized reason codes and set the return code to 0.

Contents of register 15 are not examined when read queue exit routine returns. Any messages in the data space are the responsibility of the application program. CMIP services does not perform any special processing to build ROERs for these messages. The read queue exit routine continues to be driven every time the number of waiting messages in the data space goes from zero to one until the application program disconnects from the API.

## Registers upon entry (for data space)

The following list shows the registers upon entering the read queue exit routine.

Register	Contents
1	Address of variable length parameter list. The end of the parameter list is indicated by the number 1 in the high-order bit of the last word. For details about the parameter list, see "Parameter list (for data space)."
6	Contents of user data field which was passed on the MIBConnect function.
13	Address of an 18 fullword save area.
14	Return address.
15	Entry point address of the exit.

## Registers upon termination (for data space)

The following list shows the registers upon terminating the read queue exit routine.

Register	Contents
0-14	Unchanged, restored to values on entry
15	Zero

## Parameter list (for data space)

The following list shows the parameter list for the read queue exit routine. The decimal value is first, followed by the hexadecimal value in parentheses.

Offset	Description
0 (0)	VTAM reason code. For a list, see "VTAM reason codes (for data space)" on page 87.



---

## Chapter 6. Dequeue and release routines for data space storage

The dequeue routine retrieves messages from the data space, one at a time.

The release routine frees the data space storage for each message that has been processed.

The release and dequeue routines are non-reentrant per application program.

This chapter describes:

- “Format of data on data space”
- “Dequeuing a buffer with the dequeue routine” on page 90
- “Releasing a buffer with the release routine” on page 91

---

### Format of data on data space

The format for data on data space storage is shown in the following list. The decimal value is first, followed by the hexadecimal value in parentheses.

#### Offset Description

- 0 (0) Address of API header (within data space). Refer to the declaration of APIhdr in ACYAPHDH under Appendix A, “C language header file (ACYAPHDH),” on page 235.
- 4 (4) Address of string header (within data space). Refer to “Description and example of the string” on page 49 for details.
- 8 (8) Length of API header + string header + CMIP string. This is a 4-byte field that represents the length of the total data to be copied.

The requirements for callers of the read queue exit routine are:

#### Location

User private

**Key** Key 6

**State** Supervisor state

#### AMODE

31-bit

#### Residency mode

Any

#### ASC mode

Access Register mode

#### Interrupt status

Enabled

#### Dispatchable unit mode

TCB

**Locks** No locks held

ENQs No ENQs held  
@space User address space

---

## Dequeuing a buffer with the dequeue routine

When the application program is notified by the read queue exit routine that data is on the data space (MB\_DATA\_ON\_DATA\_SPACE), the application program must call the dequeue routine to receive the data. The dequeue routine dequeues the buffer until register 0 returns a 0 buffer count.

The dequeue routine address is returned on the MIBConnect function in the interface control block.

For information about the data space vector parameter, see page 62.

## Input to the dequeue routine

This routine is serially reusable per queue. If the application program attempts to overlap execution of this routine, the results are unpredictable.

### General registers

#### Explanation

- |      |  |
|------|--|
| 0    | Value of the field RIV10NMI in the ISTRIV10_t structure filled in by MIBConnect. |
| 1    | Unused   |
| 2-13 | Undefined  |
| 14   | Return address   |
| 15   | Entry point address  |

### Access registers

#### Explanation

- |      |                               |
|------|-------------------------------|
| 0    | Undefined                     |
| 1    | ALET for interface data space |
| 2-15 | Zero                          |

## Output for dequeue routine

### General registers

#### Explanation

- |      |   |
|------|---|
| 0    | Count of remaining buffers  |
| 1    | Address of buffer that is in the data space or zero if no buffer exists |
| 2-13 | Restored to input values  |
| 14   | Return address  |
| 15   | Return code:  |
| 0    | Buffer is dequeued. The address is in register 1.                       |
| 8    | No buffers available.   |
| 16   | VTAM is terminating. The application program's TPEND exit               |

routine is driven. Do not continue calling the interface routines. Cease all reference to interface control blocks.

<b>Access registers</b>	
	<b>Explanation</b>
0	Undefined
1	ALET for interface data space
2-14	Restored to input value
15	Undefined

---

## Releasing a buffer with the release routine

To release a previously dequeued buffer, the application program must call the release routine. The release routine address is returned on the MIBConnect function in the interface control block.

For information about the data space vector parameter, see page 62.

This module is serially reusable per queue. If the application program attempts to overlap execution of this module, the results are unpredictable.

### Input to the release routine

<b>General registers</b>	
	<b>Explanation</b>
0	Value of the field RIV10NMI in the ISTRIV10_t structure filled in by MIBConnect.
1	Address of buffer to be released
2-13	Undefined
14	Return address
15	Entry point address

<b>Access registers</b>	
	<b>Explanation</b>
0	Undefined
1	ALET for interface data space
2-15	Zero

### Output to the release routine

<b>General registers</b>	
	<b>Explanation</b>
0-1	Undefined
2-13	Restored to input values
14	Return address
15	Return code:
0	Buffer released.
16	VTAM is terminating. The application program's TPEND exit

routine is driven. Do not continue calling the interface routines.  
Cease all reference to interface control blocks.

**Access registers**

	<b>Explanation</b>
0	Undefined
1	ALET for interface data space
2-14	Restored to input value
15	Undefined

**Abnormal exits**

If the buffer being released is either not allocated or is incorrect, the results are unpredictable.

---

## Chapter 7. Rules for constructing standard CMIP strings

This section describes how to look at the ASN.1 source files and read the syntax to enable you to build a string that can be sent to CMIP services. Almost all of the data types supported by ASN.1 are supported by VTAM CMIP services. VTAM CMIP services does not support the following data types:

- GraphicString (except for the default character set, which is supported)
- TeletexString and VideotexString
- EXTERNAL data type
- Contained subtypes
- Inner subtyping
- Real value
- Constructed value
- Named bit strings

---

### Overview

CMIP services includes a management information base (MIB) application program interface (API), which application programs use to send information to CMIP services. Application programs send data to CMIP services by using API functions, which are described under Chapter 3, “Overview of CMIP services API functions,” on page 41. The data sent in some of the parameters of the API functions can be in any format that is accepted as standard ASN.1 syntax. ASN.1 syntax is the data definition language used by OSI management.

This section describes how application programs can send data to CMIP services (using the API functions) and how CMIP services sends data to application programs.

The application program can send strings that are composed of values that are specified according to the rules in the ASN.1 syntax. For a particular ASN.1 syntax, an application program has some flexibility in the exact format of a string.

CMIP services returns information to application programs in a specific format. For example, when the application program sends a string to CMIP Services that includes a BOOLEAN value, the application program can use a variety of formats. But when CMIP services sends a BOOLEAN value in a string to the application program, CMIP services uses only one format for BOOLEAN values.

---

### How application programs format data to be sent to CMIP services

When calling the MIBSendRequest or MIBSendResponse functions, the application program provides a zero-terminated string that includes the following:

- The word **msg**
- A blank
- The name of an ASN.1 module
- A period
- The name of a type within that ASN.1 module

- Values for all of the fields associated with that type

For example, the following zero-terminated string could be passed as the fourth parameter to the MIBSendRequest function.

```
"msg ACF.Release (a1)"
```

When calling the MIBSendCmipRequest or MIBSendCmipResponse functions, the application program provides a zero-terminated string that includes only the values for all of the fields associated with the type listed in the ANY DEFINED BY table for the specified operation-value or error-value.

For example, to send a GET request by the MIBSendCmipRequest function, the second parameter of the MIBSendCmipRequest function should be three (operation-value for GET) and the third parameter of MIBSendCmipRequest function could be the following zero-terminated string:

```
"(baseManagedObjectClass 2.9.3.2.3.13,"
" baseManagedObjectInstance "
" (distinguishedName "
" '1.3.18.0.2.4.6=NETA;2.9.3.2.7.4=(name GEORGE)'),"
" attributeIdList (2.9.3.2.7.35,2.9.3.2.7.5))"
```

Each value is made up of a <label> <value> pair. The <label> is the identifier that appears in ASN.1 NamedTypes. See clause 12.5 of ISO-8825 for the formal definition of a NamedType.

In the following example, a, b, and c are possible labels. For the field with data type D, the type name is used as a label. Using the type name as a label is necessary only when the ASN.1 syntax was defined without labels for all SET and SEQUENCE fields. If the type name is used for a data type that has a label, the type name is rejected.

```
A ::= SEQUENCE
{
    a INTEGER,
    b OBJECT IDENTIFIER,
    c C,
    D
}
```

Labels can always be specified, but they are required only to resolve ambiguity in the ASN.1 definition. Because it is difficult to know when ambiguity exists, use the following rules when building strings to send to CMIP services:

- Labels are required on members of a SET construct, because the members of the SET can be specified in any order.
- A label is required to resolve a CHOICE; otherwise CMIP services cannot determine which choice was selected by the application program.
- It is recommended that members of a SEQUENCE be identified with a label. Labels are required only in situations where an optional member is intentionally omitted and subsequent members follow. However, unless every member of a sequence is specified, or the optional members that are intentionally omitted are located at the end of the SEQUENCE, it is simpler to identify all members with a label.
- Elements of a SET and SEQUENCE and the element of a CHOICE are surrounded by parentheses.

The <value> portion of the <label> <value> pair can be specified in the following ways:

- *Primitive* data types, such as BOOLEAN and INTEGER, that are not composed of one or more instances of other data types
- *Constructed* data types, such as SEQUENCE and SET
- *Hexadecimal* basic encoding rules (BER), which can be used for all ASN.1 types except CHOICE and ANY DEFINED BY.

Any of the five following formats are recognized by CMIP services, but CMIP services always returns explicit value notation if there are no insurmountable errors encountered during the decoding of incoming strings. If errors are encountered, the hexadecimal BER format explained in “Hexadecimal BER format” on page 98 is used.

## Explicit value format

In the explicit value format, the actual value of the primitive data type is given. For example, an application program can specify 1234 as the value of an INTEGER data type. Each of the primitive data types has a unique explicit value notation and these are explained in “Primitive ASN.1 data types” on page 99. Examples are TRUE and FALSE for BOOLEAN types, -3.125 for REAL types, and 1001001 for BIT STRINGS.

Values can be formatted and sent to the API enclosed in single or double quotation marks. Quotation marks are required if the value contains a space. Use the same kind of quotation mark to begin and end the value. The quotation marks are ignored by CMIP services.

## ASN.1 value format

The value format is based on an ASN.1 module, as shown in the following example.

```
A ::= INTEGER

a INTEGER ::= 1
b INTEGER ::= 2
c INTEGER ::= 3
d A      ::= 4

B ::= SET {
  f [1] INTEGER,
  g [2] INTEGER,
  h [3] INTEGER
}
C ::= SEQUENCE {
  f [1] INTEGER,
  g [2] INTEGER,
  h [3] INTEGER
}
```

Values for A may be specified as:

```
a
b
d
12
```

Values for B may be specified as:

```
(f a, h d, g 34)
(h 138, f d, g 34)
```

Values for C may be specified as:

```
(c, 12, 19)
(f c, 12, h 19)
(f c, g 12, h 19)
```

The application program can specify a, b, c, or d as the <value> portion of a <label> <value> pair. If the value appears in a context that might be ambiguous, such as for the value of the g field in the SET B, the appropriate <label> must accompany the <value>. The labels can be omitted when specifying values for C, because there is no ambiguity. The labels can never be omitted when specifying values for B, because A is optional and without a label for B, it is not possible to determine whether the value is for A or B.

CMIP services, using information from the compiled ASN.1 modules, verifies that the value and type are compatible.

## MIB variable format

MIB variables are values that can be set in CMIP services by an object, and then referred to later in a string. These values can be specified as MIB variables by the application program in any string. CMIP services substitutes the actual values.

MIB variables are denoted with an ampersand (&) as the first character of the variable name. The API checks to make sure that the type of the MIB variable and the type of the type reference are compatible.

CMIP services includes a set of predefined MIB variables that can be used in any string, by any object:

**&DN** Represents the distinguished name of the originator of a string that is passed to the API. The API uses its knowledge of the source of the string to provide the appropriate distinguished name. The name can be used by an object that is registered with CMIP services to identify itself when it sends a string. The API supplies the distinguished name that corresponds to the local identifier provided on the request.

**&IID** Represents the invoke identifier of the current string. This can be used in a response or when initiating a request. On requests, this MIB variable allows the sender of a string to build the string without knowing the invoke identifier. For all requests, the invoke identifier is not required because the MIB functions assign the invoke identifier after they receive the string. Therefore the API can fill in the value for the invoke identifier once it has been assigned.

**&GTM** Represents the current time in Generalized time format. For more information, see "Time types" on page 111.  
yyyy/mm/dd-hh:mm:ss.0

**&UTM** Represents the current time in Universal time format. For more information, see "Time types" on page 111.  
yyyy/mm/dd-hh:mm:ss.0

**&OC** Represents the managed object class of the originator of the string. This variable allows the application program to use generic strings in responding to requests, without having to customize them for each object



class it supports. In any response from an unregistered object or when allomorhism is being exercised, this variable cannot be used.

The following example shows how to use these MIB variables:

```
Arg =
"(managedObjectClass &OC,
" managedObjectInstance (distinguishedName &DN),
" currentTime &GTM,
" attributeList ((attributeId 2.9.3.2.7.5,
" (distinguishedName
" ((attributeType 1.3.18.0.2.4.6,
" attributeValue MYNETID),
" (attributeType 2.9.3.2.7.4,
" attributeValue (name \"MYCPNAME\"))))),
" (attributeId 2.9.3.2.7.35, enabled)
" )
")";

rc = MIBSendCmipResponse(LinkId,
OldInvokeId,
1, /* last in chain */
1, /* success */
3, /* GET response */
Arg,
LocalId_ptr,
NULL,
OldAssocHandle,
NULL);
```

CMIP Services substitutes the appropriate values for the variables &OC, &DN, and &GTM.

**Note:** The many extra spaces in the response string will be ignored by CMIP services, though they will lead to extra processing overhead.

## Constructed value format

The constructed types, SET, SEQUENCE, SET OF, and SEQUENCE OF and the CHOICE types use constructed value format. In this format, the value of a <label> <value> pair is surrounded by parentheses and contains other <label> <value> pair specifications separated by commas, as is shown in the following ASN.1 definition:

```
A ::= SEQUENCE
{
    a INTEGER,
    b BIT STRING,
    c BOOLEAN
}
```

The invoking application program specifies the following across the API:

```
(a 12, b 11011011, c TRUE)
```

To nest constructed data types, use multiple sets of parentheses. Note that the number of parentheses does not correspond directly to the number of braces in the ASN.1. It corresponds to the number of constructed data types that occur. For example, an application program could specify

```
(a 12, b (1, 2, 3, 4), c TRUE, d (111, 1101110, 11000))
```

to be sent to the API to correspond to the following ASN.1 definition:

```

A ::= SEQUENCE
  {
    a [0] INTEGER DEFAULT 0,
    b [1] SEQUENCE OF INTEGER,
    c [2] BOOLEAN OPTIONAL,
    d [3] B
  }
B ::= SEQUENCE OF C
C ::= BIT STRING

```

The numbers specified in square brackets in the ASN.1 of the previous example refer to the tagging that is used when exchanging strings between systems. Because the identifier of the named type (in this case, *a*, *b*, *c*, or *d*) corresponds not only to the type reference but also to the tagging, it is not necessary to specify the tagging across the API. Tags are determined automatically by CMIP services.

The words `DEFAULT` and `OPTIONAL` in an ASN.1 definition indicate that those fields can be omitted in an instance of type reference *A*. `DEFAULT` means the field *a* can be omitted. If it is omitted, CMIP services interprets the field as having a value the default value specified in the syntax. In the previous example, zero is assigned to the field with label *A*. If it is not omitted, CMIP services does not assign `DEFAULT` fields default values. Application programs that receive strings containing `DEFAULT` fields must be able to understand and interpret the omission of the field.

`OPTIONAL` means that the field *c* does not have to be specified. When it is not specified, CMIP services does not interpret the field.

## Hexadecimal BER format

Hexadecimal BER format is the hexadecimal value contained in the BER, enclosed in angle brackets. Hexadecimal BER format is the final format that can be used to specify a value. In some cases when CMIP services cannot decode a string sent by another CMIP services, CMIP services sends the string to the application program in hexadecimal BER format.

In this format, the value is enclosed in less than (<) and greater than (>) symbols, and consists of zero or more hexadecimal digits. In all but one case, the hexadecimal digits represent the BER encoding of the <value> portion of a particular field. For example, the value of a `BOOLEAN` in BER is specified as a single **octet**, with nonzero values representing true. An octet is a byte. To specify a true value for field *fred* to the API in hexadecimal BER format, the application program specifies:

```
... fred <01> ...
```

When specifying a value for an `ANY` type, the application program is required to specify the entire BER field, including the tag, length, and value portions. It cannot specify only the value, because the `ANY` type cannot understand what the possible types are. For example, if the same application program specifies a `BOOLEAN` value of true to the API for a field called *fred* that is an `ANY` type, the following should be specified:

```
... fred <010101> ...
```

In this example, the first octet represents the tag, which is a universal tag for `BOOLEAN`. For a full description of how BER tags are encoded see the BER standard.

The second octet represents the length of the value portion, a length of 1 octet, and the value is as specified previously.

An application program should not use hexadecimal BER when sending information to the API, because error and subtype checking that is normally performed by the API code is not applied to the BER value. The value is assumed to be correctly formed and is inserted into the BER buffer at the appropriate location.

Another potential problem is the use of the hexadecimal BER format for ANY types, because improper tags and lengths can be introduced. Hexadecimal BER format is necessary when an INTEGER that is longer than four octets needs to be shipped. Hexadecimal BER allows the application program to circumvent any limitations imposed by the API, but you might encounter problems.

When CMIP services receives strings from an application program, CMIP services attempts to decode the strings into a combination of explicit values and constructed values. During decoding, if CMIP services encounters an error in a primitive data type, CMIP services sends to the application program the value for that type in hexadecimal BER format. For example, if the contents of an INTEGER field are too large to fit within four octets, CMIP services sends the application program the INTEGER value in hexadecimal BER format.

If CMIP services encounters an error in a constructed data type or a decision data type, such as ANY DEFINED BY or CHOICE, CMIP services sends the application program the entire contents of the constructed or decision type in a single hexadecimal BER value. For example, if CMIP services does not recognize the value of an OBJECT IDENTIFIER, the OBJECT IDENTIFIER value is sent to the application program in hexadecimal BER format.

---

## Primitive ASN.1 data types

Primitive types within ASN.1 are those types that are not constructed or cannot be broken down into more primitive types. They correspond to the normal data types encountered in many programming and data definition languages.

The term *primitive type* should not be confused with *primitive encoding* as defined in the BER standard. Some primitive types, such as BIT STRINGs, can actually be encoded in a constructed manner. However, in this case, all of the components must be of the same type as the constructed BIT STRING.

The following sections describe:

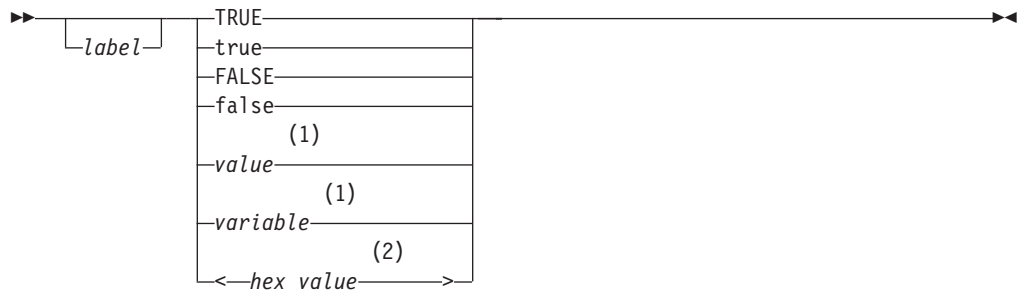
- How an application program sends the type to CMIP services
- How CMIP services sends the type to an application program

### BOOLEAN type

BOOLEAN types can have one of two values: true or false.

#### How an application program sends a BOOLEAN value to CMIP services

An application program can send a BOOLEAN value to CMIP services in any of the following forms:



**Notes:**

- 1 Values and variables specified in this position must resolve to a BOOLEAN value.
- 2 When specifying a value in this format, be aware that the BER representation consists of a single octet, with X'00' representing false, and any other value representing true.

An application program can specify a BOOLEAN value as shown in the following examples:

```
TRUE
FALSE
true
false
```

**How CMIP services sends a BOOLEAN value to an application program**

CMIP services sends one of the following BOOLEAN values:

- TRUE
- FALSE

CMIP services places labels in the string for all elements of the syntax that are present.

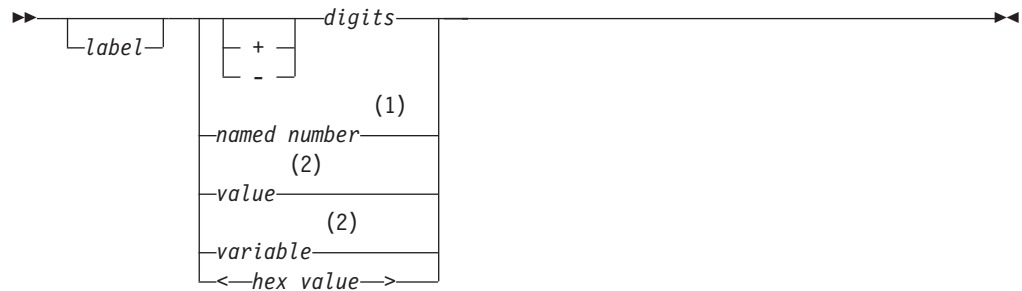
If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

**INTEGER type**

INTEGER types represent integer numbers. An INTEGER value can be either positive or negative. INTEGER values are expressed as the explicit value of the integer, which is the actual value of the integer. For example, an application program can specify 1234 as an INTEGER value. The minimum value is -2147483648; the maximum value is 2147483648.

**How an application program sends an INTEGER value to CMIP services**

An application program can send an INTEGER value to CMIP services in any of the following forms:



**Notes:**

- 1 The ASN.1 compiler recently introduced support for named numbers, and this support is expected to be added to the API in the very near future. When it is, the API will output named integer values by giving the value identifier.
- 2 Values and variables specified in this position must resolve to an INTEGER value.

The following example shows how the ASN.1 syntax might define an INTEGER value.

```
X ::= INTEGER
SlowModemSpeed ::= INTEGER {
    slowest (300),
    slower (1200),
    slow (2400)
}
```

A value for X would be:  
 123  
 Values for SlowModemSpeed would be:  
 300  
 2400

**How CMIP services sends an INTEGER value to an application program**

CMIP services sends INTEGER values as strings of decimal digits, possibly preceded by a minus sign (-). INTEGER values are always represented by their numeric values.

CMIP services places labels in the string for all elements of the syntax that are present.

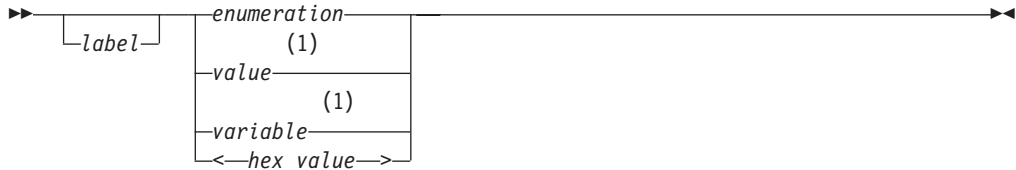
If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description. For example, if CMIP services encounters an INTEGER value longer than four octets, CMIP services sends the value to the application program in hexadecimal BER format.

**ENUMERATED type**

The values for ENUMERATED types are expressed as explicit values that are symbolic, rather than numeric.

## How an application program sends an ENUMERATED value to CMIP services

An ENUMERATED can be formatted and sent to CMIP services in the following forms:



### Notes:

- 1 Values and variables specified in this position must resolve to an ENUMERATED value.

The following example shows how the ASN.1 syntax might define an ENUMERATED value.

```
X ::= ENUMERATED {
    val1 (0),
    val2 (1),
    val3 (2)
}
```

Values for X would be:

```
val1
val3
```

## How CMIP services sends an ENUMERATED value to an application program

CMIP services sends an ENUMERATED value as a symbolic ASCII string that corresponds to the value found in the BER.

ENUMERATED values are always represented by the name of the value, not the corresponding integer value.

CMIP services places labels in the string for all elements of the syntax that are present.

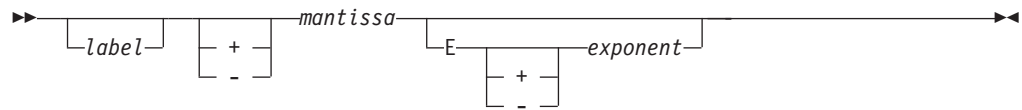
If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

## REAL type

REAL types represent real values.

### How an application program sends a REAL value to CMIP services

An application program can send a REAL value to CMIP services in any of the following forms:



The application program is required to use the hexadecimal BER format for specifying REAL values.

The following example shows how the ASN.1 syntax might define a REAL value.

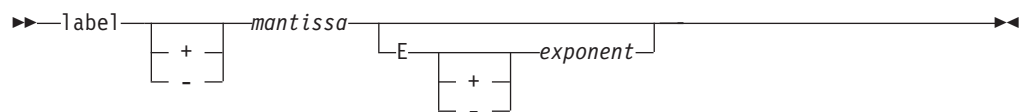
`X ::= REAL`

Values for X would be:

"3.14"  
 "0.0"  
 "-14.33e-05"

### How CMIP services sends a REAL value to an application program

CMIP services sends REAL values to an application program in the following format:



CMIP services places labels in the string for all elements of the syntax that are present.

Under the OS/2 operating system, CMIP services sends REAL values according to the criteria used for the output of `%lg` in `printf()`. CMIP services sends the smallest number of characters that can be used to represent the number.

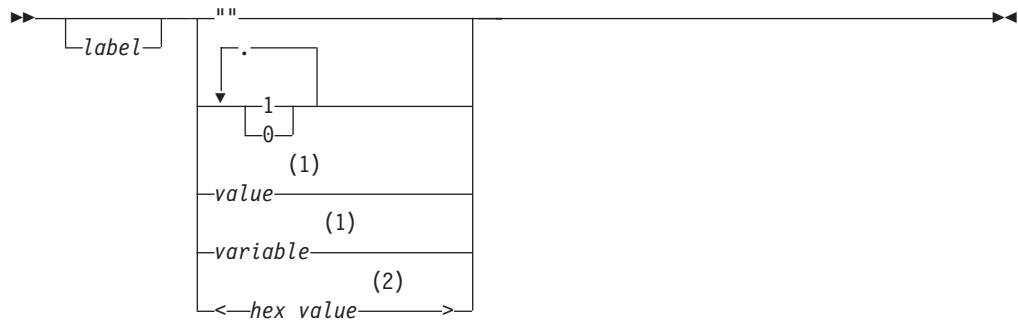
If CMIP services cannot decode the value or if CMIP services exists on an operating system other than OS/2, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

## BIT STRING type

The BIT STRING type represents a string of bits. There is no limit to the length of the string.

### How an application program sends a BIT STRING to CMIP services

An application program can send a BIT STRING to CMIP services in any of the following forms:



**Notes:**

- 1 Variables specified in this position must resolve to a BIT STRING.
- 2 When specifying a value in this format, remember that the BER representation of a BIT STRING always begins with an octet that signifies the number of unused bits in the final octet of the value. Omitting this extra octet results in decoding errors by the receiver.

The bit strings are sent to CMIP services as part of a character string, using the characters B'1' and B'0' to represent on and off. The application program can also specify a *null* BIT STRING by entering two quotation marks, either single (") or double ("""). A null BIT STRING has a length of zero.

**How an application program specifies a BIT STRING value**

The following example shows how the ASN.1 syntax might define a BIT STRING.

```
X ::= BIT STRING {
    val1 (0),
    val2 (1),
    val3 (2)
}
```

Values for X would be:

- 001 - means val3 is turned on, the others are off
- 100 - means val1 is turned on, the others are off
- 111 - val1, val2, val3 are all on

**How CMIP services sends a BIT STRING to an application program**

CMIP services sends BIT STRINGs as strings of digits, without enclosing them in quotation marks. When CMIP services receives a null BIT STRING from an application program, CMIP services sends the null BIT STRING as two double quotation marks.

CMIP services places labels in the string for all elements of the syntax that are present.

If CMIP services cannot decode the value for a BIT STRING, including null BIT STRINGs, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

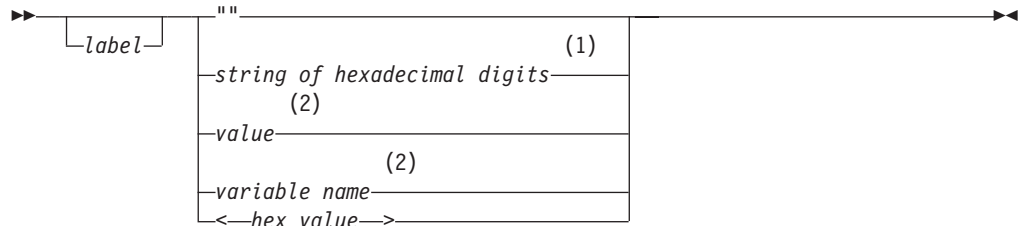
**OCTET STRING type**

The OCTET STRING type represents a string of hexadecimal digits.



## How an application program sends an OCTET STRING to CMIP services

An application program can send an OCTET STRING to CMIP services in any of the following forms:



### Notes:

- 1 The formatted string to be sent to CMIP services must have an even number of hexadecimal digits.
- 2 Variables specified in this position must resolve to OCTET STRINGS.

An application program can send OCTET STRINGS to CMIP services as strings of an even number of hexadecimal digits, using the character representation of the hexadecimal digits '0' through '9' and 'A' through 'F'. Both uppercase and lowercase letters can be used. When CMIP services returns the OCTET STRING, CMIP services uses uppercase letters.

Application programs can have OCTET STRINGS that have a length of zero. Such OCTET STRINGS are *null* OCTET STRINGS. For null OCTET STRINGS, the application program should format the string with two quotation marks with no intervening characters. The application program can specify either single or double quotation marks.

An application program can also specify OCTET STRINGS as hexadecimal BER, although this format is essentially the same as the explicit value format, with different delimiters.

## How an application program specifies an OCTET STRING

The following example shows how the ASN.1 syntax might define an OCTET STRING.

```
X ::= OCTET STRING (SIZE(2))
```

If X has a hexadecimal value of 01AB, the string passed to or from the API is:

```
F0F1C1C2
```

## How CMIP services sends an OCTET STRING to an application program

CMIP services sends an OCTET STRING in explicit value format. CMIP services sends a null OCTET STRING as two double quotation marks when it sends the string.

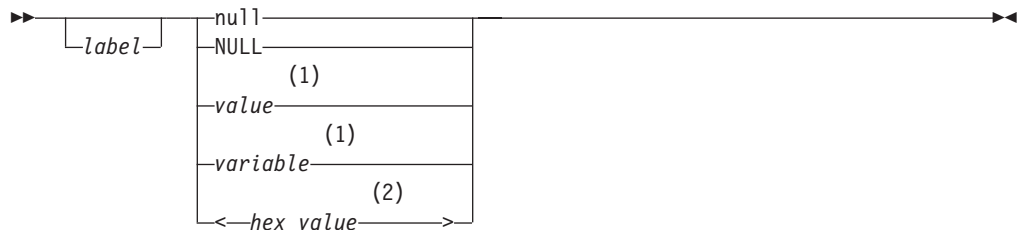
CMIP services places labels in the string for all elements of the syntax that are present.

## NULL type

A NULL type is used for optional input parameters for which the application program does not specify a value.

### How an application program sends a NULL value to CMIP services

An application program can send a NULL value to CMIP services in any of the following forms:



#### Notes:

- 1 Variables specified in this position must resolve to NULL.
- 2 When specifying a value in this format, remember that the BER representation of a NULL consists only of a tag and length field that indicates that the length is zero. Therefore, the proper representation of hexadecimal BER should be "<>".

An application program can specify a NULL value by specifying:

- The character string NULL
- An ASN.1 value label that resolves to a NULL value
- A MIB variable that resolves to a NULL value

### How an application program specifies a NULL value

The following example shows how the ASN.1 syntax might define a BIT STRING value.

```
X ::= NULL
```

The value for X is:

```
NULL
```

### How CMIP services sends a NULL value to an application program

CMIP services sends a NULL value as the uppercase string NULL.

CMIP services places labels in the string for all elements of the syntax that are present.

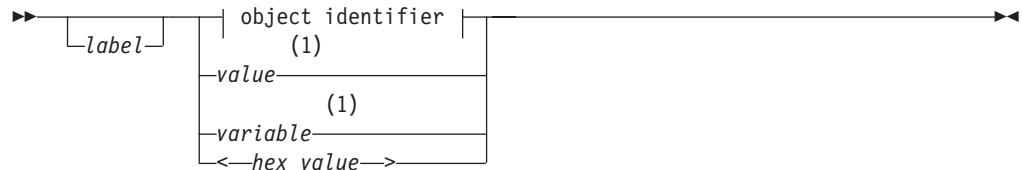
If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

## OBJECT IDENTIFIER type

OBJECT IDENTIFIERS (OIs) serve within OSI management as universally unique codepoints to represent object classes, specific values, or identities of registered parts of an object class.

### How an application program sends an OBJECT IDENTIFIER to CMIP services

An application program can send an OBJECT IDENTIFIER to CMIP services in any of the following forms:



#### object identifier:



#### Notes:

- 1 Variables specified in this position must resolve to an OBJECT IDENTIFIER.

An application program sends an OBJECT IDENTIFIER to CMIP Services by using an explicit value. OBJECT IDENTIFIERS are specified as text strings of integers separated by periods as in 1.3.18.0.0.6. Each of the numbers of the OBJECT IDENTIFIER must resolve to a long integer. An OBJECT IDENTIFIER must contain at least two numbers in an OBJECT IDENTIFIER, but there is no maximum number of components. The first number must be either 0, 1, or 2.

### How an application program specifies an OBJECT IDENTIFIER value

The following example shows how the ASN.1 syntax might define an OBJECT IDENTIFIER.

```
X ::= OBJECT IDENTIFIER
```

Values for X would be:

```
1.2.3.4.5.6
1.3.18.0.0.255
2.9.3.2.6.18
```

### How CMIP services sends an OBJECT IDENTIFIER to an application program

CMIP services sends an OBJECT IDENTIFIER as an explicit value.

CMIP services places labels in the string for all elements of the syntax that are present.

If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

## Character string types

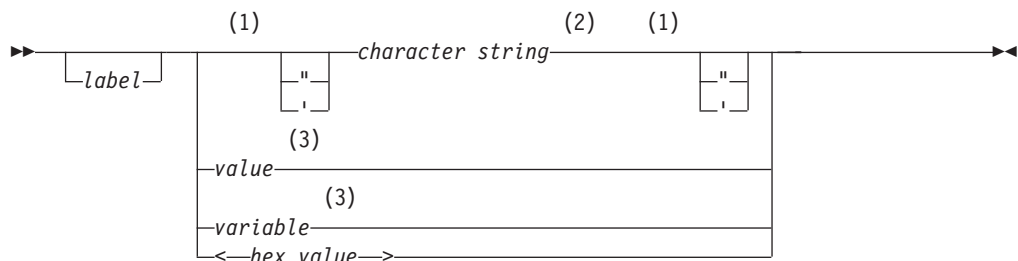
Different types of character strings can be formatted and sent to the API. Four of the string types defined in the ASN.1 standard are supported:

- NumericString
- PrintableString
- VisibleString (also known as ISO646String)
- GraphicString

The GraphicString type is the same as the ISO646String type. The application program can specify character sets other than those supported by VTAM CMIP services by using the hexadecimal BER format (see "Hexadecimal BER format" on page 98).

### How an application program sends a character string to CMIP services

An application program can send a character string value to CMIP services in as normal text strings, according to the following format:



#### Notes:

- 1 Quotation marks are especially important when specifying values of character strings, because character strings are one of the few places where special characters are valid. Quotation marks are needed if any special characters such as spaces, parentheses, or commas are included in the value.
- 2 The characters that can be specified in this string are dictated by the ASN.1 type of the string. See the text for an explicit listing of the allowable characters.
- 3 Variables specified in this position must resolve to a hexadecimal or character string.

An application program can send a character string to CMIP services with or without quotation marks depending on whether the string contains special characters.

### Valid characters for character strings

The characters that can be specified in the string types are defined in ISO-8824, the ASN.1 standard.

## Valid characters for NumericString type

Table 4. Valid characters for NumericString

Character name	Glyph
Digits	0-9
Space	

## Valid characters for PrintableString type

Table 5. Valid characters for PrintableString

Character name	Glyph
Uppercase letters	A-Z
Lowercase letters	a-z
Digits	0-9
Space	
Apostrophe	'
Left parenthesis	(
Right parenthesis	)
Plus sign	+
Comma	,
Hyphen	-
Full stop	.
Solidus	/
Colon	:
Equal sign	=
Question mark	?

## Valid characters for GraphicString and ISO646String

Table 6. Valid characters for GraphicString and ISO646String

Character name	Glyph
Uppercase letters	A-Z
Lowercase letters	a-z
Digits	0-9
Space	
Exclamation mark	!
Quotation mark	'
Number sign	#
Dollar sign	\$
Percent sign	%
Ampersand	&
Apostrophe	'
Left parenthesis	(
Right parenthesis	)

Table 6. Valid characters for GraphicString and ISO646String (continued)

Character name	Glyph
Asterisk	*
Plus sign	+
Comma	,
Hyphen	-
Full stop	.
Solidus	/
Colon	:
Semicolon	;
Less than sign	<
Equals sign	=
Greater than sign	>
Question mark	?
Commercial at	@
Left square bracket	[
Reverse solidus	\
Right square bracket	]
Upward arrow head	^
Underline	_
Grave accent	`
Left curly bracket	{
Vertical line	
Right curly bracket	}
Overline	~

Composite graphics, which are those constructed with backspaces in a GraphicString, are not allowed.

If a character that is not valid is entered on encoding, the string is rejected and an error code is returned to the application program. On decoding, characters that are not valid are accepted and translated to periods.

### How CMIP services sends a character string to an application program

When CMIP services sends character strings, if the value contains the double quotation mark (") character, CMIP services encloses the value in single quotation marks. If the string does not contain the double quotation mark character, CMIP services encloses the value in double quotation marks.

CMIP services places labels in the string for all elements of the syntax that are present.

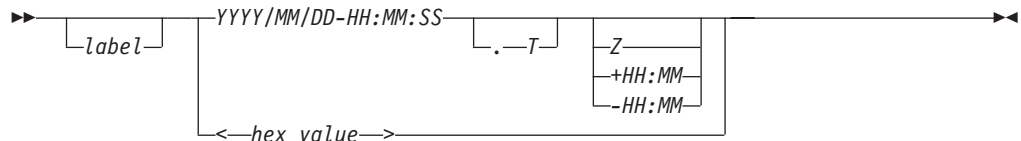
If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

## Time types

Two time specifications are supported by the API: GeneralizedTime and UniversalTime.

### How an application program sends a TIME value to CMIP services

An application program can send a TIME value to CMIP services for either type of time is in the following forms:



where the initial fields correspond to the year (4 digits), month, day, hours (specified using the 24-hour clock), minutes, and seconds. The additional fields are optional and can be included if the sender chooses. These represent the tenths of a second (.T), the type of the time (Z indicates GMT, + or - indicates a GMT offset and nothing indicates local time).

The entire non-hexadecimal value can be enclosed in quotation marks, as can any other string value, if the sender wishes.

### How CMIP services sends a TIME value to an application program

CMIP services sends a TIME value in the same format that the application program uses to send a TIME value to CMIP services. See "Hexadecimal BER format" on page 98 for a description.

## Constructed ASN.1 types

Constructed types are those that combine similar or different primitive types into ordered or unordered groups. VTAM CMIP services represents the members of constructed types by enclosing the members in parentheses. There are four constructed types. Whether a type can contain members of different types and whether order is important depends on the constructed type.

Table 7. Order and members of constructed types

Constructed type	Members	Order
SET	Members can be different types.	Order of members is not important.
SEQUENCE	Members can be different types.	Order of members is important.
SET OF	All members must be the same type.	Order of members is not important.
SEQUENCE OF	All members must be the same type.	Order of members is important.

The hexadecimal BER format can also be used for constructed types. When the hexadecimal BER format is used, either the members of the constructed type can

be specified as BER or the entire contents of the SET or SEQUENCE can be specified in a single value. For example, given the following ASN.1:

```
A ::= SEQUENCE
{
  a INTEGER,
  b INTEGER,
  c INTEGER
}
```

any of the following values may be specified:

```
(a 1, b 2, c 3)
(a <01>, b <02>, c <03>)
<020101020102020103>
```

The former value specification is preferred, because CMIP services can check that the values that are specified are valid and CMIP services can construct the correct encoding of the tags, lengths, and values.

## How CMIP services sends a constructed type to an application program

CMIP services sends constructed values according to the format used for the primitives that make up the constructed types. For example, if the SET value is comprised of INTEGER values, CMIP services sends the values in the same format that CMIP services sends INTEGER values. Values are enclosed in parentheses and can have commas between them.

CMIP services places labels in the string for all elements of the syntax that are present.

If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description.

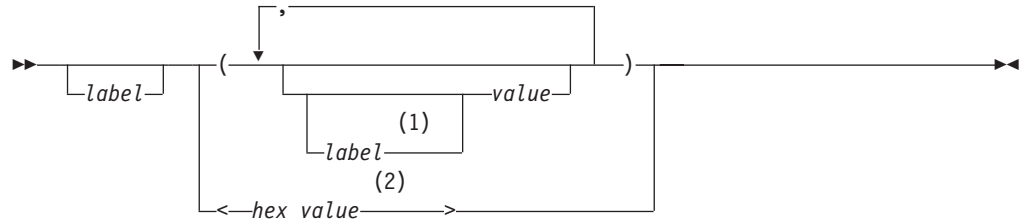
For example, if an unrecognized member occurs in a SEQUENCE or a duplicate member occurs in a SET, the entire contents of the constructed type is returned as a single hexadecimal string.

## SEQUENCE

A SEQUENCE is common in ASN.1. The number and order of members of the SEQUENCE are dictated by the ASN.1 definition of the SEQUENCE.

An application program can send a SEQUENCE to CMIP services in any of the following forms:





**Notes:**

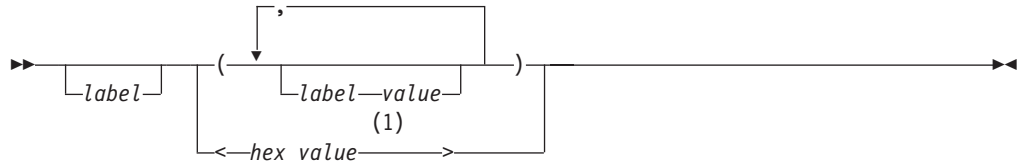
- 1 Labels are required only if an optional element of the sequence is omitted and a subsequent member is included.
- 2 When specifying a value in this format, the application program is required to specify the entire contents of the SEQUENCE, including the tags and lengths of the members, but not the tag and length of the SEQUENCE itself.

Whether a particular member is required to be included depends on whether the ASN.1 definition indicates that it is optional. It does not depend on CMIP services.

**SET**

A SET is an unordered collections of members in ASN.1, and CMIP services implements this definition by allowing the input of members of the set in any order. Because members can be in any order, CMIP services requires that labels be specified on all SET members.

An application program can send a SET to CMIP services in the following form, which is similar to that for a SEQUENCE:



**Notes:**

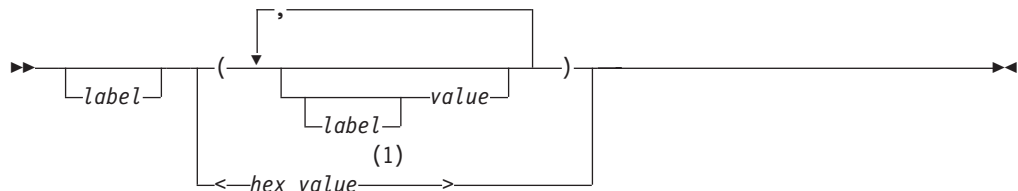
- 1 When specifying a value in this format, the application program is required to specify the entire contents of the SET, including the tags and lengths of the members, but not the tag and length of the SET itself.

As with a SEQUENCE, whether a particular member is required to be included is determined by whether the ASN.1 definition indicates that it is optional. It does not depend on CMIP services. Note that labels are required on members of a SET.

## SET OF and SEQUENCE OF types

The SET OF and SEQUENCE OF types represent one or more instances of a SET or a SEQUENCE. For a description of the differences among constructed types, see Table 7 on page 111.

An application program can send a SET OF or SEQUENCE OF value to CMIP services in the following form:



**Notes:**

- 1 When specifying a value in this format, the application program is required to specify the entire contents of the SET OF or SEQUENCE OF, including the tags and lengths of the members, but not the tag and length of the SET OF or SEQUENCE OF itself.

There is no limitation (other than subtyping specified in the ASN.1) as to the number of members that can be specified in the SET OF or SEQUENCE OF. It is valid to specify a SET OF or SEQUENCE OF with no members, so long as subtype constraints are obeyed.

---

## Decision types

Three ASN.1 types allow the application program to include different pieces of information, even after the ASN.1 definition is complete. They allow the application program to determine, at execution time, what information should fall within certain fields. VTAM CMIP services calls these types *decision types*, and they include CHOICE, ANY and ANY DEFINED BY.

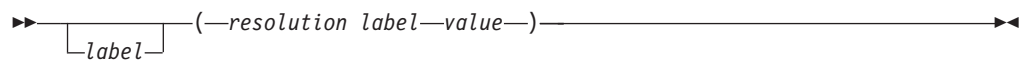
Note that the hexadecimal BER format is not supported for CHOICE and ANY DEFINED BY types. If the application program needs to specify the latter as BER, the entire SEQUENCE that contains the ANY DEFINED BY must be specified as a single BER value.

## CHOICE types

A CHOICE type is one in which a decision must be made concerning the next type to include in a string. When receiving incoming strings to be decoded, the determination of which CHOICE to take is based on the tagging in the transfer syntax. In CMIP services, the choice is based on the *resolution label* presented in the string when the CHOICE is encountered. The resolution label is the identifier of each of the NamedTypes in the CHOICE construct.

### How an application program sends a CHOICE to CMIP services

An application program can send a CHOICE to CMIP services in any of the following forms:



**Note:** The resolution label is always required.

### How an application program specifies CHOICE values

The following example shows how the ASN.1 syntax might define a CHOICE.

```
A ::= CHOICE
{
  x INTEGER,
  y OBJECT IDENTIFIER,
  z OCTET STRING
}
```

The application program can choose to have field b be an INTEGER, an OBJECT IDENTIFIER, or an OCTET STRING. If the application program chooses for it to be an INTEGER, the following string should be specified:

```
b (x 1234)
```

where the x is the resolution label.

### How CMIP services sends a CHOICE to an application program

So long as the alternative described in the BER exists within the CHOICE, CMIP services sends the CHOICE in the same format an application program uses to send a CHOICE to CMIP services. (An alternative is one of the options specified in the CHOICE syntax.)

CMIP services places labels in the string for all elements of the syntax that are present.

If CMIP services cannot decode the value, CMIP services sends the value to the application program in hexadecimal BER format, enclosed in delimiters. See "Hexadecimal BER format" on page 98 for a description. For example, if CMIP services does not recognize the alternative, CMIP services sends a CHOICE as hexadecimal BER.

## ANY DEFINED BY types

### How an application program sends an ANY DEFINED BY value to CMIP services

An application program can send an ANY DEFINED BY value to CMIP services according to the method used to send the type to which the ANY DEFINED BY resolves. The label of the input corresponds to the label of the ANY DEFINED BY construct in the ASN.1, and the value corresponds to the value of the type to which the ANY DEFINED BY resolves. The resolution field determines which type to translate.

### How an application program specifies ANY DEFINED BY values

The following example shows how the ASN.1 syntax might define an ANY DEFINED BY value.

```
A ::= INTEGER
B ::= BIT STRING
C ::= BOOLEAN

X ::= SEQUENCE
{
    a INTEGER,
    b ANY DEFINED BY a --% ANY_TABLE_REF (Y)
}

--% Y ANY_TABLE ::=
--% {
--%     1 A,
--%     2 B,
--%     3 C
--% }
```

Given this ASN.1, if one wanted to have member *b* of type *X* be a bit string, field *a* must have a value of 2 (as defined by the ANY DEFINED BY resolution table *Y*). Therefore, an application program formats and sends to CMIP services the following:

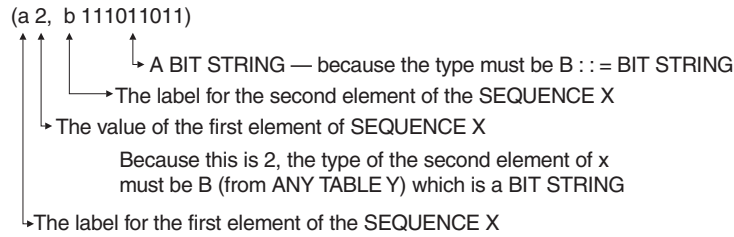


Figure 4. Defining a bit string field

## ANY types

The ANY type in ASN.1 carries no tagging information and can resolve to any other ASN.1 type. Because an unknown set of different types can be used to resolve an ANY, the API must be told about the tag to be used.

### How an application program sends an ANY value to CMIP services

An application program can send an ANY value to CMIP services in the following form:



#### Notes:

- 1 The hexadecimal value specified in this position must include the tag and length fields of the BER. Note that this is different from the hexadecimal values specified for other types.

The only valid format for an application program to use for an ANY value is hexadecimal BER.

### How CMIP services sends an ANY value to an application program

CMIP services sends an ANY value in hexadecimal BER format. It is important to note that the hexadecimal value for an ANY value **includes** the tag and length portions of the BER, in contrast to the hexadecimal BER formats of the other types.

CMIP services places labels in the string for all elements of the syntax that are present.

## Additional examples of how application programs send data

The following examples demonstrate how an application program can send primitive types and the more complex ASN.1 data types.

The first examples are based on the following ASN.1 module:

```

Abc DEFINITIONS IMPLICIT TAGS ::= BEGIN
  A ::= BOOLEAN
  B ::= INTEGER
  C ::= ENUMERATED {a(0), b(2), c(5), d(10)}

```

```

D ::= REAL
E ::= BIT STRING
F ::= OCTET STRING
G ::= NULL
H ::= OBJECT IDENTIFIER

a A ::= TRUE
b B ::= 12
c C ::= 10
e E ::= B'10010'
f F ::= H'1234567890'
g G ::= NULL
h H ::= { iso icd(3) 18 0 0 6 }
END

```

The following are all valid input strings:

Module	Type	String
Abc	A	TRUE
Abc	A	false
Abc	A	a
Abc	B	-12345
Abc	B	0
Abc	B	500000
Abc	B	b
Abc	C	b
Abc	C	c
Abc	D	3.125
Abc	D	-12E25
Abc	E	11011011010
Abc	E	""
Abc	E	e
Abc	F	1234567890123456
Abc	F	f
Abc	F	""
Abc	G	NULL
Abc	G	g
Abc	H	1.3.18.0.3
Abc	H	0.0
Abc	H	1.2.5.355465.2.1
Abc	H	h

The second set of examples show how to specify some constructed data types. This set of examples is based on the following ASN.1 module:

```

Xyz DEFINITIONS IMPLICIT TAGS ::= BEGIN

  X ::= SEQUENCE
  {
    a INTEGER,
    b BOOLEAN OPTIONAL,
    c INTEGER,

```

```

        d BIT STRING
    }
Y ::= SET OF INTEGER
Z ::= SEQUENCE
{
    a X,
    b Y
}

```

END

The following are all valid strings that the application program can send to CMIP services.

Module	Type	String
Xyz	X	(a 12, b TRUE, c 56000, d 1101101)
Xyz	X	(a 12, c 56000, d "1101101")
Xyz	X	(12, FALSE, 0, "")
Xyz	Y	(1, 2, 3, 4, 5, 6, 7, 8)
Xyz	Y	(1,2,3,4,5,6)
Xyz	Y	()
Xyz	Z	(a (a 12, b TRUE, c 56000, d 1101101), b (1,2,3,4))
Xyz	Z	(a (a 12, c 56000, d 1101101), b ())
Xyz	Z	((a 12, c 56000, d 1101101), ())





---

## Chapter 8. Examples of standard CMIP strings

This section contains examples of the CMIP strings that are sent between application programs and CMIP services.

The requests and responses are sent from the application program to CMIP services using the `MIBSendCmipRequest` and `MIBSendCmipResponse` functions. For a description of these functions, see pages “`MIBSendCmipRequest—CMIP request function`” on page 68 and “`MIBSendCmipResponse—CMIP response function`” on page 71. The indications and confirmations are received by the application program using the read queue exit routine or the dataspace dequeue routine.

The following example shows the call that an application program makes to the `MIBSendCmipRequest` to send a CMIP request. The values for the variables `OperationValue` and `Argument` will be determined by the type of request being sent. Examples on the following pages will show specific examples for the values of these variables.

```
int LinkId;
int rc;
void *LocalId;
unsigned int InvokeId;
unsigned int OperationValue;
char Argument[4096];

rc = MIBSendCmipRequest(LinkId,
                        OperationValue, /* 3 for GET, 7 for Action,
                                         8 for CREATE, etc.          */
                        Argument,
                        LocalId,
                        NULL, /* don't override source object
                               specified by LocalId          */
                        DS_NOT_PROVIDED, /* don't override dest */
                        NULL,
                        &InvokeId);
```

The following example shows the call that an application program makes to the `MIBSendCmipResponse` to send a CMIP response. The values for the variables `OperationValue` and `Argument` will be determined by the type of response being sent. Examples on the following pages will show specific examples for the values of these variables.

```
char *AssocHandleFromRequest;
int LinkId;
int rc;
void *LocalId;
unsigned int InvokeId, InvokeIdFromRequest;
unsigned int OperationValue;
char Argument[4096];

rc = MIBSendCmipResponse(LinkId,
                          InvokeIdFromRequest,
                          1, /* last-in-chain indicator */
                          1, /* successful */
                          OperationValue, /* 3 for GET, 7 for Action,
                                             8 for CREATE, etc.          */
                          Argument,
                          LocalId,
```

```

NULL, /* don't override source object
        specified by LocalId */
AssocHandleFromRequest,
&InvokeId);

```

---

## Requests and indications

The following descriptions are for CMIP requests and indications. A request is the message sent by a manager application program to an agent application program via the MIBSendCmipRequest function.

An indication is the message received by the agent application program corresponding to the request.

For each request, the following information is included:

- ASN.1 syntax
- Example request string
- Corresponding indication

### GET request—syntax

```

GetArgument ::= SEQUENCE
{
    baseManagedObjectClass      ObjectClass,
    baseManagedObjectInstance  ObjectInstance,
    accessControl                [5] AccessControl OPTIONAL,
    synchronization             [6] IMPLICIT CMISync DEFAULT bestEffort,
    scope                        [7] Scope DEFAULT base-and : baseObject,
    filter                      CMISFilter DEFAULT and : {},
    attributeIdList              [12] IMPLICIT SET OF AttributeId OPTIONAL
}

```

### GET request—example request string

The operation-value for GET is 3, so the value of the OperationValue variable will be 3 as well.

Here is an example value of the Argument variable:

```

(baseManagedObjectClass 2.9.3.2.3.13,baseManagedObjectInstance
ce (distinguishedName "1.3.18.0.2.4.6=NETA;2.9.3.2.7.4=(name
SSCP1A)")

```

This will retrieve the values of all attributes of the system object on host NETA.SSCP1A.

### GET request—corresponding indication

Here is an example GET indication corresponding to the previous GET request example, as received by the application. This shows the APIhdr at the beginning of the message.

```

00000100 0003000A 00000001 00000001 *.....*
2FAA4356 00000000 00000000 01120020 *.....*
A2998360 A3A89785 40F16B40 A2998340 *src-type 1, src *
81F16B40 94A28740 C3D4C9D7 60F14BD5 *a1, msg CMIP-1.N*
96A38986 898381A3 89969540 4D8995A5 *otification (inv*
969285C9 C440F1F9 F6F6F1F8 6B409697 *okeID 196618, op*
859981A3 89969560 A58193A4 8540F06B *eration-value 0,*
40819987 A4948595 A3404D94 81958187 * argument (manag*

```

```

8584D682 918583A3 C39381A2 A240F14B *edObjectClass 1.*
F34BF1F8 4BF04BF0 4BF2F2F6 F76B4094 *3.18.0.0.2267, m*
81958187 8584D682 918583A3 C995A2A3 *anagedObjectInst*
81958385 404D8489 A2A38995 87A489A2 *ance (distinguis*
888584D5 81948540 7DF14BF3 4BF1F84B *hedName '1.3.18.*
F04BF24B F44BF67E D5C5E3C1 5EF14BF3 *0.2.4.6=NETA;1.3*
4BF1F84B F04BF04B F2F0F3F2 7EE2E2C3 *.18.0.0.2032=SSC*
D7F1C15E F14BF34B F1F84BF0 4BF04BF2 *P1A;1.3.18.0.0.2*
F2F7F27E E2E6C9E3 C3C8C5C4 4BE2E6D5 *272=SWITCHED.SWN*
C4F3C1C2 F77D5D6B 4085A585 95A3E3A8 *D3AB7'), eventTy*
978540F2 4BF94BF3 4BF24BF1 F04BF65D *pe 2.9.3.2.10.6)*
5D00 *)

```

## ACTION request—syntax

```

ActionArgument ::= SEQUENCE {
    baseManagedObjectClass      ObjectClass,
    baseManagedObjectInstance   ObjectInstance,
    accessControl                 [5] AccessControl OPTIONAL,
    synchronization              [6] IMPLICIT CMISync DEFAULT bestEffort,
    scope                        [7] Scope OPTIONAL,
    filter                       CMISFilter DEFAULT and : {},
    actionInfo                   [12] IMPLICIT ActionInfo
}

```

## ACTION request—example request string

The operation-value for ACTION is 7, so the value of the OperationValue variable will be 7 as well.

Here is an example value of the Argument variable:

```

(baseManagedObjectClass 1.3.18.0.0.2151,baseManagedObjectIns
tance (distinguishedName "1.3.18.0.2.4.6=NETA;1.3.18.0.0.203
2=SSCP1A;1.3.18.0.0.2216=(string SnaNetwork"),actionInfo (a
ctionType 1.3.18.0.0.2222, actionInfoArg (start oneTimeOnly)
))

```

## ACTION request—corresponding indication

Here is an example ACTION indication corresponding to the previous ACTION request example, as received by the application. This shows the APIhdr at the beginning of the message.

```

00000100 00030012 * .....*
00000002 00000001 2FAA536E 00000000 *.....>....*
00000000 0120FA08 A2998360 A3A89785 *.....src-type*
40F16B40 A2998340 81F16B40 94A28740 * 1, src a1, msg *
C3D4C9D7 60F14BD9 D6C9E581 9784A440 *CMIP-1.R0IVapdu *
4D8995A5 969285C9 C440F1F9 F6F6F2F6 *(invokeID 196626*
6B409697 859981A3 89969560 A58193A4 *, operation-valu*
8540F76B 40819987 A4948595 A3404D82 *e 7, argument (b*
81A285D4 81958187 8584D682 918583A3 *aseManagedObject*
C39381A2 A240F14B F34BF1F8 4BF04BF0 *Class 1.3.18.0.0*
4BF2F1F5 F16B4082 81A285D4 81958187 *.2151, baseManag*
8584D682 918583A3 C995A2A3 81958385 *edObjectInstance*
404D8489 A2A38995 87A489A2 888584D5 * (distinguishedN*
81948540 4DD98593 81A389A5 85C489A2 *ame (RelativeDis*
A3899587 A489A288 8584D581 9485404D *tinguishedName (*
C1A3A399 8982A4A3 85E58193 A485C1A2 *AttributeValueAs*
A28599A3 89969540 4D81A3A3 998982A4 *sertion (attribu*
A385E3A8 978540F1 4BF34BF1 F84BF04B *teType 1.3.18.0.*
F24BF44B F66B4081 A3A39989 82A4A385 *2.4.6, attribute*
E58193A4 85407FD5 C5E3C17F 5D5D6B40 *Value "NETA"), *
D9859381 A389A585 C489A2A3 899587A4 *RelativeDistingu*

```

```

89A28885 84D58194 85404DC1 A3A39989      *ishedName (Attri*
82A4A385 E58193A4 85C1A2A2 8599A389      *buteValueAsserti*
9695404D 81A3A399 8982A4A3 85E3A897      *on (attributeTyp*
8540F14B F34BF1F8 4BF04BF0 4BF2F0F3      *e 1.3.18.0.0.203*
F26B4081 A3A39989 82A4A385 E58193A4      *2, attributeValu*
85407FE2 E2C3D7F1 C17F5D5D 6B40D985      *e "SSCP1A")), Re*
9381A389 A585C489 A2A38995 87A489A2      *lativeDistinguis*
888584D5 81948540 4DC1A3A3 998982A4      *hedName (Attribu*
A385E581 93A485C1 A2A28599 A3899695      *teValueAssertion*
404D81A3 A3998982 A4A385E3 A8978540      * (attributeType *
F14BF34B F1F84BF0 4BF04BF2 F2F1F66B      *1.3.18.0.0.2216,*
4081A3A3 998982A4 A385E581 93A48540      * attributeValue *
4DA2A399 89958740 7FE29581 D585A3A6      *(string "SnaNetw*
9699927F 5D5D5D5D 5D6B4081 83A38996      *ork")))), actio*
95C99586 96404D81 83A38996 95E3A897      *nInfo (actionTyp*
8540F14B F34BF1F8 4BF04BF0 4BF2F2F2      *e 1.3.18.0.0.222*
F26B4081 83A38996 95C99586 96C19987      *2, actionInfoArg*
404DA2A3 8199A340 969585E3 899485D6      * (start oneTime0*
9593A85D 5D5D5D00                                *nly))).

```

---

## Responses and confirmations

The following descriptions are for CMIP responses and confirmations. A response is the message sent by an agent application program to a manager application program via the MIBSendCmipResponse function.

A confirmation is the message received by the manager application program which corresponds to the response.

For each response or confirmation, the following information is included:

- ASN.1 syntax
- Example response string
- Corresponding confirmation

### GET response—syntax

```

GetResult ::=
    SEQUENCE { managedObjectClass ObjectClass OPTIONAL,
               managedObjectInstance ObjectInstance OPTIONAL,
               currentTime [5] IMPLICIT GeneralizedTime OPTIONAL,
               attributeList [6] IMPLICIT SET OF Attribute OPTIONAL
    }

```

### GET response—example response string

The operation-value for GET is 3, so the value of the OperationValue variable will be 3 as well.

Here is an example value of the Argument variable:

```

(managedObjectClass &OC,(distinguishedName &DN),attribu
buteList ((attributeId 2.9.3.2.7.5, (distinguishedNam
e (((attributeType 1.3.18.0.2.4.6,attributeValue
NETA), (attributeType 2.9.3.2.7.4,attributeValue
(name "SSCP1A"))))), (attributeId 2.9.3.2.7.35, enab
led)))

```

## GET response—corresponding confirmation

Here is an example GET confirmation corresponding to the previous GET response example, as received by the application. This shows the APIhdr at the beginning of the message.

```
00000000 00000000 00000000 00030008 * .....*
00000003 00000001 2FB39434 00000000 *.....m.....*
00000000 00000001 A2998360 A3A89785 *.....src-type*
40F16B40 A2998340 81F16B40 94A28740 * 1, src a1, msg *
C3D4C9D7 60F14BD9 D6D9E281 9784A440 *CMIP-1.RORSapdu *
4D8995A5 969285C9 C440F1F9 F6F6F1F6 *(invokeID 196616*
6B409985 A2A493A3 D697A389 9695404D *, resultOption (*
96978599 81A38996 9560A581 93A48540 *operation-value *
F36B4099 85A2A493 A3404D94 81958187 *3, result (manag*
8584D682 918583A3 C39381A2 A240F24B *edObjectClass 2.*
F94BF34B F24BF34B F1F36B40 94819581 *9.3.2.3.13, mana*
878584D6 82918583 A3C995A2 A3819583 *gedObjectInstanc*
85404D84 89A2A389 9587A489 A2888584 *e (distinguished*
D5819485 404DD985 9381A389 A585C489 *Name (RelativeDi*
A2A38995 87A489A2 888584D5 81948540 *stinguishedName *
4DC1A3A3 998982A4 A385E581 93A485C1 *(AttributeValueA*
A2A28599 A3899695 404D81A3 A3998982 *ssertion (attrib*
A4A385E3 A8978540 F14BF34B F1F84BF0 *uteType 1.3.18.0*
4BF24BF4 4BF66B40 81A3A399 8982A4A3 *.2.4.6, attribut*
85E58193 A485407F D5C5E3C1 7F5D5D6B *eValue "NETA")),*
40D98593 81A389A5 85C489A2 A3899587 * RelativeDisting*
A489A288 8584D581 9485404D C1A3A399 *uishedName (Attr*
8982A4A3 85E58193 A485C1A2 A28599A3 *ibuteValueAssert*
89969540 4D81A3A3 998982A4 A385E3A8 *ion (attributeTy*
978540F2 4BF94BF3 4BF24BF7 4BF46B40 *pe 2.9.3.2.7.4, *
81A3A399 8982A4A3 85E58193 A485404D *attributeValue (*
95819485 407FE2E2 C3D7F1C1 7F5D5D5D *name "SSCP1A")))*
5D5D6B40 81A3A399 8982A4A3 85D389A2 *)), attributeLis*
A3404DC1 A3A39989 82A4A385 404D81A3 *t (Attribute (at*
A3998982 A4A385C9 8440F24B F94BF34B *tributeId 2.9.3.*
F24BF74B F56B4081 A3A39989 82A4A385 *2.7.5, attribute*
E58193A4 85404D84 89A2A389 9587A489 *Value (distingui*
A2888584 D5819485 404DD985 9381A389 *shedName (Relati*
A585C489 A2A38995 A2A38995 87A489A2 888584D5 *veDistinguishedN*
81948540 4DC1A3A3 998982A4 A385E581 *ame (AttributeVa*
93A485C1 A2A28599 A3899695 404D81A3 *lueAssertion (at*
A3998982 A4A385E3 A8978540 F14BF34B *tributeType 1.3.*
F1F84BF0 4BF24BF4 4BF66B40 81A3A399 *18.0.2.4.6, attr*
8982A4A3 85E58193 A485407F D5C5E3C1 *ibuteValue "NETA*
7F5D6B40 C1A3A399 8982A4A3 85E58193 *"), AttributeVal*
A485C1A2 A28599A3 89969540 4D81A3A3 *ueAssertion (att*
998982A4 A385E3A8 978540F2 4BF94BF3 *tributeType 2.9.3*
4BF24BF7 4BF46B40 81A3A399 8982A4A3 *.2.7.4, attribut*
85E58193 A485404D 95819485 407FE2E2 *eValue (name "SS*
C3D7F1C1 7F5D5D5D 5D5D5D6B 40C1A3A3 *CP1A"))))))), Att*
998982A4 A385404D 81A3A399 8982A4A3 *tribute (attribut*
85C98440 F24BF94B F34BF24B F74BF3F5 *eId 2.9.3.2.7.35*
6B4081A3 A3998982 A4A385E5 8193A485 *, attributeValue*
40859581 82938584 5D5D5D5D 5D00 * enabled)))). *
```

## CREATE response—syntax

```
CreateResult ::=
SEQUENCE { managedObjectClass ObjectClass OPTIONAL,
            managedObjectInstance ObjectInstance OPTIONAL,
            currentTime [5] IMPLICIT GeneralizedTime OPTIONAL,
            attributeList [6] IMPLICIT SET OF Attribute OPTIONAL
}
```

## CREATE response—example response string

The operation-value for CREATE is 8, so the value of the OperationValue variable will be 8 as well.

Here is an example value of the Argument variable:

```
(managedObjectClass 1.3.18.0.0.2054, (distinguish
hedName '1.3.18.0.2.4.6=NETA;2.9.3.2.7.4=(name "
SSCP1A");2.9.3.2.7.1=(string "EFD00001")'), attr
ibuteList ((2.9.3.2.7.65, 1.3.18.0.0.2),(2.9.3.2
.7.1, (string "EFD00001")), (2.9.3.2.7.66, (2.9.3
.2.4.17,2.9.3.2.4.22,1.3.18.0.0.2063)), (2.9.3.2.
7.50, (2.9.3.2.3.4)), (2.9.3.2.7.31, unlocked), (2
.9.3.2.7.35, enabled), (1.3.18.0.0.2775, ()), (2.9
.3.2.7.33, ()), (2.9.3.2.7.56, (item (equality (at
tributeId 2.9.3.2.7.14, attributeValue 2.9.3.2.1
0.7))))), (2.9.3.2.7.55, (single (name (RDNSequence
(RelativeDistinguishedName (AttributeValueAsser
tion (attributeType 1.3.18.0.2.4.6, attributeVal
ue "NETA")), RelativeDistinguishedName (Attribut
eValueAssertion (attributeType 2.9.3.2.7.4, attr
ibuteValue (name "SSCP1A"))), RelativeDistinguis
hedName (AttributeValueAssertion (attributeType
1.3.18.0.2.4.12, attributeValue "aplposec"))))))),
(2.9.3.2.7.63,2.9.3.2.6.1)))
```

## CREATE response—corresponding confirmation

Here is an example CREATE confirmation corresponding to the previous CREATE response example, as received by the application. This shows the APIhdr at the beginning of the message.

```
00000000 0003000A * .....*
00000003 00000001 2FB398C6 00000000 *.....qF....*
00000000 00000004 A2998360 A3A89785 *.....src-type*
40F16B40 A2998340 81F16B40 94A28740 * 1, src a1, msg *
C3D4C9D7 60F14BD9 D6D9E281 9784A440 *CMIP-1.RORSapdu *
4D8995A5 969285C9 C440F1F9 F6F6F1F8 *(invokeID 196618*
6B409985 A2A493A3 D697A389 9695404D *, resultOption (*
96978599 81A38996 9560A581 93A48540 *operation-value *
F86B4099 85A2A493 A3404D94 81958187 *8, result (manag*
8584D682 918583A3 C39381A2 A240F14B *edObjectClass 1.*
F34BF1F8 4BF04BF0 4BF2F0F5 F46B4094 *3.18.0.0.2054, m*
81958187 8584D682 918583A3 C995A2A3 *anagedObjectInst*
81958385 404D8489 A2A38995 87A489A2 *ance (distinguish*
888584D5 81948540 4DD98593 81A389A5 *hedName (Relativ*
85C489A2 A3899587 A489A288 8584D581 *eDistinguishedNa*
9485404D C1A3A399 8982A4A3 85E58193 *me (AttributeVal*
A485C1A2 A28599A3 89969540 4D81A3A3 *ueAssertion (att*
998982A4 A385E3A8 978540F1 4BF34BF1 *tributeType 1.3.1*
F84BF04B F24BF44B F66B4081 A3A39989 *8.0.2.4.6, attri*
82A4A385 E58193A4 85407FD5 C5E3C17F *buteValue "NETA"*
5D5D6B40 D9859381 A389A585 C489A2A3 *)), RelativeDist*
899587A4 89A28885 84D58194 85404DC1 *inguishedName (A*
A3A39989 82A4A385 E58193A4 85C1A2A2 *ttributeValueAss*
8599A389 9695404D 81A3A399 8982A4A3 *ertion (attribut*
85E3A897 8540F24B F94BF34B F24BF74B *eType 2.9.3.2.7.*
F46B4081 A3A39989 82A4A385 E58193A4 *4, attributeValu*
85404D95 81948540 7FE2E2C3 D7F1C17F *e (name "SSCP1A"*
5D5D5D6B 40D98593 81A389A5 85C489A2 *)), RelativeDis*
A3899587 A489A288 8584D581 9485404D *tinguishedName (*
C1A3A399 8982A4A3 85E58193 A485C1A2 *AttributeValueAs*
A28599A3 89969540 4D81A3A3 998982A4 *sertion (attribu*
A385E3A8 978540F2 4BF94BF3 4BF24BF7 *teType 2.9.3.2.7*
```

```

4BF16B40 81A3A399 8982A4A3 85E58193 *.1, attributeVal*
A485404D A2A39989 9587407F C5C6C4F0 *ue (string "EFD0*
F0F0F0F1 7F5D5D5D 5D5D6B40 81A3A399 *0001")))), attr*
8982A4A3 85D389A2 A3404DC1 A3A39989 *ibuteList (Attri*
82A4A385 404D81A3 A3998982 A4A385C9 *bute (attributeI*
8440F24B F94BF34B F24BF74B F6F56B40 *d 2.9.3.2.7.65, *
81A3A399 8982A4A3 85E58193 A48540F1 *attributeValue 1*
4BF34BF1 F84BF04B F04BF25D 6B40C1A3 *.3.18.0.0.2), At*
A3998982 A4A38540 4D81A3A3 998982A4 *tribute (attribu*
A385C984 40F24BF9 4BF34BF2 4BF74BF1 *teId 2.9.3.2.7.1*
6B4081A3 A3998982 A4A385E5 8193A485 *, attributeValue*
404DA2A3 99899587 407FC5C6 C4F0F0F0 * (string "EFD000*
F0F17F5D 5D6B40C1 A3A39989 82A4A385 *01")), Attribute*
404D81A3 A3998982 A4A385C9 8440F24B * (attributeId 2.*
F94BF34B F24BF74B F6F66B40 81A3A399 *9.3.2.7.66, attr*
8982A4A3 85E58193 A485404D D6C2D1C5 *ibuteValue (OBJE*
C3E360C9 C4C5D5E3 C9C6C9C5 D940F24B *CT-IDENTIFIER 2.*
F94BF34B F24BF44B F1F76B40 D6C2D1C5 *9.3.2.4.17, OBJE*
C3E360C9 C4C5D5E3 C9C6C9C5 D940F24B *CT-IDENTIFIER 2.*
F94BF34B F24BF44B F2F26B40 D6C2D1C5 *9.3.2.4.22, OBJE*
C3E360C9 C4C5D5E3 C9C6C9C5 D940F14B *CT-IDENTIFIER 1.*
F34BF1F8 4BF04BF0 4BF2F0F6 F35D5D6B *3.18.0.0.2063)),*
40C1A3A3 998982A4 A385404D 81A3A399 * Attribute (attr*
8982A4A3 85C98440 F24BF94B F34BF24B *ibuteId 2.9.3.2.*
F74BF5F0 6B4081A3 A3998982 A4A385E5 *7.50, attributeV*
8193A485 404DD682 918583A3 C39381A2 *alue (ObjectClas*
A240F24B F94BF34B F24BF34B F45D5D6B *s 2.9.3.2.3.4)),*
40C1A3A3 998982A4 A385404D 81A3A399 * Attribute (attr*
8982A4A3 85C98440 F24BF94B F34BF24B *ibuteId 2.9.3.2.*
F74BF3F1 6B4081A3 A3998982 A4A385E5 *7.31, attributeV*
8193A485 40A49593 96839285 845D6B40 *alue unlocked), *
C1A3A399 8982A4A3 85404D81 A3A39989 *Attribute (attri*
82A4A385 C98440F2 4BF94BF3 4BF24BF7 *buteId 2.9.3.2.7*
4BF3F56B 4081A3A3 998982A4 A385E581 *.35, attributeVa*
93A48540 85958182 9385845D 6B40C1A3 *lue enabled), At*
A3998982 A4A38540 4D81A3A3 998982A4 *tribute (attribu*
A385C984 40F14BF3 4BF1F84B F04BF04B *teId 1.3.18.0.0.*
F2F7F7F5 6B4081A3 A3998982 A4A385E5 *2775, attributeV*
8193A485 404D5D5D 6B40C1A3 A3998982 *alue ()), Attrib*
A4A38540 4D81A3A3 998982A4 A385C984 *ute (attributeId*
A3A39989 82A4A385 E58193A4 85404D5D * 2.9.3.2.7.33, a*
5D6B40C1 A3A39989 82A4A385 404D81A3 *attributeValue ()*
A3998982 A4A385C9 8440F24B F94BF34B *), Attribute (at*
F24BF74B F5F66B40 81A3A399 8982A4A3 *tributeId 2.9.3.*
85E58193 A485404D 89A38594 404D8598 *2.7.56, attribut*
A4819389 A3A8404D 81A3A399 8982A4A3 *eValue (item (eq*
85C98440 F24BF94B F34BF24B F74BF1F4 *uality (attribut*
6B4081A3 A3998982 A4A385E5 8193A485 *eId 2.9.3.2.7.14*
40F24BF9 4BF34BF2 4BF1F04B F75D5D5D *, attributeValue*
5D6B40C1 A3A39989 82A4A385 404D81A3 * 2.9.3.2.10.7)))*
A3998982 A4A385C9 8440F24B F94BF34B *), Attribute (at*
F24BF74B F5F56B40 81A3A399 8982A4A3 *tributeId 2.9.3.*
85E58193 A485404D A2899587 9385404D *2.7.55, attribut*
95819485 404DD9C4 D5E28598 A4859583 *eValue (single (*
85404DD9 859381A3 89A585C4 89A2A389 *name (RDNSequenc*
9587A489 A2888584 D5819485 404DC1A3 *e (RelativeDisti*
A3998982 A4A385E5 8193A485 C1A2A285 *nguishedName (At*
99A38996 95404D81 A3A39989 82A4A385 *tributeValueAsse*
E3A89785 40F14BF3 4BF1F84B F04BF24B *rtion (attribute*
F44BF66B 4081A3A3 998982A4 A385E581 *Type 1.3.18.0.2.*
93A48540 7FD5C5E3 C17F5D5D 6B40D985 *4.6, attributeVa*
9381A389 A585C489 A2A38995 87A489A2 *lue "NETA")), Re*
888584D5 81948540 4DC1A3A3 998982A4 *lativeDistinguis*
A385E581 93A485C1 A2A28599 A3899695 *hedName (Attribu*
404D81A3 A3998982 A4A385E3 A8978540 *teValueAssertion*
F24BF94B F34BF24B F74BF46B 4081A3A3 * (attributeType *
*2.9.3.2.7.4, att*

```

```

998982A4 A385E581 93A48540 4D958194 *ribeValue (nam*
85407FE2 E2C3D7F1 C17F5D5D 5D6B40D9 *e "SSCP1A))), R*
859381A3 89A585C4 89A2A389 9587A489 *relativeDistingui*
A2888584 D5819485 404DC1A3 A3998982 *shedName (Attrib*
A4A385E5 8193A485 C1A2A285 99A38996 *uteValueAssertio*
95404D81 A3A39989 82A4A385 E3A89785 *n (attributeType*
40F14BF3 4BF1F84B F04BF24B F44BF1F2 * 1.3.18.0.2.4.12*
6B4081A3 A3998982 A4A385E5 8193A485 *, attributeValue*
407F8197 939796A2 85837F5D 5D5D5D5D * "apIposec")))))*
5D5D6B40 C1A3A399 8982A4A3 85404D81 *)), Attribute (a*
A3A39989 82A4A385 C98440F2 4BF94BF3 *ttributeId 2.9.3*
4BF24BF7 4BF6F36B 4081A3A3 998982A4 *.2.7.63, attribu*
A385E581 93A48540 F24BF94B F34BF24B *teValue 2.9.3.2.*
F64BF15D 5D5D5D5D 00 *6.1)))). *
```



---

## Chapter 9. Create and delete requests

This chapter describes how an application program uses CMIP services to remotely create and delete objects on agent systems.

Objects are not directly created or deleted by CMIP services in response to CMIP m-Create and m-Delete requests. When a manager application program sends a create or delete request to an agent system, these requests are processed by CMIP agent application programs.

---

### Create requests

CMIP services requires that the create request provide the distinguished name of the object being created.

For an object to be created by CMIP services, the name binding to be used for the object must explicitly specify that the create operation is supported. If the name binding does not explicitly specify that the create operation is supported, the create request is rejected.

Because objects are not directly created by CMIP services, an application program must exist that is capable of processing the create request.

CMIP services looks for an application program to handle the create request; this application program is called a *create handler*.

- If CMIP services *finds a create handler*, CMIP services sends the create request to the create handler.
- If CMIP services *cannot find a create handler*, CMIP services rejects the create request with a noSuchObjectClass error.

When the create handler receives the create request, it does one of the following:

- Creates the new object requested on the create request
- Rejects the create request for the new object
- Creates an object different from the object requested on the create request

### Creating the new object requested on the create request

To create a new object that is to be registered on the same connection as the create handler, the create handler registers the new object with the MIBSendRegister function using the same distinguished name and object class that were specified on the create request.

After the create handler registers the new object, the create handler acknowledges the create request. The create handler uses the MIBSendCmipResponse function to return the response to the sender of the create request.

## Rejecting the create request

If the create handler decides to reject the create request, the create handler uses the `MIBSendDeleteRegistration` function with no local identifier and the object name provided with the create request to remove the pending registration for object that was requested to be created.

Then the create handler uses the `MIBSendCmipResponse` function to return an error response to the sender of the create request. The error describes to the manager application program why the create request was rejected.

## Creating an object different from object on the create request

If the create handler decides to create an object different from the one that was requested to be created, the create handler uses the `MIBSendDeleteRegistration` function with no local identifier and the object name provided with the create request to remove the pending registration for object that was requested to be created. Then the create handler registers the other object with the `MIBSendRegister` function.

After the create handler registers the new object, the create handler acknowledges the create request. The create handler uses the `MIBSendCmipResponse` function to return the response to the sender of the create request.

---

## Delete requests

Because objects are not directly deleted by CMIP services, all application programs must be able to handle delete requests.

For registered objects, the application program sends the delete request to the application program that registered the object. For objects that are not registered, the application program sends the delete request to the subtree manager of the object. The create handler is not involved in the processing of the delete request.

When an application program receives the delete request, it either deletes the object or rejects the delete request. These two situations are described here for non-scoped delete requests.

## Deleting the object requested on the delete request

In this situation, a manager application program requests that an object be deleted and the agent application program that owns the object allows it to be deleted. In general, these are the steps that are followed:

1. The manager application program issues the CMIP delete request for an object.
2. CMIP services sends an ROIV message to the agent application program that owns the object.
3. The agent application program sends the `MIB.DeleteResponse` with a result code of 0 to CMIP services.
4. CMIP services sends `MIB.Delete` with an action code of 0 to the agent application program.
5. The agent application program uses the `MIBSendCmipResponse` to return the CMIP delete response to CMIP services.

6. CMIP services sends an RORS to the manager application program containing the application program's delete response.
7. CMIP services sends the API\_TERMINATE\_INSTANCE to the deleted object.

## Rejecting the delete request

In this situation, a manager application program requests that an object be deleted and the agent application program that owns the object rejects the delete request. In general, these are the steps that are followed:

1. The manager application program issues the CMIP delete request for an object.
2. CMIP services sends an ROIV message to the agent application program that owns the object.
3. The agent application program sends the MIB.DeleteResponse with a result code of 1 to CMIP services.
4. CMIP services sends an ROER to the manager application program.

Subtree managers might receive deletes that were not scoped specifically to the subtree manager object but that might apply to an object under the subtree manager. The subtree manager must perform delete processing with its objects.



---

## Chapter 10. VTAM-specific requests and responses

The following VTAM-specific requests and responses are accepted and processed by VTAM CMIP services. The requests are sent by the MIBSendRequest function. The responses are sent from CMIP Services to the application program. These requests and responses allow the application program to perform certain actions that are specific to VTAM CMIP services, such as:

- “Subscribing to association information”
- “Registering an application entity” on page 135
- “Starting associations” on page 137
- “Ending associations” on page 138
- “Getting association information” on page 139
- “Creating a dedicated association” on page 140

Here are the requests and responses:

- ACF.Subscribe
- ACF.UnSubscribe
- ACF.RegisterAE
- ACF.Associate
- ACF.Release
- ACF.Abort
- ACF.GetAssociationInfo
- ACF.AssociateRsp
- ACF.SubscribeRsp
- ACF.SubscribeMess
- MIB.GeneralRequest
- MIB.GeneralResponse
- MIB.GeneralError
- MIB.ServiceError
- MIB.ServiceAccept
- MIB.RegisterAccept

In the following sections, please note that the example strings are divided across multiple lines for legibility only. The actual strings being sent must be continuous.

---

### Subscribing to association information

The ACF.Subscribe and ACF.UnSubscribe strings cause CMIP services to notify an application program when the state of an association changes. These strings are used only when an application program depends on maintaining a connection with another application program. Because associations are automatically started when they are needed, these strings are used infrequently.

## Syntax for the subscription strings

The following strings relate to subscribing to associations:

- ACF.Subscribe
- ACF.UnSubscribe
- ACF.SubscribeRsp
- ACF.SubscribeMess

The syntax for each string is shown here. Notice that the same response string, ACF.SubscribeRsp, is used for both the ACF.Subscribe and the ACF.UnSubscribe strings. Zero on the ACF.SubscribeRsp string indicates success; nonzero response values are in Appendix A, "C language header file (ACYAPHDH)," on page 235. For a distinguished name, either the full name or an abbreviated version can be used. The error code 803 indicates that the association does not exist.

```
Subscribe ::= CHOICE {
    ae-title    TitleType,
    association [2] IMPLICIT HandleType
}
```

```
UnSubscribe ::= CHOICE {
    ae-title    TitleType,
    association [2] IMPLICIT HandleType
}
```

```
TitleType ::= CHOICE {
    oi [0] IMPLICIT OBJECT IDENTIFIER
    dn [1] IMPLICIT DistinguishedName
}
```

```
HandleType ::= PrintableString (SIZE(1..36))
```

When the state of an association changes and an application program has registered to receive notification of changes through the ACF.Subscribe string, an ACF.SubscribeMess string is sent to that application program:

```
SubscribeMess ::= SubscribeState
```

The ACF.SubscribeMess syntax does not include the handle of the association whose state has changed. That can be found in the src field of the string header.

In the list of ACF.SubscribeState values, the following values have meaning:

- associated (means the association is established and running)
- terminated (means the association is ended).

The idle state is a temporary initial state. The wait-a-... states are transitional states. The wait-a-assoc-... states indicate that a new association is in the process of being established. The wait-a-rel-... states show that an existing association is in the process of being terminated.

```
SubscribeState ::= INTEGER {
    idle                (0),
    wait-a-assoc-rsp    (1),
    wait-a-assoc-ind    (2),
    wait-a-assoc-cnf    (3),
    wait-a-rel-rsp      (4),
    wait-a-rel-cnf      (5),
    associated          (8),
}
```

```

wait-a-rel-cnf-indicator (9),
wait-a-rel-rsp-responder (10),
terminated (11)
}

```

## Examples of subscription strings

```

ACF.Subscribe (association 'a2')
ACF.SubscribeRsp 803

```

```

ACF.Subscribe (ae-title (dn
(RelativeDistinguishedName (AttributeValueAssertion
(attributeType 1.3.18.0.2.4.6, attributeValue NETA)),
RelativeDistinguishedName (AttributeValueAssertion
(attributeType 2.9.3.2.7.4, attributeValue (name SSCP1A))),
RelativeDistinguishedName (AttributeValueAssertion
(attributeType 1.3.18.0.2.4.12, attributeValue MYAENAME))))
ACF.SubscribeRsp 0

```

```

ACF.UnSubscribe (association s7B1920)
ACF.SubscribeRsp 0

```

```

ACF.UnSubscribe (ae-title (dn "1.3.18.0.2.4.6=NETA;2.9.3.2
.7.4=(name SSCP1A);1.3.18.0.2.4.12=OSISMASE"))
ACF.SubscribeRsp 0
ACF.SubscribeMess 8

```

## How the subscription strings are used

To establish a subscription:

1. An application program builds an ACF.Subscribe string and sends it to CMIP services.
2. CMIP services registers the subscription and returns an ACF.SubscribeRsp string to indicate the success or failure of the subscription.
3. When the state of the association changes, CMIP services sends an ACF.SubscribeMess string to the application program containing the new state of the association.

To terminate a subscription:

1. An application program builds an ACF.UnSubscribe string and sends it to CMIP services.
2. CMIP services deletes the subscription and returns an ACF.SubscribeRsp string to indicate the success or failure of the deletion. An ACF.SubscribeRsp string that indicates success does not mean that a subscription did exist.

---

## Registering an application entity

The ACF.RegisterAE request is used to register an explicit application entity with CMIP services. This function can be used if an application program needs to be its own application entity. In general, application programs do not need to use this function. The default local application entity handles all of the application program strings for an association.

An application program must register as its own application entity, if:

- The application program is going to create EFDs.

- The application program needs to request a dedicated association. For a description of how to create a dedicated association, see “Creating a dedicated association” on page 140.

Any application program can register an application entity, but only one application program can register any particular application entity. For example, application programs A and B can each register application entities A' and B', but application program B cannot register A' once it has already been registered by application program A.

Any application program can register multiple application entities, but multiple application programs cannot register the same application entity.

Once an application entity has been registered, any associations that are remotely initiated specifying the application entity as the destination of the association are associated directly with the application program that registered the application entity. Any strings that do not include targeting information, such as events, are sent to the application entity directly.

The ACF.RegisterAE request can be used to create an application entity that represents a single application program on CMIP services. This string can be useful if the application program needs to receive event reports directly from other systems.

## Syntax of the registration strings

The ACF.RegisterAE request is used to register an application entity.

The syntax for each string is shown here.

```
RegisterAE ::= TitleType

TitleType ::= CHOICE {
    oi [0] IMPLICIT OBJECT IDENTIFIER
    dn [1] IMPLICIT DistinguishedName
}

RegisterRsp ::= INTEGER {
    success (0),
    not-accomplished (1)
}
```

## Examples of RegisterAE strings

The second example, identical to the first, fails because an application entity name can be registered only once by each instance of CMIP services.

```
ACF.RegisterAE (dn "1.3.18.0.2.4.6=NETA;2.9.3.2.7.
4=(name SSCP1A);1.3.18.0.2.4.12=MYAENAME")
MIB.ServiceAccept()
```

```
ACF.RegisterAE (dn "1.3.18.0.2.4.6=NETA;2.9.3.2.7.
4=(name SSCP1A);1.3.18.0.2.4.12=MYAENAME")
MIB.ServiceError(resultCode 827)
```

## How the registration strings are used

To register an application entity title:



1. An application program builds an ACF.RegisterAE request and sends it to CMIP services. CMIP services adds the identification of the source of the string, as with any other string.
2. CMIP services adds the application entity title to the list of supported local application entity titles and sets up communication so that local strings destined for this application entity take the same short path (with no encoding or decoding performed) as the local strings that are sent to the default local application entity.
3. CMIP services associates the name of the instance with the application entity being registered. This information is added to strings that arrive on associations with the application entity by CMIP services.
4. CMIP services responds to the instance indicating that the application entity has been registered.

---

## Starting associations

The ACF.Associate string causes CMIP services to start an association explicitly on behalf of an application program. In general, this string is not needed.

The ACF.Associate string can be used to establish a dedicated association for application programs that require them. For a description of how to create a dedicated association, see “Creating a dedicated association” on page 140.

## Syntax of the associate strings

The following strings relate to starting an associations:

- ACF.Associate
- ACF.AssociateRsp

The syntax for each string is shown here.

```
Associate ::= SEQUENCE {
    targetAE TitleType,
    securityInfo OCTET STRING OPTIONAL
}

TitleType ::= CHOICE {
    oi [0] IMPLICIT OBJECT IDENTIFIER
    dn [1] IMPLICIT DistinguishedName
}
```

## Examples of the associate strings

The example that includes the MIB.ServiceError string shows what happens when the target system is not connected: no association can be established.

```
ACF.Associate(targetAE (dn "1.3.18.0.2.4.6=NETA;2.9.3.2.
7.4=(name SSCP1A);1.3.18.0.2.4.12=MYAENAME"))
ACF.AssociateRsp (handle aF)

ACF.Associate(targetAE (dn "1.3.18.0.2.4.6=NETB;2.9.3.2.
7.4=(name SSCP1A);1.3.18.0.2.4.12=OSISMASE"))
MIB.ServiceError(resultCode 817)
```

## How the associate strings are used

When an application program sends an ACF.Associate string to CMIP services and the application program has already issued the ACF.RegisterAE request, a dedicated association is created. For information about a dedicated association, see “Creating a dedicated association” on page 140.

When an application program sends an ACF.Associate string to CMIP services and it has not issued registerAE, a default association is created.

A default association and an association created automatically by CMIP services share the following characteristics:

- Both types of associations can be automatically selected by CMIP services.
- Any application program can destroy the association.
- The association is automatically destroyed by timing out if it is not used.

To establish an association:

1. An application program builds an ACF.Associate string and sends it to CMIP services.
2. CMIP services initiates an association with the desired application entity and returns the newly assigned association handle for the association.

---

## Ending associations

In some cases, an application program knows that an association should be ended. The ACF.Release and ACF.Abort strings indicate that an association should be ended gracefully (ACF.Release) or abruptly (ACF.Abort). The ACF.Release string ensures that all pending messages have cleared before the association is ended.

If the association is ended successfully, the MIB.ServiceAccept string is sent. If the association is not ended successfully, the MIB.ServiceError string is sent. For description of these strings, see “Requests and responses with the MIB prefix” on page 141.

## Syntax of the ACF.Release and ACF.Abort strings

The following strings relate to ending associations:

- ACF.Release
- ACF.Abort

The syntax for each string is shown here.

```
Release ::= SEQUENCE {HandleType}
```

```
HandleType ::= PrintableString (SIZE(1..36))
```

```
Abort ::= SEQUENCE {HandleType}
```

## Examples of the ACF.Release and ACF.Abort strings

Note that the example that includes the MIB.ServiceError string has an extra right parenthesis.

```

ACF.Release (a4)
MIB.ServiceError(resultCode 345,resultMessage "msg ACF.Release (a4 ) )"

ACF.Abort (a8)
MIB.ServiceAccept()

ACF.Release (s17B1440)
MIB.ServiceAccept()

```

## How the ACF.Release and ACF.Abort strings are used

An application program sends either an ACF.Release or ACF.Abort string containing the identification of the association to be ended. If the association exists, it is ended. CMIP services sends the ACF.AssociateRsp string to the application program.

---

## Getting association information

In some cases an application program needs to learn about an active association. An application program can request a number of items corresponding to a specific association. CMIP services returns values for the following attributes:

- state
- partner-AE-title
- securityInfo
- peerAuthenticationPerformed

## Syntax of the GetAssociationInfo string

The ACF.GetAssociationInfo string gathers information about an active association.

This syntax for each string is shown here.

```

GetAssociationInfo ::= SEQUENCE {
    handle GraphicString,
    info BIT STRING {
        state (0),
        assoc-handle (1),
        sess-handle (2),
        partner-AE-Title (3),
        application-context (4),
        presentation-context-def-list (5),
        securityInfo (6),
        peerAuthenticationPerformed (7),
    }
}

AssociationInfo ::= SET OF InformationPair

InformationPair ::= SEQUENCE {
    label GraphicString,
    value GraphicString
}

```

## Examples of the GetAssociationInfo string

The first example includes the MIB.ServiceError string because the message did not specify as many zeros or ones as there are bits in the bit string.

The remaining examples show successful use of ACF.GetAssociationInfo.

```

ACF.GetAssociationInfo(handle 'a1', info 00010)
MIB.ServiceError(resultCode 804)

ACF.GetAssociationInfo(handle a1, info 00000000)
ACF.AssociationInfo ()

ACF.GetAssociationInfo(handle 'a2', info 00010000)
ACF.AssociationInfo ((partner-AE-Title '1.3.18.0.2.4.6=N
ETA;2.9.3.2.7.4=(name "SSCP1A");1.3.18.0.2.4.12=OSISMASE'))

ACF.GetAssociationInfo(handle 'a3', info 10010000)
ACF.AssociationInfo ((state 8),(partner-AE-Title '1.3.18
.0.2.4.6=NETA;2.9.3.2.7.4=(name "SSCP1A");1.3.18.0.2.4.12=OSISMASE'))

ACF.GetAssociationInfo(handle 's147B290', info 10010011)
ACF.AssociationInfo ((state 8),(partner-AE-Title '1.3.18
.0.2.4.6=NETA;2.9.3.2.7.4=(name "SSCP2A");1.3.18.0.2.4.12=OS
ISMASE'),(securityInfo ""),(peerAuthenticationPerformed TRUE))

ACF.GetAssociationInfo(handle 'aA', info 11111111)
ACF.AssociationInfo ((state 8),(partner-AE-Title '1.3.18
.0.2.4.6=NETA;2.9.3.2.7.4=(name "SSCP2A");1.3.18.0.2.4.12=OS
ISMASE'),(securityInfo A1B2C3D4),(peerAuthenticationPerformed FALSE))

```

## How the GetAssociationInfo string is used

An application program sends a GetAssociationInfo string to CMIP services, filling in the types of information it requires. CMIP services returns an AssociationInfo string containing the desired information.

The labels used to identify the information on the response are identical to the named bits on the request.

The value is the value corresponding to the label. For securityInfo, the value is the information passed (if any) from the association partner when the association was requested. For securityInfo, the value is saved only on the target CMIP services.

For peerAuthenticationPerformed, the value (on both initiating and target systems) is 0 if no authentication is performed by CMIP services and 1 if DES-based security is performed for this association by CMIP services.

---

## Creating a dedicated association

### About this task

A dedicated association is restricted as to who can use it on the CMIP services that created the association. A dedicated association has the following characteristics:

- It is only used if specifically requested by the application program that sends the ACF.Associate string to CMIP services.
- It can only be destroyed by an ACF.Release or ACF.Abort string from the application program that sent the ACF.Associate string.

**Note:** On the other CMIP services, the association is not flagged as dedicated. Therefore, it can time out or be used by any application program.

In some cases, application programs need to monitor the existence of remote systems. For example, an application program might need to be aware when a remote system fails. Having EFDs on that remote system helps only in cases when

actual communication remains intact. If connectivity to the remote system is lost, the application program might not be notified of the event. If the application program needs to know that connectivity is lost, the application program can start a dedicated association to the remote system and monitor it for failures.

Idle CMIP associations are terminated by CMIP services on a regular basis, according to a timer:

- If limited resources is enabled, the limited resources timer is used.
- If limited resources is not enabled, the CMIP services timer is used. The CMIP services timer terminates idle associations every 2 hours.

Shared associations, which are those started automatically by CMIP services on an as-needed basis, are terminated when the timer expires, unless the association is being used for an outstanding CMIP operation.

Dedicated associations are not terminated on the originating system even if there is no outstanding work. Note that remote systems, which are those that did not initiate the dedicated association, are not aware that the association is dedicated. The remote systems treat the association as shared. The remote systems terminate the idle association when the timer on the remote system expires.

To prevent associations from being automatically terminated, you can maintain a never-ending operation on the association. For example, one application program can be designed to have a special object that never responds to a particular operation. Another application program can then issue this special operation to that object, solely for the purpose of maintaining a never-ending operation on the association.

The application programs can continue to send or receive other operations on that same association.

In addition to ensuring that the association remains active, an application program can monitor an association by subscribing to it. When an application program subscribes to an association, the application program is notified if the association is terminated. For a description of how to subscribe to an association, see “Subscribing to association information” on page 133.

To create a dedicated association, an application program must do the following:

- Register an application entity (AE) title. Refer to “Registering an application entity” on page 135 for more information.
- Establish an association with the remote system as the target application entity. Refer to “Starting associations” on page 137 for more information.
- Subscribe to the association. Refer to “Subscribing to association information” on page 133 for more information.

---

## Requests and responses with the MIB prefix

The following requests and responses are described in this section:

- MIB.GeneralRequest
- MIB.GeneralResponse
- MIB.GeneralError
- MIB.ServiceError
- MIB.ServiceAccept

- MIB.RegisterAccept

## MIB.GeneralRequest, MIB.GeneralResponse, and MIB.GeneralError

These messages are built on behalf of the application program by the MIBSendCmipRequest and MIBSendCmipResponse functions. An application program does not build them and an application program will not receive them. They appear in buffer traces of application programs that call the MIBSendCmipRequest or MIBSendCmipResponse functions.

## MIB.ServiceError

The MIB.ServiceError message is sent to an application program from CMIP services when a request or response from the application program cannot be processed for some reason. Some example reasons are parsing errors in the request, network errors trying to reach the destination object, or memory allocation errors.

For some types of errors, additional information will be provided in the optional resultMessage section of the ServiceError SEQUENCE.

Here is a sample ServiceError as received by an application, including the APIhdr:

```
03000000 00030017 00000003 00000001 *.....*
2FAA7B32 013D0000 00000000 00000001 *..#.....*
94A28740 D4C9C24B E28599A5 898385C5 *msg MIB.ServiceE*
99999699 4D9985A2 A493A3C3 96848540 *rror(resultCode *
F3F1F76B 9985A2A4 93A3D485 A2A28187 *317,resultMessag*
85407FA4 948595A3 404DF24B F94BF34B *e "ument (2.9.3.*
F24BF34B F1F36BC0 91D08586 86D48195 *2.3.13,.j.effMan*
81878584 D6829185 83A3C995 A27F5D00 *agedObjectIns").*
```

The position of the string where parsing stopped is delimited in the portion of the original message by 'X'C0' and 'X'D0'. In this case, the character pointed out is *j* of *jeffManagedObjectInstance*. This label should instead be *baseManagedObjectInstance*.

## MIB.ServiceAccept

The MIB.ServiceAccept message is sent to an application program from CMIP services when the application program sends an unconfirmed CMIP request or a CMIP response. Its purpose is to notify the application program that the request or response was processed correctly.

Here is a sample MIB.ServiceAccept as received by an application program including the APIhdr:

```
02000100 00030011 00000001 00000001 *.....*
2FAA54E5 00000000 00000000 00000001 *...V.....*
A2998360 A3A89785 40F16B40 A2998340 *src-type 1, src *
81F16B40 94A28740 D4C9C24B E28599A5 *a1, msg MIB.Serv*
898385C1 83838597 A34D5D00 *iceAccept(). *
```

## MIB.RegisterAccept

The MIB.RegisterAccept message is sent to an application program from CMIP services when an object is successfully registered by that application program.

An object can be successfully registered even if one or more items in the allomorphs list or create handler list cannot be processed. In this case, information about allomorphs or create handler failures will be in the MIB.RegisterAccept message.

Here is an example MIB.RegisterAccept as received by an application program including the APIhdr:

```

01000000 00030018 *          .....*
00000003 00000001 2FAA7CF4 00000000 *......@4....*
00000000 00010000 A2998360 A3A89785 *......src-type*
40F16B40 A2998340 81F16B40 94A28740 * 1, src a1, msg *
D4C9C24B D9858789 A2A38599 C1838385 *MIB.RegisterAcce*
97A34D95 819485C2 89958489 958740F1 *pt(nameBinding 1*
4BF34BF1 F84BF04B F04BF2F1 F7F26B40 *.3.18.0.0.2172, *
81939396 94969997 88A2C599 999699D3 *allomorphsErrorL*
89A2A340 4D5D6B40 83998581 A385C881 *ist (), createHa*
95849385 99C59999 9699D389 A2A34D5D *ndlerErrorList()*
5D00 *) *

```





---

## Chapter 11. Application-program-to-application-program security

In VTAM CMIP services, there are two kinds of security:

- System-to-system security
- Application-program-to-application-program security.

System-to-system security is between two instances of CMIP services or between CMIP services and itself. See *z/OS Communications Server: SNA Network Implementation Guide* and *z/OS Communications Server: SNA Resource Definition Reference* for more information about this type of security.

This chapter describes how to define application-program-to-application-program security.

For any particular association, application-program-to-application-program security and DES-based system-to-system security are mutually exclusive. If two application programs decide to implement application-program-to-application-program security and the CMIP Services for each application program has defined DES-based security to be used between the two CMIP services, the association between the two application programs fails. To establish a secure association between two application programs on two instances of CMIP services, choose one of the following methods:

- Use DES-based security for all associations between the two instances
- Use application-program-to-application-program security for all associations between the two instances
- Register an application entity title for one or both application programs. Use application-program-to-application-program security between the two application entities. For a description of how to register an application entity title, see “Registering an application entity” on page 135.

To use application-program-to-application-program security, you need to understand the sequence of strings sent between each instance of CMIP services and the application programs attempting to set up an association.

For syntax and details about the particular strings, see Chapter 10, “VTAM-specific requests and responses,” on page 133.

If the two instances of CMIP services for the application programs have defined the `associationKey` attribute `associationKey '.'` in the directory definition files, follow the steps here to specify application-program-to-application-program security.

As you read the steps, see Figure 5 on page 146 for an illustration. The numbers in the figure correspond to the steps.

The steps refer to an *origin application program* and a *target application program*. The origin application program requests that the association be established with the target application program. For example, the origin application program might be a manager application program, and the target application program might be an agent application program.

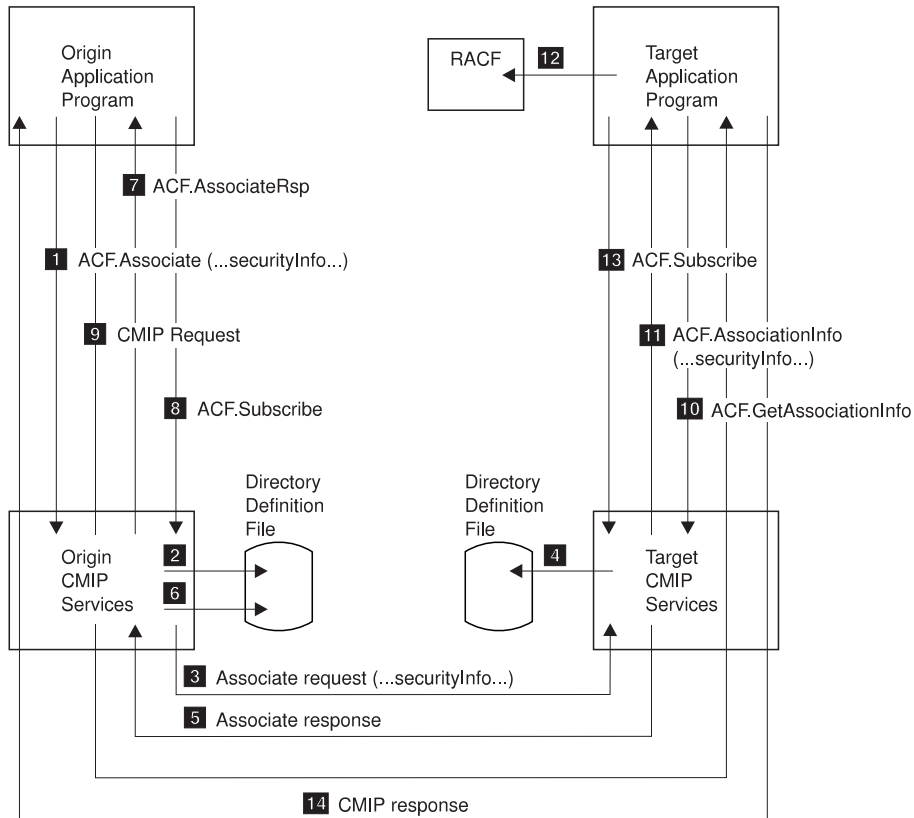


Figure 5. Application-program-to-application-program security

1. The origin application program decides to communicate with a target application program. The origin application program issues an ACF.Associate string to its CMIP services. The ACF.Associate string includes the securityInfo attribute.
2. The origin application program checks the directory definition file. The directory definition file indicates that the association is allowed to be established between the two application programs. The file also indicates that the securityInfo attribute must be passed to the target application program.
3. CMIP services sends the securityInfo value on the associate request to the other CMIP services.
4. If the receiving CMIP services is not using DES-based security, that CMIP services discovers the securityInfo value. CMIP services assumes that the securityInfo information is tied to that particular association.
5. The CMIP services for the target application program sends a positive response to the associate request.
6. The CMIP services for the origin application program checks the directory definition file again, in case it has changed.
7. When the association between the two CMIP services has been established successfully, CMIP services returns an association handle, which identifies to the application program this particular association.
8. The origin application program subscribes to that association so that the origin application program can be informed when the association ends.  
So long as the CMIP services association stays intact, the partner at the other end is the same on subsequent requests as it was on the initial request.

However, associations can be terminated independently of either the origin application program or the target application program. For example, either of the following could end an association:

- The limited resources function in VTAM that allows the selective termination of idle LU 6.2 (APPC) sessions can end an association by terminating a session that the association is using.
- CMIP services can end an association that has not been used.

For more information about the effects of the VTAM limited resources function and the CMIP services automatic termination of associations, see “Starting associations” on page 137.

Because associations can be reused for associations between different partners at a later time, the application programs on both ends of an association need to be aware of the association status.

In this example, the origin application program initiates the association. If the association goes down, the origin application program needs to initiate another association and possibly reissue requests that are outstanding at the time the prior association ended. (CMIP services for the origin application program returns an error when requests are sent over an association that has ended.)

To be aware of association termination, the origin application program can either issue an ACF.Subscribe string for that association or wait until an error code is returned from the MIBSendCmipRequest or MIBSendRequest function.

9. The origin application program sends to the target application program a CMIP request. The origin application program identifies the appropriate association by using the association handle that was returned in step 7 on page 146.

CMIP services routes the request over only the designated association. This is the first time that the target application program is aware of the existence of the origin application program.

If CMIP services cannot route the request over that association, CMIP services returns the string MIB.ServiceError (resultCode *nnn*) to the application program, where *nnn* is the number of the error code.

For the names of each error code number, see the language header file, ACYAPHDH, or Appendix A, “C language header file (ACYAPHDH),” on page 235. For the names with descriptions of each error code number, see Appendix C, “Error codes sent by CMIP services,” on page 269.

10. If this is the first CMIP request issued by the origin application program after requesting the association, the target application program has no prior knowledge of the particular association. The target application program therefore issues the GetAssociationInfo string to CMIP services, specifying the particular association handle.
11. CMIP services returns the requested information on the ACF.AssociationInfo string and includes the securityInfo value that was obtained by the origin CMIP services.
12. On *every* CMIP request, the target application program is required to verify whether the requesting application program has authority to issue such a request and to receive a valid response. In this example, the target application program accesses a security function, such as Resource Access Control Facility (RACF®).
13. As mentioned in step 8 on page 146, the application programs on both ends of the association need to be aware of the association status. Therefore, the target application program should also issue the ACF.Subscribe string to its CMIP

services. If the target application program ever receives an ACF.SubscribeMess string indicating that the association is no longer active, the target application program should discard its knowledge of this association, because this information is no longer valid.

14. The target application program responds to the CMIP request.

Note that most of these steps occur only when the association is being established. Once the association is established, only steps 9 on page 147, 12 on page 147, and 14 are performed.

---

## Part 2. VTAM topology agent



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## Chapter 12. Introduction to VTAM topology agent

In VTAM, CMIP services is made available by specifying the OSIMGMT=YES start option. This start option gives you access to the following:

- VTAM topology agent
- CMIP services

The VTAM topology agent is a part of VTAM that functions as a CMIP application program. It is designed to communicate through the application program interface that is part of VTAM CMIP services with a network manager application program, such as the NetView program. For information on the manager function, see *TME 10 NetView for OS/390 SNA Topology Manager and APPN Accounting Manager Implementation Guide*.

The information provided by the VTAM topology agent and CMIP services allows users at a topology manager application program to monitor resource status and to manage the network. The manager application program is installed, started, and maintained separately from VTAM.

The basic function of the VTAM topology agent is to provide the capability for monitoring the topology of a VTAM network. The VTAM topology agent provides this capability by supplying the following topology information:

- Local topology
- Network topology
- LUs that VTAM owns
- LUs that are owned by another node but are known to this VTAM

The VTAM topology agent supplies the topology information by:

- Responding to requests for data
- Providing unsolicited data

The following sections give the details of the CMIP operations that the VTAM topology agent supports and describe the data supplied by the topology agent for those CMIP operations. Chapter 13, “OSI object classes and VTAM resources,” on page 153 describes how the VTAM topology agent maps VTAM resources to OSI objects.

Chapter 14, “OSI operations,” on page 163 discusses the OSI operations that are performed on the objects, the CMIP responses and errors that the topology agent provides, and the general resource monitoring process.

Chapter 15, “VTAM topology monitoring,” on page 175 describes the specific resource-monitoring operations. This chapter describes how to request the monitoring and explains the data VTAM provides.

Chapter 16, “Requesting specific resource data,” on page 223 describes how the VTAM topology agent gathers information about specific resources.

For reference, the following lists are included in the appendixes:

- Appendix E, “VTAM topology agent object and attribute tables,” on page 309 contains a list of all object classes supported by the VTAM topology agent, the operations that are supported for each class, and a list of the supported attributes for each object class.
- Appendix F, “VTAM topology agent attributes definition,” on page 321 contains a comprehensive list of all supported attributes, including a description of the semantics of the attribute, the syntax of the attribute, and the uses of the attribute.



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## Chapter 13. OSI object classes and VTAM resources

This chapter describes of the OSI object definitions supported by the VTAM topology agent.

---

### OSI object classes

The VTAM topology agent provides topology data for the network resources that VTAM manages. To do this the VTAM resources must first be viewed in the object-oriented context of the OSI object definitions. The following list shows the OSI object classes supported by the VTAM topology agent:

- crossDomainResource
- crossDomainResourceManager (valid only in replies, not requests)
- definitionGroup
- appnEN
- interchangeNode
- lenNode
- logicalLink
- logicalUnit
- luCollection
- luGroup
- logicalUnitIndex
- migrationDataHost
- appnNN
- port
- appnRegisteredLu
- snaLocalTopo
- snaNetwork
- appnTransmissionGroup (valid only in replies, not requests)
- subareaTransmissionGroup (valid only in replies, not requests)
- t2-1Node
- t4Node
- t5Node
- virtualRoute (valid only in replies, not requests)
- virtualRoutingNode (valid only in replies, not requests)

Each object class definition contains a list of attributes for that class. The attributes supported by VTAM are listed by object class in Appendix E, “VTAM topology agent object and attribute tables,” on page 309. Only the object classes that are valid in requests are listed.

Although some of the object classes have obvious meanings, some represent resources in VTAM that are known by different names. The next sections address the mapping of VTAM resources back to these OSI object classes. Note that some of the OSI classes do not represent existing VTAM objects; these OSI objects

generally represent a group of VTAM resources. These object types are described more fully in Chapter 15, “VTAM topology monitoring,” on page 175.

---

## Mapping VTAM resources to OSI object classes

The resources that VTAM manages are known traditionally by a somewhat different set of names than the OSI object classes. For the VTAM resources with different names, the following table shows the mapping to the OSI classes:

*Table 8. VTAM resources mapped to OSI classes*

VTAM resource	OSI class
physical unit	logicalLink
linkstation	logicalLink
application	logicalUnit
dependent LU	logicalUnit
independent LU	crossDomainResource
CDRSC	crossDomainResource
CDRM	crossDomainResourceManager
type 5 node	t5Node
type 4 node (NCP)	t4Node
type 2.1 node	t2-1Node
APPN end node	appnEN
APPN network node	appnNN
interchange node	interchangeNode
migration data host	migrationDataHost
line	port
channel	port
appnRegisteredLu	appnRegisteredLu
subarea TG	subareaTransmissionGroup
APPN TG	appnTransmissionGroup
major node	definitionGroup
USERVAR	luGroup
generic resource	luGroup

---

## Naming the objects

Each instance of an object class is called an object instance. Because an object instance consists only of attributes and behavior, there is not an object instance name assigned to the instance. As in many object-oriented systems, one attribute is assigned to contain a value that is used to name the object instance. This attribute is called the *naming attribute*. Unlike some other systems, instance names in the VTAM topology agent do not consist solely of the value of the naming attribute. Instead, instances are identified by their *distinguished names* (DNs). The distinguished name consists of a sequence of *relative distinguished names* (RDNs), each of which contains an attribute value assertion (AVA).

Consider this example: we have a network, NETA, and a VTAM type 5 node, SSCP1A, and a channel attached to SSCP1A called 0321-L. The channel is considered a *port* object. It has a distinguished name that is composed of three relative distinguished names. In Figure 6, the leftmost name is the first relative distinguished name, the next name is the second, and the rightmost name is the third.

```
snaNetId=NETA ; snaNodeName=SSCP1A ; portId=0321-L
```

Where:

- snaNetId=NETA is the first relative distinguished name.
- snaNodeName=SSCP1A is the second relative distinguished name.
- portId=0321-L is the third relative distinguished name.

Figure 6. Distinguished name composed of three relative distinguished names

The name of the port object in this example suggests a hierarchy. The leftmost relative distinguished name is the highest level in the hierarchy, the network identifier. The next name is lower in the hierarchy, the node name. And the rightmost name is the lowest in the hierarchy, the resource name. This naming convention is called *name-containment*.

The port object name must be unique within the domain of the SSCP. The name is made unique among all SSCPs in the network by qualifying it with the SSCP name. The name is made universally unique by qualifying it with the network ID as well, assuming the network ID is unique.

VTAM-managed objects are named under VTAM, which is a *snaNode* object with the naming attribute *snaNodeName*. VTAM is named under a *netIDsubnetwork* object, with the naming attribute *snaNetId*. The distinguished names are actually a sequence of naming attributes and their values, starting at the highest level object and moving toward the lowest level object.

A summary of the distinguished names for the VTAM-managed objects is given in Table 9.

Table 9. Object names and shorthand distinguished names

Object name	Shorthand distinguished names
<u>t2-1Node</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname
<u>lenNode</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname
<u>appnNN</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname
<u>appnEN</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname
<u>virtualRoutingNode</u> (See note 1 on page 157.)	<u>snaNetID</u> =netid; <u>virtualRoutingNodeName</u> =CPname (of the virtual routing node)
<u>interchangeNode</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname
<u>migrationDataHost</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname
<u>t5Node</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =SSCPname
<u>t4Node</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =SSCPname; <u>snaNodeName</u> =NCPname
<u>logicalUnit</u>	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>luName</u>=netid.LUname</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>luName</u>=LUname</li> </ul>

Table 9. Object names and shorthand distinguished names (continued)

Object name	Shorthand distinguished names
<u>crossDomainResourceManager</u> (See note 2 on page 157.)	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>snaNodeName</u>=netid.CDRMname</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>snaNodeName</u>=CDRMname</li> </ul>
<u>crossDomainResource</u> (See note 3 on page 157.)	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>nonLocalResourceName</u>=netid.CDRSCname</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>nonLocalResourceName</u>=CDRSCname</li> </ul>
<u>appnRegisteredLu</u>	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>nonLocalResourceName</u>=netid.regLUname</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>nonLocalResourceName</u>=regLUname</li> </ul>
<u>logicalUnitIndex</u>	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>logicalUnitIndexName</u>=netid.LUname</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>logicalUnitIndexName</u>=LUname</li> </ul>
<u>luGroup</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>luGroupName</u> =USERVAR or generic resource name
<u>luCollection</u>	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>luCollectionId</u>=luCollection</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>linkName</u>=PName; <u>luCollectionId</u>=luCollection</li> </ul>
<u>port</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>portId</u> = LINEname
<u>logicalLink</u>	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>linkName</u>=linkstation_name or PName</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>linkName</u>=netid.linkstation_name or netid.PName</li> </ul>
<u>virtualRoute</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>virtualRouteId</u> =netid.originSubareaNumber.destSubareaNumber.virtualRouteNumber.transmissionPriority
<u>appnTransmissionGroup</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>transmissionGroupId</u> =TGN.partner_NETID.partner_CPNAME
<u>subareaTransmissionGroup</u> (See note 4 on page 157.)	One of the following: <ul style="list-style-type: none"> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>transmissionGroupId</u>=local_subarea.TGN.partner_NETID.partner_subarea.partner_node</li> <li>• <u>snaNetID</u>=netid; <u>snaNodeName</u>=CPname; <u>snaNodeName</u>=NCPname; <u>transmissionGroupId</u>=local_subarea.TGN.partner_NETID.partner_subarea.partner_node</li> </ul>

Table 9. Object names and shorthand distinguished names (continued)

Object name	Shorthand distinguished names
<u>definitionGroup</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>definitionGroupName</u> =mjnode_type.mjnode_name
<u>snaNetwork</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>graphid</u> =(string "SnaNetwork")
<u>snaLocalTopo</u>	<u>snaNetID</u> =netid; <u>snaNodeName</u> =CPname; <u>graphid</u> =(string "SnaLocalTopology")

**Note:**

1. This object is identified by a role attribute, which is a pointer that consists of the distinguished name of the object, but the object actually does not reside on the local node.
2. A CDRM name is not required to match the real SSCP name of the type 5 node it represents. CDRMs might be defined such that the network identifier is known and unchangeable. Therefore, CDRM objects are named using the CDRM name defined to VTAM. A CDRM with a predefined network identifier includes the network identifier in the last RDN<sup>®</sup>. A CDRM without a predefined network identifier does not include the network identifier in the last RDN. The real name and network identifier of the adjacent SSCP are available in the realSSCPname attribute when the CDRM is active.
3. A CDRSC that represents a predefined alias does not include a network identifier in the last RDN because the network identifier can change. A CDRSC with a predefined network identifier includes the network identifier in the last RDN. The CDRSC name used in this RDN is the name that was predefined for the CDRSC. This name is not necessarily the same as the real name of the resource that the CDRSC maps. The real name and network identifier of the resource is provided in the cdrscRealLUname attribute of the crossDomainResource object.
4. Partner\_node name for subarea transmission groups can be formed from the subarea number if the contacted subarea node does not provide its name in the X'0E' control vector on contacted.

---

## OSI object states

Among the many attributes contained within the managed objects, some of the most important attributes are the *state attributes*. The state attributes consist of the six attributes defining the OSI states, as documented in the ISO/IEC 10164-2 standard, in addition to a seventh state, which represents the normal VTAM resource status.

Each OSI state attribute is described in the following list:

- **Operational state attribute**

Indicates whether a resource is operational, according to the following values:

**Enabled**

The resource is partially or fully operational and available for use.

**Disabled**

The resource is not partially or fully operational and is not available for use.

- **Usage state attribute**

Indicates whether a resource is in use, according to the following values:

**Idle** The resource is not in use.

**Active** The resource is in use and has sufficient spare operating capacity to provide for additional users simultaneously.

**Busy** The resource is in use and it has no spare operating capacity to provide for additional users at this instance.

- **Administrative state attribute**

Indicates whether a resource is allowed to perform functions. The administrative state of a managed object is determined separately from the operational and usage states. Administrative state can have the following values:

**Unlocked**

The resource is permitted to perform services for its users.

**Locked**

The resource is prohibited from performing services for its users.

**Shut down**

Only existing instances are permitted to use the resource.

- **Procedural status attribute**

This attribute is supported by only those classes of managed objects that represent some procedure (for example, a test process) that progresses through a sequence of phases. The procedural status attribute can have the following values:

**Not initialized**

Indicates that the resource must be initialized before it can perform normal functions. The initialization procedure has not been started.

**Initializing**

Indicates that the resource must be initialized before it can perform normal functions. The initialization procedure has been started, but is not yet complete.

**Terminating**

Indicates that this resource is in a termination phase.

- **Availability status attribute**

**Offline**

Indicates that the resource requires a routine operation to place it online and make it available for use.

**Intest** Indicates the resource is undergoing a test procedure.

**Degraded**

Indicates overuse of cycles or buffers.

**Dependency**

Indicates that a higher-level resource is in a state of transition, either up or down. For related information on dependency, see "ACTION(snapshot) update merging" on page 172.

**Failed** Indicates that a resource is inoperative.

- **Unknown status attribute**

Indicates that the state of the resource represented by the managed object is unknown. When the unknown status attribute value is true, the value of the state attribute cannot reflect the actual state of the resource.

- **Native status attribute**

Indicates the VTAM internal state of the resource.

## Mapping VTAM status to OSI states

The topology agent maps the existing status of VTAM resources to OSI states when the topology agent reports object data. For traditional subarea resources, the mapping is straightforward; however, for some APPN resources, a VTAM status does not exist.

Table 10 shows how VTAM resource status is mapped to OSI states. Table 11 on page 161 shows the valid combinations of OSI states for the resources with no applicable VTAM status.

### OSI states for VTAM resources with VTAM status

In Table 10, to find the OSI state for a VTAM resource with a particular VTAM status, find the status in the first column. Follow the row across until it intersects with the column for your VTAM resource. The abbreviation in that cell of the table indicates the OSI state that is assigned. Look up that abbreviation in the list of abbreviations at the end of the table.

Table 10. VTAM resource status to OSI states

VTAM resource status	Native status	NCP	CDRM	LU and CDRSC	Type 2 PU and type 2.1 PU	Link station	Line	VTAM agent host
ACT	ACT	uea	uea	uei	uea	uea	uea	uea
ACT/S	ACT/S	N/A	N/A	uea	N/A	N/A	N/A	N/A
INACT	INACT	udi	udi	udi	udi	udi	udi	N/A
INACTIVE (INOP) (See note 1 on page 160)	INACTIVE	udi-fl	udi-fl	udi-fl (for LUs) udi (for CDRSCs)	udi-fl	udi-fl	udi-fl	N/A
INACTIVE (NEVAC)	NEVAC	udi-ni	udi-ni	udi-ni	udi-ni	udi-ni	udi-ni	N/A
PND-ACT	PND-ACT	udi-in	udi-in	udi-in	udi-in	udi-in	udi-in	N/A
PND-INACT	PND-INACT	uea-tm	uea-tm	uea-tm	uea-tm	uea-tm	uea-tm	N/A
CONNECT-ABLE	CONNECT-ABLE	N/A	N/A	uei-ol (Switched resources only)	uei-ol (Switched resources only)	N/A	N/A	N/A
ROUTABLE	ROUTABLE	N/A	N/A	uei-it	uei-it	N/A	N/A	N/A
ROUTABLE (released)	ROUTABLE	N/A	N/A	uei-it-ol	uei-it-ol	N/A	N/A	N/A
ACTIVE (congested)	ACTIVE	ueb	N/A	N/A	ueb	N/A	N/A	N/A
ACT	DISABLE	N/A	N/A	uei-po	N/A	N/A	N/A	N/A
INACTIVE (released)	RELEASED	udi-ol	N/A	udi-ol	udi-ol	udi-ol	udi-ol	N/A
INACTIVE (reset)	RESET	udi-unkwn	udi-unkwn	udi-unkwn	udi-unkwn	udi-unkwn	udi-unkwn	N/A

Table 10. VTAM resource status to OSI states (continued)

VTAM resource status	Native status	NCP	CDRM	LU and CDRSC	Type 2 PU and type 2.1 PU	Link station	Line	VTAM agent host
PND-INACT (reset)	PND-INACT	uea-tm-unkwn	uea-tm-unkwn	uea-tm-unkwn	uea-tm-unkwn	uea-tm-unkwn	uea-tm-unkwn	N/A

**Note:**

The OSI states and statuses are from the ISO/IEC 10164-2 standard. The states are listed in the following order:

- Administrative state (administrativeState)
- Operational state (operationalState)
- Usage state (usageState).

For a description of the states, see “OSI object states” on page 157.

**OSI status**

**Description**

- uea** Unlocked Enabled Active
- ueb** Unlocked Enabled Busy
- uei** Unlocked Enabled Idle
- udi** Unlocked Disabled Idle
- tm** proceduralStatus = terminating
- ol** availabilityStatus = offline
- fl** availabilityStatus = failed
- it** availabilityStatus = in test
- po** availabilityStatus = power off
- in** proceduralStatus = initializing
- ni** proceduralStatus = not initialized
- unkwn**  
unknownStatus = unknown
- N/A** Not Applicable

**Footnotes for the table entries:**

1. A resource is considered INOP when the VTAM display of the resource shows INOP. In most cases, the internal VTAM status of an INOP resource is INACTIVE. However, it is possible to have other status values also showing INOP. Therefore, the availabilityStatus value failed might appear with nativeStatus values other than INACTIVE.
2. An additional value of dependency might be added to the *availabilityStatus* attribute if a higher-level resource is in transition.
3. NCP slow down indication always forces usage state=busy.



## OSI states for VTAM resources without VTAM native status

For information about the status of APPN network nodes and transmission groups, see Table 11. Note that the *nativeStatus* attribute does not apply to these resources.

Table 11. OSI states for VTAM resources without native status

VTAM resource	OSI state														
appnTG	uea uea-tm udi udi-ol														
networkNode or interchange node (As reported in snaNetwork APPN network topology.)	uea uea-tm ueb ueb-tm uea-dg ueb-dg udi-ol														
<p><b>Description of the OSI resource statuses:</b></p> <p>The OSI states and statuses are from the ISO/IEC 10164-2 standard. The states are listed in the following order:</p> <ul style="list-style-type: none"> <li>• Administrative state (administrativeState)</li> <li>• Operational state (operationalState)</li> <li>• Usage state (usageState)</li> </ul> <p>For a description of the states, see “OSI object states” on page 157.</p> <p><b>OSI Status</b></p> <table> <thead> <tr> <th></th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><b>uea</b></td> <td>Unlocked Enabled Active</td> </tr> <tr> <td><b>ueb</b></td> <td>Unlocked Enabled Idle</td> </tr> <tr> <td><b>udi</b></td> <td>Unlocked Disabled Idle</td> </tr> <tr> <td><b>-dg</b></td> <td>availabilityStatus = degraded</td> </tr> <tr> <td><b>-tm</b></td> <td>proceduralStatus = terminating</td> </tr> <tr> <td><b>-ol</b></td> <td>APPN garbage collection indicator</td> </tr> </tbody> </table>			Description	<b>uea</b>	Unlocked Enabled Active	<b>ueb</b>	Unlocked Enabled Idle	<b>udi</b>	Unlocked Disabled Idle	<b>-dg</b>	availabilityStatus = degraded	<b>-tm</b>	proceduralStatus = terminating	<b>-ol</b>	APPN garbage collection indicator
	Description														
<b>uea</b>	Unlocked Enabled Active														
<b>ueb</b>	Unlocked Enabled Idle														
<b>udi</b>	Unlocked Disabled Idle														
<b>-dg</b>	availabilityStatus = degraded														
<b>-tm</b>	proceduralStatus = terminating														
<b>-ol</b>	APPN garbage collection indicator														



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## Chapter 14. OSI operations

This chapter describes the OSI operations that are performed on the objects that were described under Chapter 13, “OSI object classes and VTAM resources,” on page 153. The following topics are included:

- Introduction to the CMIP verbs that are used to specify the operations and overview of the VTAM topology agent processing of the operations
- Overview of types of responses the VTAM topology agent provides to an input CMIP request
- High-level description of the resource-monitoring process using an ACTION(*snapshot*) operation

The details of the specific monitoring capabilities of the VTAM topology agent are provided under Chapter 15, “VTAM topology monitoring,” on page 175.

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### Specifying OSI operations with CMIP verbs

The set of OSI operations, specified by CMIP verbs, is used to collect topology data about VTAM resources represented as object instances.

Not all object classes are supported for all operations; in some cases, object classes are supported only for response data and not for request data.

Performing an operation on an object instance usually involves a manager application program sending a CMIP request message (ROIV) to the object. The message contains an indication of the type of operation being requested, as well as other data related to the requested operation. The VTAM topology agent receives the request message, performs the requested operation, and generates and sends a CMIP response message to the manager application program. This sequence is altered slightly when objects send unsolicited messages or requests that provide information about an **event** that has occurred.

A given operation is either *confirmed* or *unconfirmed*. A confirmed operation is one that requires that a response be returned to the application program that issued the request. An unconfirmed operation is one for which there can be no response.

The following operations, supported by the VTAM topology agent, are described in more detail in the following sections:

- GET
- CANCEL-GET
- ACTION
- EVENT-REPORT
- SET
- DELETE
- Other operations

#### GET

GET is a confirmed request that is issued by a manager application program. The request is directed to an object instance, requesting the return of attribute data for that object instance. The GET response contains the requested attribute data.

## CANCEL-GET

CANCEL-GET is a confirmed request that is issued by a manager application program. The function of this operation is to terminate the processing of a GET request previously issued by this manager application program. The CANCEL-GET response message contains only an indication of whether the GET request was successfully terminated.

## ACTION

The ACTION operation has two types: confirmed and unconfirmed. The types are usually specified as:

- ACTION, which is unconfirmed
- ACTION-CONFIRMED, which is confirmed

This discussion refers only to ACTION-CONFIRMED. ACTION is a multi-function operation. The ACTION request is requesting the target object to do one of a set of possible functions. The particular function being requested is specified by the detailed **actionType** data contained in the request. The VTAM topology agent supports only one type of action, ACTION(*snapshot*). The ACTION(*snapshot*) operation is a request directed to one of a set of special objects, requesting the return of a set of topology data. The type and amount of data returned varies, depending upon the class of object that is the target of the request.

## SET

The SET operation has both confirmed and unconfirmed types. The SET request is directed to an object instance, requesting that specified attributes for that object be set to values provided in the SET request. The VTAM topology agent does not support the setting of VTAM resource data by using the CMIP SET operation. However, the VTAM topology agent does respond to any confirmed SET request it receives. For a discussion of error responses, see “Responding to CMIP requests” on page 165.

## DELETE

DELETE is a confirmed operation directed to an object instance. The intended function of the DELETE operation is to request that an object instance be deleted. The DELETE response contains an indication of whether the object was actually deleted. The VTAM topology agent does not support the deletion of VTAM resources by using the CMIP DELETE operation. However, the VTAM topology agent does respond to any DELETE request it receives. (See error discussion, “Responding to CMIP requests” on page 165.)

## Other operations

Examples of other OSI operations include create, linked-reply, and other types of ACTION. Although the create and linked-reply operations are valid, there is no situation in which the VTAM topology agent can receive these operations. Other types of ACTIONS can be received by the VTAM topology agent.

The create request is used to create a new instance of a specified object class. For CMIP services to route a create request, an application program must have registered as a **create-handler** for the requested object class. The VTAM topology agent does not register as a create-handler for any object class, so CMIP services never routes a create request to the topology agent.

The linked-reply operation is a request, but it is better described as part of a multiple-message reply. The responses for some requests might require multiple messages. All of the messages except the last message of a multiple message reply are linked-reply operations. A linked-reply message must refer to the original request message for which this message is part of the reply. The VTAM topology agent does not send any requests for which a linked-reply is returned, so the topology agent never receives linked-reply operations. The VTAM topology agent does, however, send linked-reply messages.

As mentioned before, there are a number of action types for the ACTION operation other than *snapshot*. The VTAM topology agent does not support the other action types, but the topology agent responds to any confirmed ACTION request it receives. For a discussion of errors, see “Responding to CMIP requests.”

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## Responding to CMIP requests

This section provides an overview of the types of responses, both positive and negative, that the VTAM topology agent provides, given an input CMIP request. Subsequent sections describe the details of monitoring VTAM resources by using the CMIP requests.

A CMIP request message is really a form of a **protocol data unit (PDU)**, as are the various kinds of response messages. The following list provides a summary of the types of PDUs used by the VTAM topology agent:

### ROIVapdu

The **ROIV** message represents a request message and is usually an unsolicited message. In one case, an ROIV represents one of a set of linked-reply messages, but even in this case the ROIV is treated as a request message. The ROIV request messages are either confirmed (requiring a response) or unconfirmed (allowing no response), depending on the particular operation being requested. The linked-reply ROIV message might contain the requested response data, or it might contain an indication that an error has occurred. All requests that are sent to the VTAM topology agent are ROIV messages.

### RORSapdu

The **RORS** message represents a final response message. It is sent only in response to a previous ROIV request message and only if the ROIV request requires a response message. An ROIV request message can have a maximum of one RORS message sent in response. Therefore, if a request requires multiple reply messages, all but the final reply messages must be in the form of ROIV linked-reply messages. The VTAM topology agent sends RORS messages in response to all confirmed requests that it receives, when the subsequent processing is successful. An RORS message is also sent if an error occurred and the error indication was sent as part of a linked-reply ROIV message.

### ROERapdu

The **ROER** message represents a negative response message. It is used to indicate the unsuccessful processing for a request message. For the ROER message to be used for a response, it must be the only message in the response. Therefore, if one or more linked-reply ROIV messages are sent in a response and then an error occurs, the ROER message cannot be used to indicate the processing error. Instead, the error is indicated in an additional linked-reply ROIV, followed by an RORS.

## Responding to GET ROIV messages

The VTAM topology agent can receive a GET ROIV request for any VTAM resource, regardless of whether the resource exists. Whether the resource is valid or not, all GET requests are valid, and the agent always responds with either a single positive response (RORS) or a single negative response (ROER).

## Responding to CANCEL-GET messages

The CANCEL-GET ROIV request, by virtue of being sent to the VTAM topology agent from CMIP services, *must* refer to an existing, valid GET request. Two responses are generated, an ROER for the GET request that is referred to, indicating that the operation was cancelled, and an RORS for the CANCEL-GET request indicating that this operation was completed successfully. If the CANCEL-GET request is issued after the VTAM topology agent has processed the GET request, then the response to the CANCEL-GET request is an ROER, indicating that this operation could not be processed.

## Responding to ACTION ROIV messages

An ACTION ROIV request can be valid or not valid. The VTAM topology agent responds to ACTION requests that are not valid with a single negative response (ROER). Valid ACTION requests are processed, but errors can still occur during that processing. The VTAM topology agent can respond to valid ACTION requests with either positive or negative responses. These responses, however, may not be simple single messages; instead, they may involve a series of messages.

A typical positive response to an ACTION is a number of linked-reply ROIV messages followed by a single ACTION response message (RORS). A negative response to an ACTION request can be more complicated; the negative response may take the form of the ROER, or it can be a linked-reply ROIV message that contains `specificErrorInfo` data, followed by an RORS message.

The determination of which type of error response is used is dependent upon whether any linked-reply ROIV messages with data have been sent. If no linked-reply messages with data have been sent in response, an ROER is used for the error response. If one or more linked-reply messages have been sent in response to this ACTION request, then a linked-reply ROIV containing the `specificErrorInfo` construct is sent, followed by an RORS response message.

## EVENT-REPORT, SET, and DELETE messages

EVENT-REPORT messages are always sent as unconfirmed ROIV messages; these ROIVs do not represent linked-replies, and it is not possible to include any error information in them.

A SET ROIV request sent to the VTAM topology agent will result in either an ROER or an RORS message, depending on the specific data in the request.

A DELETE ROIV request sent to the VTAM topology agent will always result in an ROER response message.

---

## Monitoring resources with the ACTION(snapshot) operation

The ACTION(*snapshot*) operation can be used to collect current resource information and to monitor future resource change information. This section describes the general use of ACTION(*snapshot*) for resource monitoring. Chapter 15, "VTAM topology monitoring," on page 175 provides the details of using ACTION(*snapshot*) to monitor specific kinds of VTAM resource data.

### ACTION(snapshot) request

Similar to other operations, the ACTION(*snapshot*) request is sent to an object instance. It differs from other operations in that the number of object classes that support the ACTION(*snapshot*) operation is small. The classes that do support ACTION(*snapshot*) represent collections of objects.

The following object classes support the ACTION(*snapshot*):

#### Object class

##### Description

#### snaLocalTopo

Represents the graph object that contains all of the resources owned by a local VTAM. An ACTION request to this object is asking for the following data:

- Local VTAM data
- Lines
- PUs
- Link stations
- Owned NCP data
- Contacted adjacent node data
- APPN and subarea TGs

#### snaNetwork

Represents the graph object that contains all of the network information known at a VTAM node.

#### luCollection

Represents the collection object that contains all of the LU information associated with a specific PU or the VTAM host.

#### logicalUnitIndex

Represents the collection object that contains the instances of a given LU name known at a VTAM node or throughout the network. Note that an ACTION on the *logicalUnitIndex* object is not considered a monitoring function. It more closely resembles the function of the GET operation and is discussed in detail with the GET operation instead of with the various ACTION monitors.

In addition to the object class and object instance, the ACTION request includes a segment called the *actionInfoArg*. This segment is a sequence of three possible fields, of which any specific ACTION request can include a maximum of two of the following fields:

**start**

Indicates that the ACTION request is to start a new *snapshot* operation. If this field is present in the request, an additional token of information is included in this field that is one of the following:

**oneTimeOnly**

Indicates that the *snapshot* is requesting only initial data, that is, the monitoring of future changes to resource data is *not* being requested.

**ongoing**

Indicates that both initial data and update data are being requested; this includes the current resource information and future changes to this data.

**stop**

Indicates that the ACTION request is to stop a previous start ACTION request. The start and stop fields are mutually exclusive; however, one of these two fields must appear in a valid ACTION(*snapshot*) request. If the stop field is present, an additional mandatory token is included after the stop token that provides the invoke identifier of the start request that is to be terminated.

**additional info (addInfo)**

Optionally specifies data that is specific to the target object. For example, both *snapshots* for *snaLocalTopo* and *snaNetwork* might contain the *appnPlusSubareaParm* parameter, which has an information value representing either *appnOnly* or *appnPlusSubarea*. This field applies only if the start field is included.

## ACTION(snapshot) response

ACTION(*snapshot*) responses can be any of the following variations on PDU content:

- Single RORS

If there is no *snapshot* data for the VTAM topology agent to supply and the request is *oneTimeOnly*, the empty set might be returned in RORS message.

- Linked-reply and RORS

If the VTAM topology agent has *snapshot* data to provide, the response consists of one or more linked-reply ROIV messages followed by an RORS message.

- Single ROER

If an error occurs and no data linked-reply ROIV messages are sent in response, a single ROER message is sent in response, indicating the failure to process successfully.

- Linked-reply error and RORS

If one or more linked-reply ROIV messages with data is sent in response before an error occurs, an ROER message cannot be used. In this case, an additional linked-reply ROIV is sent containing an indication of the error, followed by an RORS message.

In a *snapshot* response message containing valid data, the basic unit of information is a sequence of:

- vertex 1 (v1)
- vertex 2 (v2)
- endpoint 1 (e1)



Multiple sets of this sequence (v1, v2, e1) can occur within a *snapshot* response. Each of the three components (v1, v2, e1) has the same basic syntactic structure. However, the semantics and the actual structure of v1, v2, and e1 vary with the different target objects of the *snapshot*.

The structure of each v1, v2, or e1 is as follows:

**object** Provides the distinguished name (DN) of the primary object instance being reported in this component. If this component is vertex 1 or endpoint 1, additional object instances might be reported elsewhere in the v1 or e1 string.

**class** Provides the object class of the instance identified in the object field.

**states** Provides a condensed, encoded form of the state attributes for the object instance identified in the object field. The attributes are given in the OCTET string form instead of the full attribute form. The state attributes, their positions in the OCTET string, and the possible values are:

**Octet State**

**0** operationalState  
     **00** disabled  
     **01** enabled  
     **FF** N/A or unchanged

**1** usageState  
     **00** idle  
     **01** active  
     **02** busy  
     **FF** N/A or unchanged

**2** administrativeState  
     **00** locked  
     **01** unlocked  
     **02** shuttingDown  
     **FF** N/A or unchanged

**3** availabilityStatus

Note that this attribute represents a SET, so it might have multiple values; each value shown below represents a bit position. To show multiple values, the bits representing the values are logically ORed together.

**00** noStatus  
**01** notInstalled  
**02** degraded  
**04** dependency  
**08** offDuty  
**10** offLine  
**20** powerOff

	40	failed
	80	inTest
	FF	N/A or unchanged
4		proceduralStatus
	00	no status
	08	terminating
	10	reporting
	20	initializing
	40	not initialized
	80	initialization required
	FF	N/A or unchanged
5		unknownStatus
	00	false
	01	true
	FF	N/A or unchanged
6		nativeStatus
	00	Active
	01	Active with sessions
	02	Inactive
	03	Never active
	04	pending active
	05	pending inactive
	06	Connectable
	07	Routable
	09	Congested
	0A	Released
	0B	Reset
	0C	Inop
	FF	N/A or unchanged

**info** Provides an optional set of attributes associated with the object instance identified in the object field. The list of attributes provided varies with the target *snapshot* object.

**moreInfo**

Provides for any additional information that is necessary; for example, for the vertex 1 of a *snaLocalTopo snapshot* this field might contain a set of object data specifying a *port* object.

**reason** Indicates why the *snapshot* update is being sent:

Value	Description
-------	-------------

**deleted**

Object is deleted.

**addOrUpdate**

Object is added or changed. The default is addOrUpdate.

## **ACTION(snapshot) initial data**

The response data that is common to both an ongoing and a oneTimeOnly *snapshot* is called *initial data*. The initial data provides the immediate view or snapshot of the current resource data. For a oneTimeOnly *snapshot*, the initial data is the entire set of data returned to the manager application program. For an ongoing *snapshot*, the initial data is returned first, followed later by *update data*.

Initial data is returned in linked-reply ROIV messages, with the number of messages varying according to *snapshot* type and configuration. The minimum number of linked-replies is one; there is no maximum number.

When all initial data linked-replies have been sent, the VTAM topology agent must notify the manager application program that the initial data is complete. The VTAM topology agent provides two ways for a manager application program to determine that initial data is complete:

- If the *snapshot* is ongoing, after all linked-replies with initial data are sent, the VTAM topology agent sends one additional linked-reply message with no *snapshot* data in it, called the empty set linked-reply. The purpose of this message is to indicate that the transfer of initial data is now complete. This special linked-reply is identified by the value of the actionReplyInfo field being (). All (v1,v2,e1) data is reported in the actionReplyInfo section of the *snapshot* response, so the absence of data in this field indicates no more initial data.
- If the *snapshot* is oneTimeOnly, following the linked-replies of initial data, an empty set linked-reply is sent to indicate initial data transfer is complete. Next, an RORS message is sent to indicate that processing for the entire request is complete.

## **ACTION(snapshot) update data**

Snapshot updates consist of:

- Changes to resource information that was previously reported in initial data
- Resource information not reported in initial data that is newly defined or learned by VTAM

Update data is reported only for ongoing *snapshots*. It is never reported for oneTimeOnly *snapshots*. Other than being reported later than initial data, following the empty set linked-reply, there is little difference between initial data and update data. The syntax is the same, but the VTAM topology agent generally provides less data in the update data than in the initial data.

The update data is reported in linked-replies that might contain multiple sets of (v1, v2, e1) data. When a topology update occurs, an update is generated and formatted into a response string. However, the VTAM topology agent does not immediately send every update string to the manager application program. Instead, the VTAM topology agent attempts to use storage efficiently by filling the *snapshot* buffer. The VTAM topology agent might wait a short period of time to see if more update data is generated. If more updates are generated, the updates are

added to the existing *snapshot* response. If no updates occur within the time interval (1 second), the existing *snapshot* response is sent to the manager application program.

Update data is generated by the VTAM topology agent for these reasons:

- An object is created.  
A resource that is within the scope of a given *snapshot* becomes known to VTAM and there is an ongoing *snapshot* in the update phase. The creation of the object is reported as update data.
- An object is deleted.  
A resource previously reported within a given *snapshot* is no longer known to VTAM. The resource might be deleted because a major node was inactivated or a connection was removed. This change is reported as an object deletion in update data.
- An object changes state.  
A resource previously reported within a given *snapshot* has changed state. It is important to note that the state that has changed is the VTAM internal state; this state is mapped to the set of state attributes that are reported for the object. Because several VTAM internal states are mapped to the same set of state attribute values, there is no guarantee that any of the seven state attributes changed, although it is likely.

Although VTAM in general does not report updates when attribute values change, there are exceptions. In cases where significant data associated with a reported resource has changed, updates are sent to report new attribute values, even if the state of the resource does not change.

## **ACTION(snapshot) update merging**

As noted previously, one of the reasons for reporting topology update data is resource state changes. Of the state changes that occur for resources, many of the resulting states are transient in nature. That is, the resource is in transition from one state to another, but the transition is through a series of intermediate states. These intermediate states are usually brief and are considered less important than the resting states.

Because the number of updates reporting transient state changes can be large, the VTAM topology agent suppresses the intermediate updates. This process is called *merging*, because the intermediate updates are merged instead of discarded.

Updates that can be merged are:

- *snaLocalTopo*
- *snaNetwork*, for CDRMs only
- *luCollection* (with some exceptions)

*luCollection* updates for independent LUs in a *snapshot* directed at a specific PU are not merged. *snaNetwork* updates for APPN network data are not merged.

Updates for resources moving to transient states are merged until an update is received that shows the resource moving to a resting state. The resting state update is merged, and the final, merged update is sent.

It is possible for resources to stay in transient states too long; for example, when an error occurs and a resource is hung in a state that is not a resting state. The VTAM topology agent periodically looks for updates that have been held too long; when these are found, they are sent.

The UPDDELAY start option controls the maximum length of time that VTAM waits before looking for resource updates that have been in transient states too long. This start option specifies the maximum number of seconds to wait before looking for resources that are hung. Note that decreasing the value for UPDDELAY might force VTAM to look for these resources more often, but does not necessarily imply that resources are reported any faster. The time specified in the UPDDELAY start option does not affect the computing of whether a resource has stayed in a transient state too long. That computing is not controllable and is based primarily on recent updates statistics.

Although a given type of *snapshot* update is eligible to be merged, in some cases, individual updates are not merged.

EVENT-REPORT data is also subject to the merge process.

By design, the merge process suppresses intermediate state data; however, there is one case where the loss of intermediate state data is not acceptable. The *availabilityStatus* attribute reports the value of dependency when a higher-level resource is in transition. When updates are merged, the newest state data generally replaces the older state data, but for the dependency information this is not the case. The VTAM topology agent preserves the dependency information from all updates that are merged to a single update by performing the logical OR operation on the dependency information from all updates. The result is that if any of the set of merged updates have the dependency flag set for a resource, the reported (merged) update reports the dependency in the *availabilityStatus* attribute.

## **ACTION(snapshot) termination**

If the start request for the ACTION(*snapshot*) is for a oneTimeOnly *snapshot*, then it is not necessary to issue a stop request. The oneTimeOnly *snapshot* stops itself when the initial data transfer is complete. The ongoing *snapshots*, however, must be explicitly stopped by using an additional ACTION(*snapshot*) request that specifies stop instead of start. The stop request must indicate which *snapshot* request should be terminated by including the invoke identifier of the start *snapshot* request.

Upon receiving a stop ACTION(*snapshot*) request, the VTAM topology agent suspends the reporting of update data, responds to both the start request and the stop request, and terminates processing for both requests. Note that the stop request is not processed until the transfer of the initial data for the target *snapshot* is complete.



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## Chapter 15. VTAM topology monitoring

This chapter describes the details of the specific monitoring capabilities of the VTAM topology agent. The following topics are included:

- “Requesting and monitoring network data (snaNetwork)”
- “Requesting and monitoring local topology (snaLocalTopo)” on page 188
- “Requesting and monitoring LU data (luCollection)” on page 209
- “Monitoring resources through event reports” on page 217

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### Requesting and monitoring network data (snaNetwork)

This section contains the following topics:

- “Overview”
- “Action request”
- “Initial data response” on page 176
- “Update data response” on page 177
- “Action termination” on page 177
- “snaNetwork snapshot data (APPN data)” on page 178
- “snaNetwork snapshot data (subarea data)” on page 180
- “snaNetwork snapshot example” on page 181

#### Overview

This section describes the action that is used to request monitoring and stop monitoring network data for the *snaNetwork* managed object class.

Management of the network requires that a manager application program be able to request the names of all nodes and APPN transmission groups and virtual routes that connect any two nodes and to be able to monitor their status.

Operations against *snaNetwork* can be directed at the following VTAM topology agent host node types:

- Interchange node
- Network node
- Migration data host
- Pure type 5 node

**Note:** Pure end nodes cannot provide *snaNetwork* data and fail the request with an ROER response.

#### Action request

A *snapshot* action request is used to request network data from the VTAM topology agent. The action is sent as an m-Action-Confirmed operation.

The manager application program can request that any future updates to the *snaNetwork snapshot* object to be returned, as they occur by specifying ongoing in the request. The network data can be requested without updates by specifying the *oneTimeOnly* value in the request.

The manager application program can specify the *appnPlusSubareaParm* in the additional information field. The value, either 0 or 1, represents either *appnOnly* (0), which means to request APPN network data, or *appnPlusSubarea* (1), which means to request both APPN and subarea network data. The default value is *appnOnly* if the *appnPlusSubareaParm* is not specified.

The target resource is the only object instance of the *snaNetwork* object class at the VTAM topology agent. Following is the example of an ongoing, *appnPlusSubarea snaNetwork snapshot* request:

```
msg CMIP-1.ROIVapdu (invokeID 196610, operation-value 7, argument (baseManagedObjectClass 1.3.18.0.0.2151,baseManagedObjectInstance (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue NETA)), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue SSCP1A)), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2216, attributeValue (string "SnaNetwork"))))),actionInfo (actionType 1.3.18.0.0.222,actionInfoArg (start ongoing, addlInfo ((identifier 1.3.18.0.0.2164, significance TRUE, information 1))))))
```

## Initial data response

The interchange node or network node provides the APPN network data that is current at the time the operation is processed. The APPN network data includes information about network nodes, interchange nodes, border nodes, virtual routing nodes, and transmission groups (TGs) that connect the APPN nodes. A connection between nodes A and B is reported once for each direction: from Node A to Node B and from Node B to Node A.

The migration data host nodes, type 5 nodes and interchange nodes provide the subarea network data that is current at the time the operation is processed. The subarea network data includes information about the local VTAM agent host, cross-domain resource managers, and virtual routes that connect the subarea nodes.

Interchange nodes are the only nodes that provide both APPN and subarea data.

If the *oneTimeOnly snapshot* action is requested, the initial data is returned in action linked-replies. To indicate that the initial data for the entire set of network data has been returned, the VTAM topology agent sends an additional ROIV action linked-reply that is an empty set linked-reply. Following the empty set is an RORS message.

If the ongoing *snapshot* action is requested, all the initial data is returned in action linked-replies, just as for the *oneTimeOnly snapshot* action and is followed by an empty-set linked-reply. The VTAM topology agent is then ready to process updates for the *snaNetwork* object.



## Update data response

When the ongoing *snapshot* action has been issued and is currently in effect, the following changes cause updates to the *snaNetwork* object, which result in the sending of a *snaNetwork snapshot* linked-reply:

- Any status changes for a node or APPN transmission group (TG)
- Changes in the characteristics of a node or APPN TG
- Creation, deletion, or state change of a cross-domain resource manager

Updates for the *snaNetwork* object for subarea network data might be merged with related updates by the VTAM topology agent before being written to the *snapshot* linked-replies.

## Action termination

The VTAM topology agent terminates an ongoing *snaNetwork snapshot* action under the following conditions :

- A stop *snapshot* action request is received.
- An error occurs during *snapshot* processing in VTAM.
- The association between the local CMIP services and the manager application program's CMIP services terminates.

The following is an example of a valid stop *snapshot* action request :

```
msg CMIP-1.ROIvapdu (invokeID 196612,
  operation-value 7, argument (baseManagedObjectClass 1.3.18.0.0.2151, baseManagedObjectInstance (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2216, attributeValue (string "SnaNetwork"))))), actionInfo (actionType 1.3.18.0.0.2222, actionInfoArg (stop 196610))))
```

The stop request in the previous example looks much like the associated start request except for the *actionInfoArg* portion of the request. For the stop request the stop keyword is used along with the invoke identifier of the start request that is to be terminated.

The result of the VTAM topology agent's processing of a stop request is three messages :

- An empty-set linked-reply for the start request
- An RORS response to the start request
- An RORS response to the stop request

The following shows examples of these three messages:

### First, the empty-set linked reply:

(Note that the associated invoke identifier in a linked-reply is given in the linked-ID field.)

```

msg CMIP-1.ROIvapdu (invokeID
1, linked-ID 196610, operation-value 2, argument
(actionResult (managedObjectClass 1.3.18.0.0.215
1, managedObjectInstance (distinguishedName (Rela
tiveDistinguishedName (AttributeValueAssertion (a
ttributeType 1.3.18.0.2.4.6, attributeValue "NETA
")), RelativeDistinguishedName (AttributeValueAss
ertion (attributeType 1.3.18.0.0.2032, attributeV
alue "SSCP1A")), RelativeDistinguishedName (Attri
buteValueAssertion (attributeType 1.3.18.0.0.2216
, attributeValue (string "SnaNetwork"))))), actio
nReply (actionType 1.3.18.0.0.2222, actionReplyIn
fo ())))))

```

Next, the RORS for the start request :

```

msg CMIP-1.RORSapdu (invokeID
196610)

```

Finally, the RORS for the stop request:

```

msg CMIP-1.RORSapdu (invokeID
196612, resultOption (operation-value 7, result
(managedObjectClass 1.3.18.0.0.2151, managedObjec
tInstance (distinguishedName (RelativeDistinguish
edName (AttributeValueAssertion (attributeType 1.
3.18.0.2.4.6, attributeValue "NETA")), RelativeDi
stinguishedName (AttributeValueAssertion (attribu
teType 1.3.18.0.0.2032, attributeValue "SSCP1A"))
, RelativeDistinguishedName (AttributeValueAsser
tion (attributeType 1.3.18.0.0.2216, attributeValu
e (string "SnaNetwork"))))), actionReply (actionT
ype 1.3.18.0.0.2222, actionReplyInfo ())))))

```

## snaNetwork snapshot data (APPN data)

For APPN network topology data, the linked-replies for *snaNetwork* are made up of multiple instances of the following sequence:

```

vertex1 --Origin node of the transmission group
vertex2 --Destination node of the transmission group
endpoint1 --Transmission group between vertex1 and vertex2

```

In general, the data structure of vertex1, vertex2, and endpoint1 is as follows:

```

vertex1
  object --object distinguished name
  class --object class
  states --OSI states of this object
  info
    resourceSequenceNumber --object attribute
    appnNodeCapabilities --object attribute
    extendedAppnNodeCapabilities --object attribute
    --(reported only for central
    --directory server nodes)

vertex2
  object --object distinguished name
  class --object class

endpoint1
  object --object distinguished name
  class --object class (APPN TG)
  states --OSI states of this object
  info,

```

```

resourceSequenceNumber --object attribute
appnTGCapabilities      --object attribute
cp-cpSessionSupport    --object attribute

```

The format of vertex1 differs according to the data received. When vertex2 or endpoint1 is the main reason for an update, vertex1 shows only the following:

vertex1

```

object --object distinguished name
class  --object class

```

The following list includes descriptions of what is contained in vertex1, vertex2, and endpoint1.

#### vertex1

Data reported for a single node object for either initial data or for a single update for the object. Vertex 1 is considered the origin of the TG specified in endpoint 1.

**object** Distinguished name of origin node resource

**class** Objects related to the monitored node are reported under the following object classes:

- appnNN
- interchangeNode
- virtualRoutingNode

**states** 14-character string for the OSI states:

- operationalState
- usageState
- administrativeState
- availabilityStatus
- proceduralStatus
- unknownStatus
- nativeStatus (nativeStatus is always N/A for the APPN snaNetwork data.)

**info** Set of attributes for the node object. This field is missing from vertex1 if vertex2 or endpoint1 is the main reason for the update.

#### vertex2

Contains all data reported for a single node object for either initial data or a single update for the object. Vertex 2 is considered the destination of the TG specified in endpoint 1.

**object** Distinguished name of destination node resource.

**class** Objects related to the monitored node are reported under the following object classes:

- appnNN
- virtualRoutingNode

Note that interchange nodes are reported in class appnNN in vertex 2.

#### endpoint1

Contains data for a TG that connects vertex1 and vertex2.

**object** Distinguished name of TG resource.

- class** Monitored transmission group object is reported under the *appnTransmissionGroup* object class.
- states** Consists of a 14-character string for the OSI states. (*nativeStatus* is always N/A for the APPN *snaNetwork* data.)
- info** Set of attributes for the transmission group object.

Note that the reason field is always omitted for APPN data and should always assume the default value of addOrUpdate.

## snaNetwork snapshot data (subarea data)

For subarea network topology data, the linked-replies for *snaNetwork* contain data made up of multiple instances of the following sequence:

```
vertex1    --Adjacent SSCP (CDRM)
vertex2    --Local VTAM
endpoint1  --Virtual route supporting active CDRM
```

VTAM provides the long form of vertex1 when it reports initial data or object creation such as for the activation of a new CDRM major node. VTAM provides the short form of vertex1 when it reports changes or deletions.

In general, the data structure of vertex1, vertex2, and endpoint1 is as follows:

```
vertex1
  object  --object distinguished name
  class   --object class (CDRM)
  states  --OSI states of this object
  info
    dependencies --object attribute
    realSSCPname --object attribute
  reason  --reason for this vertex1 to be reported

vertex2
  object  --object distinguished name (local VTAM)
  class   --object class

endpoint1
  object  --object distinguished name
  class   --object class (VR)
```

The following list explains what the fields contain.

### vertex1

Contains all data reported for a single node object for either initial data or a single update for the object (CDRM).

**object** Distinguished name of CDRM resource

**class** Monitored node objects are reported under the *crossDomainResourceManager* object class.

**states** Consists of a 14-character string for the OSI states

**info** Set of attributes for the CDRM related object.

**reason** Indicates why the *snapshot* update is being sent.

**Note:** The reason field is omitted when the intended value is addOrUpdate.

Value	Description
-------	-------------

**deleted**

Object is deleted.

**addOrUpdate**

Object is added or changed. The default is addOrUpdate.

**vertex2**

Reports on the local VTAM agent host.

**object** Distinguished name of local VTAM agent host.**class** Always reported as *t5node* object class.**endpoint1**

Contains all data reported for a single virtual route object for either initial data or a single update for the virtual route.

**object** Distinguished name of the virtual route.**class** Monitored virtual route objects are reported under the *virtualRoute* object class.To see the vertex1 entries that are included in each type of subarea *snapshot* action, see Table 12.*Table 12. vertex1 entries for CDRM reported objects.* Object creation means the creation of a new CDRM.

	Initial data	Object creation	Object state change	Object attribute change	Object deletion
object	X	X	X	X	X
class	X	X	X	X	X
states	X	N/A	X	X	N/A
info	X	X	X	X	X
<i>dependencies</i>	X	X	X	X	N/A
<i>realSSCPname</i>	X	X	X	N/A	N/A
reason	N/A	N/A	N/A	N/A	X

**snaNetwork snapshot example**

The following example shows the initial data response for appnPlusSubarea *snaNetwork snapshot* of the following configuration, where SSCP2A is defined to SSCP1A as a CDRM and an APPN TG is active between SSCP1A and SSCP2A.

```
(Interchange node)
  SSCP1A ----- SSCP2A
                APPN TG 21      (Interchange node)
```

```
msg CMIP-1.ROIvApdu (invokeID
131074, linked-ID 196610, operation-value 2, arg
ument (actionResult (managedObjectClass 1.3.18.0.
0.2151, managedObjectInstance (distinguishedName
(RelativeDistinguishedName (AttributeValueAsserti
on (attributeType 1.3.18.0.2.4.6, attributeValue
"NETA")), RelativeDistinguishedName (AttributeVal
ueAssertion (attributeType 1.3.18.0.0.2032, attri
buteValue "SSCP1A")), RelativeDistinguishedName (
AttributeValueAssertion (attributeType 1.3.18.0.0
```

```

.2216, attributeValue (string "SnaNetwork")))),
actionReply (actionType 1.3.18.0.0.2222, actionRe
plyInfo ((vertex1 (object (distinguishedName (Rel
ativeDistinguishedName (AttributeValueAssertion (
attributeType 1.3.18.0.2.4.6, attributeValue "NET
A")), RelativeDistinguishedName (AttributeValueAs
sertion (attributeType 1.3.18.0.0.2032, attribute
Value "SSCP1A")))), class 1.3.18.0.0.1826, states
010101000000FF, info (Attribute (attributeId 1.3
.18.0.0.2019, attributeValue 2), Attribute (attri
buteId 1.3.18.0.0.1940, attributeValue 3348))), v
ertex2 (object (distinguishedName (RelativeDistin
guishedName (AttributeValueAssertion (attributeTy
pe 1.3.18.0.2.4.6, attributeValue "NETA")), Relat
iveDistinguishedName (AttributeValueAssertion (at
tributeType 1.3.18.0.0.2032, attributeValue "SSCP
2A")))), class 1.3.18.0.0.1822), endpoint1 (objec
t (distinguishedName (RelativeDistinguishedName (
AttributeValueAssertion (attributeType 1.3.18.0.2
.4.6, attributeValue "NETA")), RelativeDistinguis
hedName (AttributeValueAssertion (attributeType 1
.3.18.0.0.2032, attributeValue "SSCP1A")), Relati
veDistinguishedName (AttributeValueAssertion (att
ributeType 1.3.18.0.0.2044, attributeValue "21.NE
TA.SSCP2A")))), class 1.3.18.0.0.1823, states 010
101000000FF, info (Attribute (attributeId 1.3.18.
0.0.2019, attributeValue 2), Attribute (attribute
Id 1.3.18.0.0.1941, attributeValue 00), Attribute
(attributeId 1.3.18.0.0.1958, attributeValue TRU
E))), (vertex1 (object (distinguishedName (Relat
iveDistinguishedName (AttributeValueAssertion (at
tributeType 1.3.18.0.2.4.6, attributeValue "NETA"
)), RelativeDistinguishedName (AttributeValueAsse
rtion (attributeType 1.3.18.0.0.2032, attributeVa
lue "SSCP2A")))), class 1.3.18.0.0.1826, states 0
10101000000FF, info (Attribute (attributeId 1.3.1
8.0.0.2019, attributeValue 2), Attribute (attribu
teId 1.3.18.0.0.1940, attributeValue 3348))), ver
tex2 (object (distinguishedName (RelativeDistingu
ishedName (AttributeValueAssertion (attributeType
1.3.18.0.2.4.6, attributeValue "NETA")), Relativ
eDistinguishedName (AttributeValueAssertion (attr
ibuteType 1.3.18.0.0.2032, attributeValue "SSCP1A
")))), class 1.3.18.0.0.1822), endpoint1 (object
(distinguishedName (RelativeDistinguishedName (At
tributeValueAssertion (attributeType 1.3.18.0.2.4
.6, attributeValue "NETA")), RelativeDistinguishe
dName (AttributeValueAssertion (attributeType 1.3
.18.0.0.2032, attributeValue "SSCP2A")), Relative
DistinguishedName (AttributeValueAssertion (attri
buteType 1.3.18.0.0.2044, attributeValue "21.NETA
.SSCP1A")))), class 1.3.18.0.0.1823, states 01010
1000000FF, info (Attribute (attributeId 1.3.18.0.
0.2019, attributeValue 2), Attribute (attributeId
1.3.18.0.0.1941, attributeValue 00), Attribute (
attributeId 1.3.18.0.0.1958, attributeValue TRUE
))), (vertex1 (object (distinguishedName (Relativ
eDistinguishedName (AttributeValueAssertion (attri
buteType 1.3.18.0.2.4.6, attributeValue "NETA"))
), RelativeDistinguishedName (AttributeValueAssert
ion (attributeType 1.3.18.0.0.2032, attributeValu
e "SSCP1A")), RelativeDistinguishedName (Attribut
eValueAssertion (attributeType 1.3.18.0.0.2032, a
tttributeValue "NETA.SSCP1A")))), class 1.3.18.0.0
.2278, states 01010100000000, info (Attribute (at
tributeId 1.3.18.0.0.2194, attributeValue (depend
ents (and (Dependents (item (distinguishedName (R

```

```

relativeDistinguishedName (AttributeValueAssertion
(attributeType 1.3.18.0.2.4.6, attributeValue "N
ETA")), RelativeDistinguishedName (AttributeValue
Assertion (attributeType 1.3.18.0.0.2032, attribu
teValue "SSCP1A")), RelativeDistinguishedName (At
tributeValueAssertion (attributeType 1.3.18.0.0.2
272, attributeValue "CDRM.CDRM1A")))), Dependents
(item (distinguishedName (RelativeDistinguished
Name (AttributeValueAssertion (attributeType 1.3.
18.0.2.4.6, attributeValue "NETA")), RelativeDist
inguishedName (AttributeValueAssertion (attribute
Type 1.3.18.0.0.2032, attributeValue "SSCP1A")))
))))), Attribute (attributeId 1.3.18.0.0.5246, at
tributeValue "NETA.SSCP1A")), vertex2 (object (d
istinguishedName (RelativeDistinguishedName (Attr
ibuteValueAssertion (attributeType 1.3.18.0.2.4.6
, attributeValue "NETA")), RelativeDistinguishedN
ame (AttributeValueAssertion (attributeType 1.3.1
8.0.0.2032, attributeValue "SSCP1A")))), class 1.
3.18.0.0.1845)), (vertex1 (object (distinguishedN
ame (RelativeDistinguishedName (AttributeValueAss
ertion (attributeType 1.3.18.0.2.4.6, attributeVa
lue "NETA")), RelativeDistinguishedName (Attribut
eValueAssertion (attributeType 1.3.18.0.0.2032, a
ttributeValue "SSCP1A")), RelativeDistinguishedNa
me (AttributeValueAssertion (attributeType 1.3.18
.0.0.2032, attributeValue "NETA.SSCP2A")))), clas
s 1.3.18.0.0.2278, states 00000100400003, info (A
ttribute (attributeId 1.3.18.0.0.2194, attributeV
alue (dependents (and (Dependents (item (distingui
shedName (RelativeDistinguishedName (AttributeVa
lueAssertion (attributeType 1.3.18.0.2.4.6, attri
buteValue "NETA")), RelativeDistinguishedName (At
tributeValueAssertion (attributeType 1.3.18.0.0.2
032, attributeValue "SSCP1A")), RelativeDistingui
shedName (AttributeValueAssertion (attributeType
1.3.18.0.0.2272, attributeValue "CDRM.CDRM1A")))
)), Dependents (item (distinguishedName (RelativeD
istinguishedName (AttributeValueAssertion (attrib
uteType 1.3.18.0.2.4.6, attributeValue "NETA")),
RelativeDistinguishedName (AttributeValueAssertion
(attributeType 1.3.18.0.0.2032, attributeValue
"SSCP1A"))))))))))), Attribute (attributeId 1.3.18.
0.0.5246, attributeValue "")), vertex2 (object (
distinguishedName (RelativeDistinguishedName (Att
ributeValueAssertion (attributeType 1.3.18.0.2.4.
6, attributeValue "NETA")), RelativeDistinguished
Name (AttributeValueAssertion (attributeType 1.3.
18.0.0.2032, attributeValue "SSCP1A")))), class 1
.3.18.0.0.1845))))))

```

The linked-reply in the example, identified by the operation value being 2, contains a set of 4 instances of the (v1,v2,e1) sequence, although not all instances of the sequence contain all fields of the sequence. The following is a summary of the contents of the 4 sequences:

#### First sequence: (v1,v2,e1) APPN data

vertex 1 : NETA;SSCP1A

```

Class      : interchangeNode
States    :
Operational State   : Enabled
Usage State         : Active
Administrative State : Unlocked
Availability Status  : No Status

```

```

        Procedural Status      : No Status
        Unknown Status         : False
        Native Status           : N/A
    Info :
        resourceSequenceNumber  : 2
        appnNodeCapabilities    : 3348

vertex 2 : NETA;SSCP2A

        Class : appnNN

endpoint 1 : NETA;SSCP1A;21.NETA.SSCP2A

        Class : appnTransmissionGroup
    States :
        Operational State      : Enabled
        Usage State             : Active
        Administrative State    : Unlocked
        Availability Status     : No Status
        Procedural Status      : No Status
        Unknown Status         : False
        Native Status           : N/A
    Info :
        resourceSequenceNumber  : 2
        appnTGcapabilities     : 00
        cp-cpSessionSupport    : TRUE

```

This sequence represents the connection from the local node to partner node. This sequence shows:

- In vertex 1: name, class and attributes of the local node (origin of TG). SSCP1A is not a central directory server, so extendedAppnNodeCapabilities is not reported.
- In vertex 2: name and class of the partner node (destination of TG).
- In endpoint 1: name, class and attributes of the APPN transmission group (TG number : 21)

### Second sequence: (v1,v2,e1) APPN data

```

vertex 1 : NETA;SSCP2A

        Class : interchangeNode
    States :
        Operational State      : Enabled
        Usage State             : Active
        Administrative State    : Unlocked
        Availability Status     : No Status
        Procedural Status      : No Status
        Unknown Status         : False
        Native Status           : N/A
    Info :
        resourceSequenceNumber  : 2
        appnNodeCapabilities    : 3348

vertex 2 : NETA;SSCP1A

        Class : appnNN

endpoint 1 : NETA;SSCP2A;21.NETA.SSCP1A

        Class : appnTransmissionGroup
    States :
        Operational State      : Enabled
        Usage State             : Active
        Administrative State    : Unlocked
        Availability Status     : No Status

```



```

Procedural Status      : No Status
Unknown Status        : False
Native Status         : N/A
Info :
resourceSequenceNumber : 2
appnTGcapabilities    : 00
cp-cpSessionSupport   : TRUE

```

This sequence represents the connection from the partner node to local node. This sequence shows:

- In vertex 1: name, class and attributes of the partner node (origin of TG). SSCP2A is not a central directory server so extendedAppnNodeCapabilities is not reported.
- In vertex 2: name and class of the local node (destination of TG).
- In endpoint 1: name, class and attributes of the APPN transmission group (TG number : 21). Note that APPN transmission groups are unidirectional and this is a different TG than reported in the first sequence.

### Third sequence: (v1,v2) subarea data

```
vertex1 : NETA;SSCP1A;NETA.SSCP1A
```

```

Class : CrossDomainResourceManager
States :
Operational State : Enabled
Usage State       : Active
Administrative State : Unlocked
Availability Status : No Status
Procedural Status : No Status
Unknown Status    : False
Native Status     : ACTIVE

Info :
realSSCPname      : NETA.SSCP1A
dependencies      : NETA;SSCP1A;CDRM.CDRM1A
                  NETA;SSCP1A

```

```
vertex2 : NETA;SSCP1A
```

```
Class : t5Node
```

This sequence shows the name and state of local agent host CDRM. This sequence shows:

- The long form of vertex1. The first object in Dependencies is a *definitionGroup* representing the major node where the CDRM is defined.
- The **only** form of vertex2, representing the local VTAM agent host. Note the class is reported as *t5Node* for the subarea topology even though the actual host type is interchange node (as shown in the first sequence).

### Fourth sequence: (v1,v2) subarea data

```
vertex1 : NETA;SSCP1A;NETA.SSCP2A
```

```

Class : CrossDomainResourceManager
States :
Operational State : Disabled
Usage State       : Idle
Administrative State : Unlocked
Availability Status : No Status
Procedural Status : Not Initialized
Unknown Status    : False
Native Status     : NEVAC

```

```

Info :
      realSSCPName      : NETA.SSCP1A
      dependencies      : NETA;SSCP1A;CDRM.CDRM1A
                        NETA;SSCP1A

vertex2 :    NETA;SSCP1A

Class   : t5Node

```

This sequence shows the name and state of CDRM for SSCP2A (a cross domain host). This sequence shows:

- The long form of vertex1. SSCP2A is not an active CDRM (no CDRM-CDRM session) so no virtual route is reported.
- The **only** form of vertex2, representing the local VTAM agent host.

The following example shows the APPN network topology update data for the ongoing *snaNetwork* snapshot. The update was caused by inactivating the line and PU connecting the two hosts. In this example only APPN topology changes are reported because this is an APPN connection.

```

msg CMIP-1.ROIvapu (invokeID
  131076, linked-ID 196610, operation-value 2, arg
  ument (actionResult (managedObjectClass 1.3.18.0.
  0.2151, managedObjectInstance (distinguishedName
  (RelativeDistinguishedName (AttributeValueAsserti
  on (attributeType 1.3.18.0.2.4.6, attributeValue
  "NETA")), RelativeDistinguishedName (AttributeVal
  ueAssertion (attributeType 1.3.18.0.0.2032, attri
  buteValue "SSCP1A")), RelativeDistinguishedName (
  AttributeValueAssertion (attributeType 1.3.18.0.0
  .2216, attributeValue (string "SnaNetwork")))),
  actionReply (actionType 1.3.18.0.0.2222, actionRe
  plyInfo ((vertex1 (object (distinguishedName (Rel
  ativeDistinguishedName (AttributeValueAssertion (
  attributeType 1.3.18.0.2.4.6, attributeValue "NET
  A")), RelativeDistinguishedName (AttributeValueAs
  ssertion (attributeType 1.3.18.0.0.2032, attribute
  Value "SSCP1A")))), class 1.3.18.0.0.1822), verte
  x2 (object (distinguishedName (RelativeDistinguis
  hedName (AttributeValueAssertion (attributeType 1
  .3.18.0.2.4.6, attributeValue "NETA")), RelativeD
  istinguishedName (AttributeValueAssertion (attrib
  uteType 1.3.18.0.0.2032, attributeValue "SSCP2A")
  )), class 1.3.18.0.0.1822), endpoint1 (object (d
  istinguishedName (RelativeDistinguishedName (Attr
  ivateValueAssertion (attributeType 1.3.18.0.2.4.6
  , attributeValue "NETA")), RelativeDistinguishedN
  ame (AttributeValueAssertion (attributeType 1.3.1
  8.0.0.2032, attributeValue "SSCP1A")), RelativeDi
  stinguishedName (AttributeValueAssertion (attribu
  teType 1.3.18.0.0.2044, attributeValue "21.NETA.S
  SCP2A")))), class 1.3.18.0.0.1823, states 0101010
  00000FF, info (Attribute (attributeId 1.3.18.0.0.
  2019, attributeValue 4), Attribute (attributeId 1
  .3.18.0.0.1941, attributeValue 00), Attribute (at
  tributeId 1.3.18.0.0.1958, attributeValue TRUE)))
  ), (vertex1 (object (distinguishedName (RelativeD
  istinguishedName (AttributeValueAssertion (attrib
  uteType 1.3.18.0.2.4.6, attributeValue "NETA")),
  RelativeDistinguishedName (AttributeValueAssertio
  n (attributeType 1.3.18.0.0.2032, attributeValue
  "SSCP1A")))), class 1.3.18.0.0.1822), vertex2 (ob
  ject (distinguishedName (RelativeDistinguishedNam
  e (AttributeValueAssertion (attributeType 1.3.18.
  0.2.4.6, attributeValue "NETA")), RelativeDisting

```

```

uishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP2A"))), class 1.3.18.0.0.1822), endpoint1 (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2044, attributeValue "21.NETA.SSCP2A")))), class 1.3.18.0.0.1823, states 000001000000FF, info (Attribute (attributeId 1.3.18.0.0.2019, attributeValue 6), Attribute (attributeId 1.3.18.0.0.1941, attributeValue 00), Attribute (attributeId 1.3.18.0.0.1958, attributeValue TRUE))))))

```

### First sequence: (v1,v2,e1) APPN data

vertex 1 : NETA;SSCP1A

Class : appnNN

vertex 2 : NETA;SSCP2A

Class : appnNN

endpoint 1 : NETA;SSCP1A;21.NETA.SSCP2A

Class : appnTransmissionGroup

States :

Operational State : Enabled  
Usage State : Active  
Administrative State : Unlocked  
Availability Status : No Status  
Procedural Status : No Status  
Unknown Status : False  
Native Status : N/A

Info :

resourceSequenceNumber : 4  
appnTGcapabilities : 00  
cp-cpSessionSupport : TRUE

This sequence reports the state of connection between network nodes SSCP1A and SSCP2A through APPN TG 21.

### Second sequence: (v1,v2,e1) APPN data

vertex 1 : NETA;SSCP1A

Class : appnNN

vertex 2 : NETA;SSCP2A

Class : appnNN

endpoint 1 : NETA;SSCP1A;21.NETA.SSCP2A

Class : appnTransmissionGroup

States :

Operational State : Disabled  
Usage State : Idle  
Administrative State : Unlocked  
Availability Status : No Status  
Procedural Status : No Status  
Unknown Status : False  
Native Status : N/A

Info :  
resourceSequenceNumber : 6  
appnTGcapabilities : 00  
cp-cpSessionSupport : TRUE

This sequence reports the state of connection between network nodes SSCP1A and SSCP2A through APPN TG 21. Note that the TG operational state is now disabled.

---

## Requesting and monitoring local topology (snaLocalTopo)

This section contains the following topics:

- “Overview”
- “Action request” on page 190
- “Initial data response” on page 191
- “Update data response” on page 191
- “Action termination” on page 193
- “snaLocalTopo snapshot data” on page 194
- “snaLocalTopo snapshot example” on page 200

### Overview

This section describes the actions that are used to monitor the resources owned by a VTAM topology agent host.

Management of VTAM resources requires that a manager application program be able to obtain an initial list of the resources, their status, their connectivity, and selected other pertinent data to be followed later by notification of changes to the status or connectivity. The manager application program can monitor these VTAM resources by sending the ACTION(*snapshot*) request to the *snaLocalTopo* object instance at the local VTAM topology agent or at a remote VTAM topology agent.

The *snaLocalTopo snapshot* is used to obtain information about the following resource data:

- VTAM topology agent host  
A set of attribute data associated with the object class of the VTAM node is reported. The VTAM topology agent host is always reported as a vertex 1 in the *snapshot* response.
- Remote VTAM host  
If a remote VTAM host is connected to the VTAM topology agent host, the remote VTAM host is reported in the *snaLocalTopo snapshot*. The remote VTAM host is reported as a vertex 2 in the *snapshot* response.
- Owned NCPs  
For NCPs that are owned by the VTAM topology agent host, a set of attribute data associated with the NCP itself is reported. An owned NCP is reported as a *t4Node* object in vertex 2 (associated with a VTAM host vertex 1) and also is reported as a vertex 1 in the *snapshot* response.
- Contacted NCPs  
A contacted NCP is reported as a *t4Node* object in vertex 2 (associated with a local NCP vertex 1).
- Virtual routing nodes  
A virtual node is reported as a *virtualRoutingNode* object in vertex 2.

- Other contacted nodes  
Other nodes that are contacted are reported as *t2-1Node*, *lenNode*, *appnEN*, and *appnNN* objects in vertex 2. Type 1 and type 2.0 nodes are not reported in vertex 2.
- Lines  
The lines and channels attached to the VTAM topology agent host are reported; also, for any NCP reported as a vertex 1, the predefined and dynamically defined lines are reported. All lines and channels are reported as *port* objects in vertex 1.
- Physical units and link stations  
The dynamic, leased, and switched PUs and link stations associated with the VTAM topology agent host or with owned NCPs (reported as vertex 1) are reported as *logicalLink* objects in endpoint 1. Remote link stations, for nodes reported in vertex 2, are not reported as objects; instead, they are reported in the *partnerConnection* attribute of the *logicalLink* object in endpoint 1.
- Connections to adjacent nodes  
The connections from the VTAM host to adjacent nodes are reported; also, the connections from owned NCPs are reported. The connections are reported as *appnTransmissionGroup* and *subareaTransmissionGroup* objects in endpoint 1.

The VTAM topology agent host is reported as an instance of one of the following object classes:

- Type 5 node (*t5Node*)
- APPN network node (*appnNN*)
- Interchange node (*interchangeNode*)
- APPN end node (*appnEN*)
- Migration data host (*migrationDataHost*)

When a connection to an adjacent, contacted node is reported, the adjacent node is reported as an instance of one of the following object classes:

- Type 5 node (*t5Node*)
- APPN network node (*appnNN*)
- Interchange node (*interchangeNode*)
- APPN end node (*appnEN*)
- Type 4 node (*t4Node*)
- LEN node (*lenNode*)
- Type 2.1 node (*t2-1Node*)
- Virtual routing node (*virtualRoutingNode*)

A connection to an adjacent node is reported by the following resources:

- APPN transmission groups (*appnTransmissionGroup*)
- Subarea transmission groups (*subareaTransmissionGroup*)
- Lines and channels (*port*)
- Physical units (*logicalLink*)
- Link stations (*logicalLink*)

Other predefined resources (that are not currently being used for connections) are also reported as part of the *snaLocalTopo snapshot*.

The data reported for a *snaLocalTopo snapshot* can be partially controlled with the VTAMTOPO filtering option. Appendix G, "VTAMTOPO filtering option reporting," on page 359 shows a summary of the results of using the VTAMTOPO filtering option for connected switched PUs. See the z/OS Communications Server: SNA Resource Definition Reference and the z/OS Communications Server: SNA Operation for more information about the VTAMTOPO filtering option.

## Action request

A *snapshot* action request is used to request local topology data from a VTAM topology agent host. The action request is sent as an m-Action-Confirmed operation.

The manager application program can request that any future updates to the *snaLocalTopo* object be returned, as they occur. The local topology data is requested without updates by specifying the *oneTimeOnly* value in the *actionInfoArg* portion of the request. The local topology data and future updates can be requested by specifying the *ongoing* value in the *actionInfoArg* portion of the request.

The target object of the request is the only object instance in the *snaLocalTopo* object class. Therefore, a single object instance name **must** be specified as the *baseManagedObjectInstance* in the request.

Optionally, the manager application program can specify the *appnPlusSubareaParm* parameter that indicates whether the requested data is *appnOnly* or *appnPlusSubarea*. An *appnOnly* request does not result in only APPN objects being reported. However, it does result in no NCP objects being reported. Instead, an NCP is considered part of a composite node with the VTAM topology agent host. The *appnPlusSubarea* request results in NCPs being reported as type 4 nodes. If the *appnPlusSubareaParm* is not specified in the request, the default value is *appnOnly*.

The following example shows a start request for *snaLocalTopo* data:

```
msg CMIP-1.R0IVapdu (invokeID 196612,
operation-value 7, argument (baseManagedObjectCl
ass 1.3.18.0.0.2152, baseManagedObjectInstance (
distinguishedName (RelativeDistinguishedName (At
tributeValueAssertion (attributeType 1.3.18.0.2.
4.6, attributeValue "NETA")), RelativeDistinguis
hedName (AttributeValueAssertion (attributeType
1.3.18.0.0.2032, attributeValue "SSCP1A")), Rela
tiveDistinguishedName (AttributeValueAssertion (
attributeType 1.3.18.0.0.2216, attributeValue (s
tring "SnaLocalTopology")))), actionInfo (actio
nType 1.3.18.0.0.2222, actionInfoArg (start ongo
ing, addlInfo (ManagementExtension (identifier 1
.3.18.0.0.2164, significance TRUE, information 1
))))))
```

Note from the example that the *snaLocalTopo* object name is composed of the network identifier and node name of the VTAM topology agent host, followed by the *graphId* (1.3.18.0.0.2216) naming attribute, which is required to have a value of (string "SnaLocalTopology"). The *actionType* is a *snapshot*, and the *actionInfoArg* indicates that this request is to start an ongoing *snapshot*. Also in this example the *appnPlusSubareaParm* (1.3.18.0.0.2164) is specified with information value of 1, which means *appnPlusSubarea*. An information value of 0 means *appnOnly*. The significance value of TRUE means that if the VTAM topology agent finds an error associated with the specification of this *appnPlusSubareaParm* parameter, then the

manager application program needs to receive an error response (ROER). A FALSE value tells the VTAM topology agent to ignore the parameter if an error is found.

This is a typical example of a *snaLocalTopo snapshot* request that can be used simply by supplying the appropriate network ID and SSCP or CP name of the VTAM topology agent host.

## Initial data response

Both ongoing and oneTimeOnly *snapshots* receive a set of initial data as part of the *snapshot* response. The initial data is the report of the appropriate resource data and connectivity as it exists at the time the request is processed. The contents of the initial data depend most on the current configuration of the local resources and somewhat on the network configuration. The contents of the initial data also depends on the value of the *appnPlusSubareaParm* specified in the *snapshot* request. If the *appnPlusSubareaParm* value is 0 (appnOnly), the NCPs are not reported separately from the VTAM host; they are considered part of the VTAM composite node.

The initial data is sent by a set of linked-reply messages; each linked-reply message contains one or more sets of the sequence (vertex 1, vertex 2, endpoint 1), abbreviated as (v1,v2,e1). Vertex 1 represents either the VTAM topology agent host node or an owned NCP node. Vertex 1 optionally contains *port* information. Vertex 2 represents a contacted node adjacent to the node specified in the associated vertex 1; vertex 2 is optional. If both vertex 1 and vertex 2 are present, endpoint 1 represents the transmission group used for the connection and the *logicalLink* on the vertex 1 side of the connection. If only vertex 1 is present (no vertex 2), endpoint 1 represents a *logicalLink* at the vertex 1 node that is not currently being used for a connection. Endpoint 1 is optional.

The first time a node is reported as vertex 1 in a *snaLocalTopo snapshot*, the full set of attribute data associated with that node is reported; this is referred to as the **long form** of vertex 1. For subsequent reports of that same node in vertex 1, the attribute data is omitted; this is called the **short form** of vertex 1.

Each sequence of (v1,v2,e1) can report at most one *port*, one *logicalLink*, one transmission group, and two nodes. All resources reported in a single sequence of (v1,v2,e1) are related.

To report other VTAM resources, such as other lines or PUs, VTAM must be repeated as a vertex 1 for each sequence of (v1,v2,e1) until the list of resources is exhausted. When all initial data has been sent, the VTAM topology agent sends one additional linked-reply message; the value in the actionReplyInfo field of this message is '()', an empty set.

If the *snaLocalTopo snapshot* request is the oneTimeOnly type, the empty set linked-reply is followed by the final *snapshot* RORS response message. If the *snapshot* is the ongoing type, no additional messages are sent by the VTAM topology agent until a reportable change occurs to a resource within the scope of the *snaLocalTopo snapshot* request.

## Update data response

For ongoing *snapshots* after the initial data has been sent, all subsequent reportable resource changes are reported in linked-reply messages. The same message syntax

is used for the update data as is used for initial data. In fact, a single linked-reply message does not indicate whether the data is initial data or update data; it depends solely on whether the message arrived before the empty set linked-reply or after it.

Update data is generated by the VTAM topology agent for these reasons:

- An object is created.  
Objects are reported when VTAM learns about them. For example, when a major node is activated, VTAM learns about the resources defined in the major node. When a connection is established, VTAM learns about the contacted node and reports the node. The long form of the object is always reported for an object creation, with the reason field omitted, implying the default value of addOrUpdate.
- An object is deleted.  
Objects are reported as deleted when the object definition is deleted from VTAM, as happens when a major node is inactivated. Objects are also reported as deleted when they logically cease to exist, as is the case with an APPN transmission group whose connection has been broken. The short form of an object is reported for an object deletion, with reason value of deleted.
- An object changes state.  
An object is reported when the internal VTAM state of the object changes, such as from pending-active to active. The internal VTAM state is mapped to the extended OSI state attributes, which are reported. Because several VTAM internal states are mapped to the same set of OSI state attribute values, it is possible for the internal VTAM status to change but the derived OSI states not to change. These unchanged OSI states might still be reported by VTAM. Note that it is likely that most of the resource state changes will not each result in a sequence of (v1,v2,e1) being sent because the merge process holds and merges updates where the resources are in non-resting states. For more information about the merge process, see “ACTION(snapshot) update merging” on page 172. The short form of the object is generally reported for state changes; however, important attributes may also be reported with the state changes. The reason field is omitted, implying the default value of addOrUpdate.
- An attribute value changes.  
An attribute value change refers to changes in resource data other than the state of the resource. In general, the VTAM topology agent does not support the reporting of attribute value changes; however, there are instances of attribute value changes that are considered to be too important to ignore. These few selected changes are reported. The short form of an object is reported for an attribute value change; however, there will always be a small set of attributes also reported. The reason field is omitted, implying the default value of addOrUpdate.

Table 13 shows the *snaLocalTopo* update data and the reasons for the updates.

**Note:** MODIFY VTAMTOPO can generate a snaLocalTopo Update.

*Table 13. Resources with reason for snaLocalTopo update data*

Resource	Reason	Notes
Local VTAM	None	Local VTAM is never the cause of update data



Table 13. Resources with reason for *snaLocalTopo* update data (continued)

Resource	Reason	Notes
NCP	Vertex 1 created	NCP major node activated
	Vertex 1 deleted	NCP major node deactivated
	Vertex 1 state change	NCP changed state
	Vertex 1 attribute value change	Learned gateway information; report attributes <i>gatewayNode</i> or <i>interconnectedNetIds</i> or both
Line	Created	Major node containing line activated
	Deleted	Major node containing line deactivated
	State change	Line changed state
	Attribute value change	Report learned data in attributes: <i>adapterAddresses</i> or <i>relatedAdapter</i> .
PU or link station	Created	Major node containing PU activated
	Deleted	Major node containing PU deactivated
	State change	PU changed state
	Attribute value change	If associated LINE information changes, report attributes <i>portId</i> or <i>adjacentLinkStationAddress</i> or both
Contacted node	Created	New connection established to node
	Deleted	Loss of connection to node
Transmission group	Created	New connection established
	Deleted	Loss of a connection

The VTAM topology agent continues to send update data until a valid request is received to stop the *snapshot*.

## Action termination

The VTAM topology agent terminates an ongoing *snaLocalTopo snapshot* action under the following conditions:

- A stop *snapshot* action request is received.
- An error occurs during *snapshot* processing in VTAM.
- The association between the local CMIP services and the manager application program's CMIP services terminates.

The following is an example of a valid stop request:

```
msg CMIP-1.R0IVapdu (invokeID 196613,
operation-value 7, argument (baseManagedObjectClass
1.3.18.0.0.2152, baseManagedObjectInstance (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6,
attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2216, attributeValue (string "SnaLocalTopology"))))), actionInfo (actionType 1.3.18.0.0.2222, actionInfoArg (stop 196612))))
```

The stop request in the previous example looks very similar to the associated start request except for the `actionInfoArg` portion of the request. For the stop request, the stop keyword is used along with the invoke identifier of the start request that is to be terminated.

The result of the VTAM topology agent's processing of a stop request is three messages:

- An empty set linked-reply for the start request
- An RORS response to the start request
- An RORS response to the stop request

The following shows examples of these three messages:

**First, the empty set linked-reply:** (Note that the associated invoke identifier in a linked-reply is given in the `linked-ID` field.)

```
msg CMIP-1.ROIvapdu (invokeID
  1, linked-ID 196612, operation-value 2, argument
  (actionResult (managedObjectClass 1.3.18.0.0.215
  2, managedObjectInstance (distinguishedName (Rela
  tiveDistinguishedName (AttributeValueAssertion (a
  ttributeType 1.3.18.0.2.4.6, attributeValue "NETA
  ")), RelativeDistinguishedName (AttributeValueAss
  ertion (attributeType 1.3.18.0.0.2032, attributeV
  alue "SSCP1A")), RelativeDistinguishedName (Attri
  buteValueAssertion (attributeType 1.3.18.0.0.2216
  , attributeValue (string "SnaLocalTopology"))))),
  actionReply (actionType 1.3.18.0.0.2222, actionR
  eplyInfo ())))
```

**Next, the RORS for the start request:**

```
msg CMIP-1.RORSapdu (invokeID
  196612)
```

**Finally, the RORS for the stop request:**

```
msg CMIP-1.RORSapdu (invokeID
  196613, resultOption (operation-value 7, result
  (managedObjectClass 1.3.18.0.0.2152, managedObjec
  tInstance (distinguishedName (RelativeDistinguish
  edName (AttributeValueAssertion (attributeType 1.
  3.18.0.2.4.6, attributeValue "NETA")), RelativeDi
  stinguishedName (AttributeValueAssertion (attribu
  teType 1.3.18.0.0.2032, attributeValue "SSCP1A"))
  , RelativeDistinguishedName (AttributeValueAsser
  tion (attributeType 1.3.18.0.0.2216, attributeValu
  e (string "SnaLocalTopology"))))), actionReply (a
  ctionType 1.3.18.0.0.2222, actionReplyInfo ())))
```

## snaLocalTopo snapshot data

For local topology data, the structure of the **long form** of vertex 1 is defined as follows:

### vertex1

Identifies the beginning of vertex 1. The lower level fields in vertex 1 are:

**object** Object instance name of the node represented by vertex 1. VTAM always returns the distinguishedName form of an object instance name.

- class** Object identifier (OI) representing the object class of the reported node.
- states** String of characters representing the OSI state of the vertex 1 node. For a list of OSI states, see “OSI object states” on page 157.
- info** Set of attributes providing data about the vertex 1 node. Not all attributes appear in all instances of vertex 1. The list of all possible attributes is:
- dependencies**  
Included only if vertex 1 represents an NCP.
  - opEquipmentList**  
Included only if vertex 1 represents the local VTAM host.
  - softwareList**  
Included only if vertex 1 represents the local VTAM host.
  - sysplexInfo**  
Included only if vertex 1 represents the local VTAM host.
  - appnNodeCapabilities**  
Included only if vertex 1 represents the local VTAM host and the VTAM node is an *appnNN* or an *interchangeNode*.
  - extendedAppnNodeCapabilities**  
Included only if vertex 1 represents the local VTAM host and the VTAM node is an *appnNN* or an *interchangeNode*.
  - subareaLimit**  
Included only if vertex 1 represents a subarea node, which is a *t5Node*, *t4Node*, *interchangeNode*, or *migrationDataHost*.
  - subareaAddress**  
Included only if vertex 1 represents a subarea node, which is a *t5Node*, *t4Node*, *interchangeNode*, or *migrationDataHost*.
  - puName**  
Included only if vertex 1 represents the local VTAM host, and VTAM is subarea-capable.
  - gatewayNode**  
Included only if vertex 1 represents an NCP, and the NCP is gateway-capable.
  - gatewaySSCP**  
Included only if vertex 1 represents the local VTAM host, and VTAM is gateway-capable.
  - interconnectedNetIds**  
Included only if vertex 1 represents an NCP, and the NCP is gateway-capable.
- moreInfo**  
Included only if a *port* object is to be reported in vertex 1 and is followed by a ManagementExtension that contains the *port* object.
- identifier**  
Object identifier for the *objectStuffInMoreInfoParm*, which identifies the syntax for this ManagementExtension.

### information

Port data in the ManagementExtension, which contains the following fields:

- object** Object instance name of the *port* to be reported. VTAM always reports the distinguishedName form of object instance name.
- class** Object identifier (OI) representing the *port* object class.
- states** String of characters representing the OSI state of the *port*. For a list of OSI states, see "OSI object states" on page 157.
- info** Set of attributes providing data about the *port*. Not all attributes appear in all instances of *port* objects. The list of all possible attributes is:

#### dependencies

Always included.

#### adapterNumbers

Included only if the *snapshot* type is appnOnly.

#### connectionId

Included only if the *snapshot* type is appnPlusSubarea.

#### adapterAddresses

Always included.

#### lineType

Always included.

#### dlcName

Always included.

#### relatedAdapter

Always included.

The structure of the **short form** of vertex 1 is defined as follows:

### vertex1

Identifies the beginning of vertex 1. The lower level fields in vertex 1 are:

- object** Object instance name of the node represented by vertex 1. VTAM always returns the distinguishedName form of object instance name.
- class** Object identifier (OI) representing the object class of the reported node.
- states** String of characters representing the OSI state of the vertex 1 node only if a state change occurred for the vertex 1 node. For a list of OSI states, see "OSI object states" on page 157.
- info** Set of attributes providing data about the vertex 1 node. Not all attributes appear in all instances of vertex 1. The list of all possible attributes is:

**gatewayNode**

Included only if vertex 1 represents an NCP and VTAM has discovered that the NCP is gateway-capable.

**interconnectedNetIds**

Included only if vertex 1 represents an NCP and VTAM has discovered that the NCP is gateway-capable.

**moreInfo**

Included only if a port object is to be reported in vertex 1 and is followed by a ManagementExtension that contains the port object. The form included here is the short form of the port.

**identifier**

Object identifier for the objectStuffInMoreInfoParm, which identifies the syntax for this ManagementExtension.

**information**

Port data in the ManagementExtension, which contains the following fields:

**object** Object instance name of the port to be reported. VTAM always reports the distinguishedName form of object instance name.

**class** Object identifier (OI) representing the port object class.

**states** String of characters representing the OSI state of the port. For a list of OSI states, see "OSI object states" on page 157.

**info** Set of attributes providing data about the port. Not all attributes appear in all instances of port objects. The list of all possible attributes is:

**adapterAddresses**

Included only to report an attribute value change.

**relatedAdapter**

Included only to report an attribute value change.

**reason** Included only if the port is reported as deleted.

**reason** Included only if the vertex 1 node is being reported as deleted.

Note that although the previous lists show the long form of the port in the long form of vertex 1 and the short form of the port in the short form of vertex 1, it is possible to have the long form of port contained in the short form of vertex 1. For example, if a node was already reported in a previous vertex 1 (long form) and was reported again (short form), but this time the vertex 1 included a port that has not yet been reported, the port is the long form. The VTAM topology agent never reports the short form of a port in a long form of vertex 1.

Vertex 2 for snaLocalTopo does not have a long form and a short form; there is only one form. The structure of vertex 2 is as follows:

**vertex2**

Identify the beginning of vertex 2. The lower level fields in vertex 2 are:

**object** Object instance name of the node represented by vertex 2. VTAM always returns the distinguishedName form of object instance name.

**class** Object identifier (OI) representing the object class of the reported node.

VTAM might not report the true object class of composite nodes such as interchange nodes. When reporting subarea connections, vertex2 object class is always t5Node or t4Node.

**reason** Included only if the vertex 2 node is being reported as deleted.

The structure of endpoint 1 for snaLocalTopo is variable, depending on what objects are reported. Endpoint 1 can contain both a transmission group object and a logicalLink object, or it can contain just a logicalLink object. Endpoint 1 never contains only a transmission group object. If both a TG and a logicalLink are reported, the TG is reported as the first and primary object in endpoint 1. If only a logicalLink is reported, the logicalLink is reported as the primary object in endpoint 1.

The structure of endpoint 1 is shown in two parts; first, the structure of the TG object is shown, including where the logicalLink object fits into the structure. Then the logicalLink object is shown with a structure used for either the primary or secondary object in endpoint 1.

The TG object structure follows:

**object** Object instance name of the TG to be reported. VTAM always reports the distinguishedName form of object instance name.

**class** Object identifier (OI) representing either the appnTransmissionGroup or the subareaTransmissionGroup object class.

**states** String of characters representing the OSI state of the TG; this field is included only for appnTransmissionGroup objects. For a list of OSI states, see "OSI object states" on page 157.

**info** Set of attributes providing data about the TG. Not all attributes appear in all instances of TG objects. The info label and value are included only for appnTransmissionGroup objects. The list of all possible attributes is:

**cp-cpSessionSupport**

Included only for appnTransmissionGroup objects.

**appnTGCapabilities**

Included only for appnTransmissionGroup objects.

**moreInfo**

Always included for a TG object and is followed by a ManagementExtension that contains the logicalLink object.

**identifier**

Object identifier for the objectStuffInMoreInfoParm, which is a parameter that identifies the syntax for this ManagementExtension.

**information**

logicalLink data in the ManagementExtension. At this point the logicalLink data described below is inserted.

**reason** Included only if the TG is being reported as deleted.

The **logical link** object structure follows:

- object** Object instance name of the logicalLink to be reported. VTAM always reports the distinguishedName form of object instance name.
- class** Object identifier (OI) representing the logicalLink object class.
- states** String of characters representing the OSI state of the logicalLink. For a list of OSI states, see "OSI object states" on page 157.
- info** Set of attributes providing data about the logicalLink. Not all attributes appear in all instances of logicalLink objects. The list of all possible attributes is:

**dependencies**

Included for initial data, object creation updates, state change updates for switched PUs, and attribute value change updates caused by line filtering through the MODIFY VTAMTOPO command.

**connectionId**

Included only for native ATM connections and only if the snapshot type is appnPlusSubarea, for initial data and object creation updates.

- portId** Reported for initial data, object creation updates, state change updates for switched PUs, and selected attribute value change updates; however, this attribute might be suppressed if it refers to a switched logical line and switched logical lines are being suppressed (because of how the VTAMTOPO filtering option is specified).

**partnerConnection**

Included only if the resource represented by this logicalLink is a link station and if the partner logicalLink information is available. Included for initial data, object creation updates, and state change updates.

**adjacentLinkStationAddress**

Included if the associated line is a logical token ring line, a frame relay line, an XCA line, an XCF line, an ATM line, or an SDLC line with a polling address. The attribute might also be included for PUs that have the ADDR keyword coded on the PU definition statement. The attribute is included for initial data, object creation updates, state change updates, and selected attribute value change updates.

**adjacentNodeType**

Included for initial data, object creation updates, and state change updates.

**dlurLocalIsAddress**

Included when a DLUR supports downstream PUs. LogicalLink reports local addressing information.

**dlurName**

Included only if the PU is attached to VTAM through the dependent LU server and dependent LU requester capabilities. Included for initial data, object creation updates, and state change updates.

- reason** Included only if the logicalLink is being reported as deleted.

## snaLocalTopo snapshot example

The following example of *snaLocalTopo snapshot* response data shows only the first linked-reply message of the initial data; the sample configuration is the VTAM topology agent host (SSCP1A) connected to an active NCP (NCP3AB8). After the example string, the contents of the message are described in further detail.

```
msg CMIP-1.ROIVapdu (invokeID
  131074, linked-ID 196612, operation-value 2, arg
  ument (actionResult (managedObjectClass 1.3.18.0.
  0.2152, managedObjectInstance (distinguishedName
  (RelativeDistinguishedName (AttributeValueAsserti
  on (attributeType 1.3.18.0.2.4.6, attributeValue
  "NETA")), RelativeDistinguishedName (AttributeVal
  ueAssertion (attributeType 1.3.18.0.0.2032, attri
  buteValue "SSCP1A")), RelativeDistinguishedName (
  AttributeValueAssertion (attributeType 1.3.18.0.0
  .2216, attributeValue (string "SnaLocalTopology")
  )))), actionReply (actionType 1.3.18.0.0.2222, ac
  tionReplyInfo ((vertex1 (object (distinguishedNam
  e (RelativeDistinguishedName (AttributeValueAsser
  tion (attributeType 1.3.18.0.2.4.6, attributeValu
  e "NETA")), RelativeDistinguishedName (AttributeV
  alueAssertion (attributeType 1.3.18.0.0.2032, att
  ributeValue "SSCP1A")))), class 1.3.18.0.0.1826,
  states 01010100000000, info (Attribute (attribute
  Id 1.3.14.2.2.4.33, attributeValue (ObjectInstanc
  e (distinguishedName (RelativeDistinguishedName (
  AttributeValueAssertion (attributeType 1.3.18.0.2
  .4.8, attributeValue "ORGREG")), RelativeDistingu
  ishedName (AttributeValueAssertion (attributeType
  2.5.4.10, attributeValue "IBM")), RelativeDistin
  guishedName (AttributeValueAssertion (attributeTy
  pe 1.3.14.2.2.4.45, attributeValue "9021")), Rela
  tiveDistinguishedName (AttributeValueAssertion (a
  ttributeType 1.3.14.2.2.4.50, attributeValue "032
  082"))))))), Attribute (attributeId 1.3.14.2.2.4.5
  3, attributeValue (ObjectInstance (distinguishedN
  ame (RelativeDistinguishedName (AttributeValueAss
  ertion (attributeType 1.3.18.0.2.4.8, attributeVa
  lue "ORGREG")), RelativeDistinguishedName (Attri
  buteValueAssertion (attributeType 2.5.4.10, attri
  buteValue "IBM")), RelativeDistinguishedName (Attr
  ibuteValueAssertion (attributeType 0.0.13.3100.0.
  7.38, attributeValue (pString "ACF/VTAM.4.3.0"))
  )))), Attribute (attributeId 1.3.18.0.0.2296, att
  ributeValue "SYSPLEX"), Attribute (attributeId 1.
  3.18.0.0.1940, attributeValue 3340), Attribute (a
  ttributeId 1.3.18.0.0.1970, attributeValue 0000),
  Attribute (attributeId 1.3.18.0.0.2036, attribut
  eValue 511), Attribute (attributeId 1.3.18.0.0.20
  35, attributeValue 1), Attribute (attributeId 1.3
  .18.0.0.2013, attributeValue "ISTPUS"), Attribute
  (attributeId 1.3.18.0.0.1972, attributeValue TRU
  E)), moreInfo (ManagementExtension (identifier 1.
  3.18.0.0.2162, information (object (distinguished
  Name (RelativeDistinguishedName (AttributeValueAs
  sertion (attributeType 1.3.18.0.2.4.6, attributeV
  alue "NETA")), RelativeDistinguishedName (Attrib
  uteValueAssertion (attributeType 1.3.18.0.0.2032,
  attributeValue "SSCP1A")), RelativeDistinguishedN
  ame (AttributeValueAssertion (attributeType 1.3.1
  8.0.0.2142, attributeValue "0321-L")))), class 1.
  3.18.0.0.2089, states 01010100000000, info (Attri
  bute (attributeId 1.3.18.0.0.2194, attributeValue
  (dependents (and (Dependents (item (distinguishe
```



dName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.ISTPUS")))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A"))))), Attribute (attributeId 2.9.3.5.7.1, attributeValue "0321"), Attribute (attributeId 1.3.18.0.0.2117, attributeValue ()), Attribute (attributeId 1.3.18.0.0.2131, attributeValue nonswitched), Attribute (attributeId 1.3.18.0.0.2127, attributeValue "CHANNEL"), Attribute (attributeId 1.3.18.0.0.2244, attributeValue (noInfo NULL))))), **vertex2** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8")))), class 1.3.18.0.0.1844), **endpoint1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2044, attributeValue "1.1.NETA.3.NCP3AB8")))), class 1.3.18.0.0.1840, moreInfo (ManagementExtension (identifier 1.3.18.0.0.2162, information (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "0321-S")))), class 1.3.18.0.0.2085, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2142, attributeValue "0321-L"))))))))), Attribute (attributeId 1.3.18.0.0.2142, attributeValue "0321-L"), Attribute (attributeId 1.3.18.0.0.2236, attributeValue (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "PU321A"))))), Attribute (attributeId 1.3.18.0.0.2121, attributeValue t4)))))), (**vertex1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (

attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8"))), class 1.3.18.0.0.1844, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8"))))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")))))))), Attribute (attributeId 1.3.18.0.0.2036, attributeValue 255), Attribute (attributeId 1.3.18.0.0.2035, attributeValue 3)), moreInfo (ManagementExtension (identifier 1.3.18.0.0.2162, information (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2142, attributeValue "LN3A6"))))), class 1.3.18.0.0.2089, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8"))))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8")))))))), Attribute (attributeId 2.9.3.5.7.1, attributeValue "0303"), Attribute (attributeId 1.3.18.0.0.2117, attributeValue ()), Attribute (attributeId 1.3.18.0.0.2131, attributeValue nonswitched), Attribute (attributeId 1.3.18.0.0.2127, attributeValue "SDLC"), Attribute (attributeId 1.3.18.0.0.2244, attributeValue (noInfo NULL))))), **endpoint1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "P3A3274E"))))), class 1.3.18.0.0.2085, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.

4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8")))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2142, attributeValue "LN3A6")))))))), Attribute (attributeId 1.3.18.0.0.2142, attributeValue "LN3A6"), Attribute (attributeId 1.3.18.0.0.2236, attributeValue (noInfo NULL)), Attribute (attributeId 1.3.18.0.0.2119, attributeValue (1sAddr C2)), Attribute (attributeId 1.3.18.0.0.2121, attributeValue t20))), (**vertex1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8")))), class 1.3.18.0.0.1844), **vertex2** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "P3A4956G")))), class 1.3.18.0.0.1827), **endpoint1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2044, attributeValue "0.NETA.P3A4956G")))), class 1.3.18.0.0.1823, states 010101000000FF, info (Attribute (attributeId 1.3.18.0.0.1958, attributeValue FALSE), Attribute (attributeId 1.3.18.0.0.1941, attributeValue 00)), moreInfo (ManagementExtension (identifier 1.3.18.0.0.2162, information (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "P3A4956G")))), class 1.3.18.0.0.2085, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8")))))))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attribut

eValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2142, attributeValue "LN3A6"))))))), Attribute (attributeId 1.3.18.0.0.2142, attributeValue "LN3A6"), Attribute (attributeId 1.3.18.0.0.2236, attributeValue (noInfo NULL)), Attribute (attributeId 1.3.18.0.0.2119, attributeValue (IsAddr C4)), Attribute (attributeId 1.3.18.0.0.2121, attributeValue len))))) , (**vertex1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8")))), class 1.3.18.0.0.1844, moreInfo (ManagementExtension (identifier 1.3.18.0.0.2162, information (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2142, attributeValue "LN3A1")))), class 1.3.18.0.0.2089, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8")))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "NCP3AB8"))))))))))) , Attribute (attributeId 2.9.3.5.7.1, attributeValue "0305"), Attribute (attributeId 1.3.18.0.0.2117, attributeValue ()), Attribute (attributeId 1.3.18.0.0.2131, attributeValue nonswitched), Attribute (attributeId 1.3.18.0.0.2127, attributeValue "SDLC"), Attribute (attributeId 1.3.18.0.0.2244, attributeValue (noInfo NULL))))) , (**endpoint1** (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "P3A3767A")))), class 1.3.18.0.0.2085, states 01010100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8")))))))))))

```

))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2142, attributeValue "LN3A1"))))))), Attribute (attributeId 1.3.18.0.0.2142, attributeValue "LN3A1"), Attribute (attributeId 1.3.18.0.0.2236, attributeValue (noInfo NULL)), Attribute (attributeId 1.3.18.0.0.2119, attributeValue (lsAddr C2)), Attribute (attributeId 1.3.18.0.0.2121, attributeValue t1)))))))))

```

The linked-reply in the example, identified by the operation value of 2, contains a set of four instances of the (v1,v2,e1) sequence. Not all instances of the sequence contain all fields of the sequence. The following is a summary of the contents of the four sequences:

#### First sequence: (v1,v2,e1)

```

vertex 1 : NETA;SSCP1A (local VTAM host)
          class : interchangeNode
          states :
            Operational State : Enabled
            Usage State       : Active
            Administrative State : Unlocked
            Availability Status : No Status
            Procedural Status  : No Status
            Unknown Status     : False
            Native Status      : Active
          info :
            opEquipmentList : ORGREG.IBM.9021.032082
            softwareList     : ORGREG.IBM.ACF/VTAM.4.3.0
            sysplexInfo      : SYSPLEX
            appnNodeCapabilities : 3340
            extAppnNodeCap   : 0000
            subareaLimit     : 511
            subareaAddress   : 1
            puName           : ISTPUS
            gatewaySSCP      : TRUE
          moreInfo :
            NETA;SSCP1A;0321-L
            class : port
            states :
              Operational State : Enabled
              Usage State       : Active
              Administrative State : Unlocked
              Availability Status : No Status
              Procedural Status  : No Status
              Unknown Status     : False
              Native Status      : Active
            info :
              connectionId : 0321
              adapterAddresses : ()
              lineType      : nonswitched
              dlcName       : channel
              relatedAdapter : NOINFO NULL
              dependencies  : NETA;SSCP1A;NCP.ISTPUS,
                           NETA;SSCP1A

vertex 2 : NETA;SSCP1A;NCP3AB8 (locally owned NCP)
          class : t4Node

endpoint 1: NETA;SSCP1A;1.1.NETA.3.NCP3AB8

```

```

class : subareaTransmissionGroup
NETA;SSCP1A;0321-S
class : logicalLink
states :
  Operational State : Enabled
  Usage State       : Active
  Administrative State : Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active
info :
  portId           : 0321-L
  partnerConnection : NETA;NCP3AB8;PU321A
  adjacentNodeType  : t4 (type 4)
  dependencies      : NETA;SSCP1A;0321-L

```

This sequence represents the connection from the local VTAM host to a locally owned NCP. This sequence shows:

- The long form of vertex 1 (the attributes for the local VTAM host)
- The long form of the *port* in vertex 1 (channel data)
- The **only** form of vertex 2 (showing the NCP)
- The form of endpoint 1 containing both a *subareaTransmissionGroup* and a *logicalLink*

#### Second sequence: (v1,e1)

```

vertex 1 : NETA;SSCP1A;NCP3AB8 (locally owned NCP)
class : t4Node
states :
  Operational State : Enabled
  Usage State       : Active
  Administrative State : Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active
info :
  subareaLimit      : 255
  subareaAddress     : 3
  dependencies       : NETA;SSCP1A;NCP.NCP3AB8
                     NETA;SSCP1A
moreInfo :
NETA;SSCP1A;LN3A6 (SDLC line in NCP major node)
class : port
states :
  Operational State : Enabled
  Usage State       : Active
  Administrative State : Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active
info :
  connectionId      : 0303
  adapterAddresses   : ()
  lineType           : nonswitched
  dlcName            : SDLC
  relatedAdapter     : NOINFO NULL
  dependencies       : NETA;SSCP1A;NCP.NCP3AB8,
                     NETA;SSCP1A;NCP3AB8

endpoint 1: NETA;SSCP1A;P3A3274E (PU defined under LN3A6)
class : logicalLink

```

```

states :
  Operational State : Enabled
  Usage State       : Active
  Administrative State : Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active
info :
  portId           : LN3A6
  partnerConnection : NOINFO NULL
  adjacentLinkStationAddress : LSADDR C2
  adjacentNodeType  : t20 (type 2.0)
  dependencies      : NETA;SSCP1A;NCP.NCP3AB8,
                    NETA;SSCP1A;LN3A6

```

This sequence begins the reporting of the NCP resources; the first line defined in the NCP major node is reported, along with the first of two PUs defined under that line. This sequence shows:

- The long form of vertex 1 (the attributes for the NCP)
- The long form of the *port* in vertex 1 (SDLC line data)
- The line / PU are being used for a connection to a type 2.0 node; VTAM does not report type 2.0 nodes in vertex 2
- The form of endpoint 1 containing only a *logicalLink*; there is no TG information because the contacted node is type 2.0

### Third sequence: (v1,v2,e1)

```

vertex 1 : NETA;SSCP1A;NCP3AB8 (locally owned NCP)
          class : t4Node

```

```

vertex 2 : NETA;P3A4956G
          class : lenNode

```

```

endpoint 1: NETA;SSCP1A;0.NETA.P3A4956G
            class : appnTransmissionGroup
            states :
              Operational State : Enabled
              Usage State       : Active
              Administrative State : Unlocked
              Availability Status : No Status
              Procedural Status  : No Status
              Unknown Status     : False
              Native Status      : N/A
            info :
              cp-cpSessionSupport : FALSE
              appnTGcapabilities  : 00

```

```

NETA;SSCP1A;P3A4956G (PU defined under LN3A6)
class : logicalLink
states :
  Operational State : Enabled
  Usage State       : Active
  Administrative State : Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active
info :
  portId           : LN3A6
  partnerConnection : NOINFO NULL
  adjacentLinkStationAddress : LSADDR C4

```

```

adjacentNodeType : 1en
dependencies      : NETA;SSCP1A;NCP.NCP3AB8,
                  NETA;SSCP1A;LN3A6

```

This sequence continues the reporting of the NCP resources by reporting the second PU defined under the previously reported line, which is used for a connection to a LEN node. This sequence shows:

- The short form of vertex 1 (long form of NCP already reported)
- The *port* data for LN3A6 was already reported, so the *port* is omitted from vertex 1
- Vertex 2 contains the contacted LEN node.
- The form of endpoint 1 containing an APPN TG and a *logicalLink*. The *port* associated with this PU, although not provided in vertex 1, can be identified by the *portId* attribute of the *logicalLink*.

#### Fourth sequence: (v1,e1)

```

vertex 1 : NETA;SSCP1A;NCP3AB8 (locally owned NCP)
          class : t4Node
          moreInfo :
            NETA;SSCP1A;LN3A1 (SDLC line in NCP major node)
            class : port
            states :
              Operational State : Enabled
              Usage State       : Active
              Administrative State : Unlocked
              Availability Status : No Status
              Procedural Status  : No Status
              Unknown Status     : False
              Native Status      : Active
            info :
              connectionId      : 0305
              adapterAddresses   : ()
              lineType           : nonswitched
              dlcName            : SDLC
              relatedAdapter     : NOINFO NULL
              dependencies        : NETA;SSCP1A;NCP.NCP3AB8,
                                  NETA;SSCP1A;NCP3AB8

endpoint 1: NETA;SSCP1A;P3A3767A (PU defined under LN3A1)
           class : logicalLink
           states :
             Operational State : Enabled
             Usage State       : Active
             Administrative State : Unlocked
             Availability Status : No Status
             Procedural Status  : No Status
             Unknown Status     : False
             Native Status      : Active
           info :
             portId             : LN3A1
             partnerConnection  : NOINFO NULL
             adjacentLinkStationAddress : LSADDR C2
             adjacentNodeType    : t1 (type 1)
             dependencies        : NETA;SSCP1A;NCP.NCP3AB8,
                                  NETA;SSCP1A;LN3A1

```

This sequence continues the reporting of the NCP resources by reporting another line, a PU defined under the line, and a connection to a type 1 node. This sequence shows:

- The short form of vertex 1 (long form of NCP already reported)



- The long form of *port* data for LN3A1 is included because it is the initial report of LN3A1.
- The line / PU are being used for a connection to a type 1 node; VTAM does not report connected type 1 nodes in vertex 2.
- The form of endpoint 1 containing only a *logicalLink*. There is no TG information to report for a connection to a type 1 node.

---

## Requesting and monitoring LU data (*luCollection*)

This section contains the following topics:

- “Overview”
- “Action request” on page 210
- “Initial data response” on page 210
- “Update data response” on page 211
- “Action termination” on page 212
- “*luCollection* snapshot data” on page 213
- “*luCollection* (PU) snapshot example” on page 214

### Overview

This section describes the action that is used to request monitoring and stop monitoring LU data for a given PU object or agent host object using the *luCollection* managed object class.

Management of LUs requires that a manager application program be able to request the names of all the LUs under a certain PU and to monitor their status. The manager application program can use a *snapshot* action request against the *luCollection* object to get LU information.

The VTAM agent supports two types of *luCollection*

1. *luCollection* against a specified physical unit. This form of *luCollection* is called *luCollection* (PU) and returns all dependent LUs that are defined (either statically or dynamically) under the PU. The physical unit must be defined at the agent host for this command to be successful. For physical units that represent connections to type 2.1 nodes, the independent logical units currently using the PU as an adjacent link station (ALS) for sessions are also reported on the *luCollection snapshot* response.
2. *luCollection* against the agent host. This form of *luCollection* which does not specify a *linkName* in the *luCollection* distinguished name is called *luCollection* (Host) and returns LU resources that are associated with the VTAM agent host. This includes:
  - Application programs
  - CDRSCs
  - USERVARs
  - Generic resources
  - Local non-SNA terminals

The reporting of all CDRSCs for *luCollection* (Host) can generate large amounts of data to be processed because dynamic real CDRSCs as well as predefined CDRSCs can be reported. With the exception of low-entry networking (LEN) independent LUs, these CDRSCs can offer little benefit in terms of managing the network

because they represent resources that could be reported by agents at the nodes that own the real resources represented by the CDRSCs. However, these CDRSCs might be of interest in some environments. The user can select which types of CDRSCs are to be included in the *luCollection* (Host) object reported by the VTAM topology agent by specifying one of the following values on the OSITOP0 start option:

- ILUCDRSC: Report independent LUs only. This is the default value if not specified.
- ALLCDRSC: Report all CDRSCs, including independent LUs.

**Note:** This start option does not affect the reporting of independent LUs under *luCollection* (PU).

## Action request

A *snapshot* action request is used to request LU data from an agent node. The action is sent as an m-Action-Confirmed operation.

The manager application program can request that any future updates to the *luCollection* object be returned, as they occur. The LU data is requested without updates by specifying the *oneTimeOnly* value in the request. The LU data and any future updates can be requested by specifying the *ongoing* value in the request.

The following example shows a request to the target PU P3A3274A. The following special identifiers are used in the request:

**1.3.18.0.0.1811**

*luCollection*

**1.3.18.0.0.1815**

*luCollectionId*

**1.3.18.0.0.2222**

*snapshot*

```
msg CMIP-1.ROIVapdu (invokeID 196610, operation-value 7,
argument (baseManagedObjectClass 1.3.18.0.0.1811, baseManagedObjectInst
tance (distinguishedName (RelativeDistinguishedName (AttributeValueAss
ertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), Relativ
eDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.
2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeV
alueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "P3A3274A
")), RelativeDistinguishedName (AttributeValueAssertion (attributeType
1.3.18.0.0.1815, attributeValue "luCollection")))), actionInfo (actio
nType 1.3.18.0.0.2222, actionInfoArg (start ongoing))))))
```

## Initial data response

If the *oneTimeOnly snapshot* action is requested, all the data (initial data only) is returned in action linked replies. To indicate that the data for the entire set of LUs has been returned, the agent sends an additional ROIV action linked reply that is an empty set. Then an RORS action response is sent with only the invoke identifier of the original action request.

If the *ongoing snapshot* action was requested, all the initial data is returned in action linked replies, as for the *oneTimeOnly snapshot* action. To indicate that the initial data for the entire set of LUs has been returned, the VTAM topology agent sends an additional ROIV action linked reply that is an empty set. The VTAM topology agent is then ready to process updates for the *luCollection* object.

Table 14. Reported resources for luCollection (host) initial data

Resource	Object class	Notes
Non-SNA terminal	LU	Local terminal
Application program	LU	VTAM application program. Model not reported.
CDRSC	CDRSC	Dynamic alias never reported. Others affected by OSITOPPO start option. Model not reported.
USERVAR	LU Group	Report USERVAR name and value
Generic resource	LU Group	Report generic and real members

Table 15. Reported resources for luCollection (PU) initial data

Resource	Object class	Notes
Dependent LU	LU	Logical Unit
ILU	CDRSC	ILU reported as CDRSC

**Note:** ILUs that have multiple sessions through the same PU (ALS) will only be reported once.

## Update data response

When the ongoing *snapshot* action has been issued and is currently in effect, updates to the *luCollection* object results in the sending of a *snapshot* linked reply with the update. In this case, only data pertinent to the subject LU flows in the *snapshot* linked reply. In general, updates for *luCollection* (Host) are caused by the activation or inactivation of a major node containing LU or CDRSC definitions or a state change of these resources. Creation or deletion of USERVARs and generic resources also cause updates.

Table 16. Resources with reason for luCollection (host) update data

Resource	Reason	Notes
Non-SNA LU or application program	Creation	Major node activation. Model application ignored.
	Deletion	Major node inactivation. Model application ignored.
	State change	Resource changed state. Model application ignored.
CDRSC	Creation	Dynamic alias ignored. Model CDRSC ignored.
	Deletion	Dynamic alias ignored. Model CDRSC ignored.
	State change	Resource changed state. Model CDRSC ignored.
	Attribute value change	CDRSC has a new owning CDRM. Model CDRSC ignored.

Table 16. Resources with reason for *luCollection* (host) update data (continued)

Resource	Reason	Notes
LU Group	Creation	USERVAR or generic resource created
	Deletion	USERVAR or generic resource deleted
	State change	Not applicable
	Attribute value change (member added or member deleted)	Not supported for this <i>snapshot</i>

Updates for *luCollection* (PU) are generally caused by state changes of dependent LUs defined under a monitored PU. Also, creation or deletion of dynamic dependent LUs as well as connection of independent LUs using the PU as an adjacent link station (ALS) will result in updates.

Table 17. Resources with reason for *luCollection* (PU) update data

Resource	Reason	Notes
Dependent LU	Creation	Dynamic LU created
	Deletion	Dynamic LU deleted
	State change	Dependent LU changed state
Independent LU	Creation	New session through adjacent link station
	Deletion	End last session through adjacent link station
	State change	Not reported

Updates for the *luCollection* object can be merged with related updates by the VTAM topology agent before being written to the *snapshot* linked replies.

A *snapshot luCollection* is automatically cancelled when the PU supporting the *luCollection* is deleted. *luCollection* updates are not merged when they are the result of a VTAM-cancelled *luCollection*.

Some updates for *luCollection snapshots* might be reported under more than one *luCollection*. For example, some updates, such as updates for independent LUs, might be reported under several monitored PUs and also under the VTAM host. All VTAM host *luCollection* updates are merged, but updates for a specific PU are not merged if the updates represent independent LUs.

Updates that report a deleted object are not merged.

## Action termination

The VTAM topology agent terminates an ongoing *snapshot* action for the *luCollection* object under the following conditions:

- A stop *snapshot* action request is received.
- An error occurs during *snapshot* processing in VTAM.
- The association that the *snapshot* is using terminates.
- The target PU object associated with the *luCollection* object is deleted.

When a stop *snapshot* action request is received, the agent sends an ROIV action linked reply for the *snapshot* start request that is an empty set, an RORS action response to the *snapshot* start request, and an RORS action response to the *snapshot* stop request.

## luCollection snapshot data

The linked-replies for *luCollection* are made up of multiple instances of the following structure:

```
vertex1
  object --LU-related object distinguished name
  class --object class
  states --OSI states for this object
  info
    dependencies --object attribute
    residentNodePointer --object attribute
    nlrResidentNodePointer --object attribute
    luGroupMembers --object attribute
    cdrscRealLuName --object attribute
    userLabel --object attribute
  reason --reason for this vertex1 to be reported
```

The following list explains what the fields contain.

### vertex1

Contains all data reported for a single LU-related object for either initial data or for a single update for the object.

**object** Distinguished name of the LU-related object.

**class** Monitored LU-related objects are reported under the following object classes:

- logicalUnit
- crossDomainResource
- luGroup (For USERVAR or generic resource)

**states** 14-character string for one of the following OSI states:

- operationalState
- usageState
- administrativeState
- availabilityStatus
- proceduralStatus
- unknownStatus
- nativeStatus

No states information is returned for luGroup

**info** Set of attributes for the LU-related object. Not all attributes are reported for all object classes or are necessarily reported in the order shown in the following tables Table 18 and Table 19 on page 214. The following table shows which attributes might be reported for an object class.

Table 18. Attributes for *luCollection* (host) reported objects

Attribute	LU	CDRSC	luGroup
<u>dependencies</u>	X	X	
<u>residentNodePointer</u>	X		

Table 18. Attributes for luCollection (host) reported objects (continued)

Attribute	LU	CDRSC	luGroup
<u>nlrResidentNodePointer</u>		X	
<u>luGroupMembers</u>			X
<u>cdrscRealLuName</u>		X	
<u>userLabel</u>	X	X	
<u>tn3270DnsName</u>	X		
<u>tn3270IpAddress</u>	X		
<u>tn3270portNumber</u>	X		

Table 19. Attributes for luCollection (PU) reported objects

Attribute	LU	CDRSC
<u>dependencies</u>	X	X
<u>residentNodePointer</u>	X	
<u>nlrResidentNodePointer</u>		X
<u>cdrscRealLuName</u>		X

**reason** Indicates why the snapshot update is being sent:

**Note:** The reason field is omitted when the intended value is addOrUpdate.

**Value Description**

**deleted**

Object is deleted.

**addOrUpdate**

Object is added or changed. The default is addOrUpdate.

## luCollection (PU) snapshot example

The following example shows an initial data response for the target PU P3A3274A. This example shows only vertex1 data for LU L3A3278A:

```

msg CMIP-1.R0IVapdu
(invokedID 131075, linked-ID 196610, operation-value 2, argument (action
nResult (managedObjectClass 1.3.18.0.0.1811, managedObjectInstance (di
stinguishedName (RelativeDistinguishedName (AttributeValueAssertion (a
ttributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistingu
ishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, att
ributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAsser
tion (attributeType 1.3.18.0.0.2133, attributeValue "P3A3274A")), Rela
tiveDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0
.0.1815, attributeValue "luCollection")))), actionReply (actionType 1.
3.18.0.0.2222, actionReplyInfo ((vertex1 (object (distinguishedName (R
elativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.1
8.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (Attribu
teValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1
A")), RelativeDistinguishedName (AttributeValueAssertion (attributeTyp
e 1.3.18.0.0.1984, attributeValue "NETA.L3A3278A")))), class 1.3.18.0.
0.1829, states 01000100000000, info (Attribute (attributeId 1.3.18.0.0
.2194, attributeValue (dependents (and (Dependents (item (distinguishe
dName (RelativeDistinguishedName (AttributeValueAssertion (attributeTy
pe 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName
(AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValu
e "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attr

```

```

attributeType 1.3.18.0.0.2272, attributeValue "NCP.NCP3AB8")))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "NETA.P3A3274A")))))))", Attribute (attributeId 1.3.18.0.0.2018, attributeValue (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "NETA.P3A3274A")))))))

```

The following translated initial data shows LU L3A3278A is active but not used, under PU P3A3274A. The *userLabel* attribute is not reported because the LU is not an application with an ACBNAME.

luCollection object name: NETA;SSCP1A;P3A3274A;luCollection

vertex 1: NETA;SSCP1A;NETA.L3A3278A

```

class          : logicalUnit
states
  Operational State : Enabled
  Usage State       : Idle
  Administrative State: Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active

info
  residentNodePointer : NETA;SSCP1A;NETA.P3A3274A
  dependencies:       : NETA;SSCP1A;NCP.NCP3AB8
                     : NETA;SSCP1A;NETA.P3A3274A

```

The following example shows update data for the target PU P3A3274A. The example includes vertex1 data for LU L3A3278A. The following special identifiers are used in the responses:

**1.3.18.0.0.1811**

*luCollection*

**1.3.18.0.0.1815**

*luCollectionId*

**1.3.18.0.0.2222**

*snapshot*

```

msg CMIP-1.R0IVapdu
(invokedID 131077, linked-ID 196610, operation-value 2, argument (actionResult (managedObjectClass 1.3.18.0.0.1811, managedObjectInstance (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2133, attributeValue "P3A3274A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.1815, attributeValue "luCollection")))), actionReply (actionType 1.3.18.0.0.2222, actionReplyInfo ((vertex1 (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.1984, attributeValue "NETA.L3A3278A")))), class 1.3.18.0.0.1829, states 01010100000001, info ()))))))

```

The following translated update data shows a session with LU L3A3278A was started. No attributes are reported because this update represents a state change.

luCollection object name: NETA;SSCP1A;P3A3274A;luCollection

vertex 1: NETA;SSCP1A;NETA.L3A3278A

```
class          : logicalUnit
states
  Operational State      : Enabled
  Usage State           : Active
  Administrative State  : Unlocked
  Availability Status    : No Status
  Procedural Status     : No Status
  Unknown Status        : False
  Native Status         : Active with session
```

The following example shows attribute data for APPL APPL1A which represents a TN3270 connection with an IP address, DNS and port.

```
msg CMIP-1.RORSapdu (invokeID 196616, resultOption (operation-value 3, result (managedObjectClass 1.3.18.0.0.1829, managedObjectInstance (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.1984, attributeValue "NETA.APPL1")))), currentTime "2002/11/07-08:47:22.0", attributeList (Attribute (attributeId 2.9.3.2.7.31, attributeValue unlocked), Attribute (attributeId 2.9.3.2.7.50, attributeValue ()), Attribute (attributeId 1.2.124.360501.1.209, attributeValue ()), Attribute (attributeId 2.9.3.2.7.33, attributeValue ()), Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "APPL.APPL1A"))))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A"))))))), Attribute (attributeId 1.2.124.360501.1.240, attributeValue (string "APPL1")), Attribute (attributeId 1.3.18.0.0.1984, attributeValue "NETA.APPL1"), Attribute (attributeId 1.3.18.0.0.1819, attributeValue "APPL1"), Attribute (attributeId 2.9.3.2.7.63, attributeValue 1.3.18.0.0.1911), Attribute (attributeId 1.3.18.0.0.2080, attributeValue 0), Attribute (attributeId 2.9.3.2.7.65, attributeValue 1.3.18.0.0.1829), Attribute (attributeId 2.9.3.2.7.35, attributeValue enabled), Attribute (attributeId 2.9.3.2.7.66, attributeValue (OBJECT-IDENTIFIER 2.9.3.2.4.16, OBJECT-IDENTIFIER 2.9.3.2.4.17, OBJECT-IDENTIFIER 0.0.13.3100.0.4.1, OBJECT-IDENTIFIER 1.3.14.2.2.2.40, OBJECT-IDENTIFIER 1.3.14.2.2.2.35, OBJECT-IDENTIFIER 1.3.18.0.0.1871, OBJECT-IDENTIFIER 1.3.18.0.0.2066, OBJECT-IDENTIFIER 1.3.18.0.0.1818, OBJECT-IDENTIFIER 1.2.124.360501.10.62, OBJECT-IDENTIFIER 1.3.18.0.0.7898)), Attribute (attributeId 2.9.3.2.7.36, attributeValue ()), Attribute (attributeId 1.3.18.0.0.2018, attributeValue (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A"))))), Attribute (attributeId 1.2.124.360501.1.302, attributeValue (noResources none
```



```

)), Attribute (attributeId 1.3.18.0.0.7901, attributeValue (
ipv6 "8:7:6:5:4:3:2:1%ZONE1ABC")), Attribute (attributeId 1.
3.18.0.0.7902, attributeValue (portNumber "1027")), Attribut
e (attributeId 1.3.18.0.0.7900, attributeValue (fullName "AB
CDEFGH")), Attribute (attributeId 2.9.3.2.7.38, attributeVal
ue FALSE), Attribute (attributeId 2.9.3.2.7.39, attributeVal
ue idle), Attribute (attributeId 0.0.13.3100.0.7.50, attribu
teValue "APPL1"))))

```

The following translated data shows an IPv6 type IP address with zone, the DNS and port.

```

Name           : NETA.SSCP1A.NETA.APPL1(luName)
Class          : LU
Attribute List :

administrativeState : UNLOCKED
attachedCircuitList : ()
availabilityStatus  : ()
functionId         : APPL1
luName             : NETA.APPL1
luSecondName       : APPL1
nameBinding         : LU_not_TYPE5
nativeStatus       : ACT
objectClass        : LU
operationalState   : ENABLED
proceduralStatus   : ()
residentNodePointer : NETA.SSCP1A(snaNodeName)
tn3270ClientIpAddress : 8:7:6:5:4:3:2:1%ZONE1ABC
tn3270ClientPortNumber : 1027
tn3270ClientDnsName : ABCDEFGH
unknownStatus      : FALSE
usageState         : IDLE
userLabel          : APPL1

```

---

## Monitoring resources through event reports

This section contains the following topics:

- “Overview”
- “Management of the event reporting environment” on page 218
- “Creation of the event forwarding discriminator” on page 218
- “Reporting events to the manager application program” on page 219
- “Event report data” on page 219
- “Event report example” on page 221

### Overview

A manager application program can monitor certain resource objects maintained by the VTAM topology agent for certain defined events. The VTAM topology agent uses the event reporting in CMIP services to monitor resources.

The resource monitoring process consists of:

- Management of the event reporting environment
- Notification of events from the agent application program to the manager application program

## Management of the event reporting environment

The event reporting environment is mostly determined by the set of **event forwarding discriminator (EFD)** objects that exist at any given time. The VTAM topology agent does not become involved with the management of the event reporting environment. CMIP services handles the creation and maintenance of the event reporting environment.

The event reporting environment for the VTAM topology agent is determined partly by the OSIEVENT start option. For a description of the factors that control the event reporting environment, see “Special considerations for topology manager application programs” on page 14.

## Creation of the event forwarding discriminator

The manager application program can create an EFD object at CMIP services by sending a CMIP create request specifying:

- A managed object class (EFD)
- A managed object instance
- The discriminator construct that is used to filter notifications
- The destination that contains the name of the object (application program) that should receive event reports

The following example shows a CMIP create EFD request; the discriminator construct passes only LU group change notifications.

The following special identifiers are used in the request:

### 2.9.3.2.3.4

eventForwardingDiscriminator

### 2.9.3.2.7.1

discriminatorId

### 2.9.3.2.7.56

discriminatorConstruct

### 2.9.3.2.7.14

eventType

### 1.3.18.0.0.1810

luGroupChangeNotif

### 2.9.3.2.7.55

destination

### 1.3.18.0.0.2175

managerApplicationName

```
msg CMIP-1.R0IVapdu (invokeID 196611, operation-value 8,
(managedObjectClass 2.9.3.2.3.4,(managedObjectInstance (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue NETA)), RelativeDistinguishedName (AttributeValueAssertion (attributeType 2.9.3.2.7.4, attributeValue (name SSCP1A))), RelativeDistinguishedName (AttributeValueAssertion (attributeType 2.9.3.2.7.1, attributeValue (string luGrCh)))))),attributeList((attributeId 2.9.3.2.7.31,attributeValue unlocked),(attributeId 2.9.3.2.7.56,attributeValue (item (equality (attributeId 2.9.3.2.7.14,attributeValue 1.3.18.0.0.1810))), (attributeId 2.9.3.2.7.55,attributeValue (single (name (RDNSSequence (RelativeDistinguishedName (AttributeValueA
```

```
Assertion (attributeType 1.3.18.0.2.4.6, attributeValue NETA)), RelativeDistinguishedName (AttributeValueAssertion (attributeType 2.9.3.2.7.4, attributeValue (name SSCP1A))), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2175, attributeValue Manager)))))))))
```

## Reporting events to the manager application program

Once the resource monitoring environment is created, unsolicited management information can flow from the agent to the manager. When certain defined events occur, a resource object sends a notification. The VTAM topology agent sends this notification data to CMIP services. CMIP services applies the filtering constructs based on active EFDs to the notification message. If it is determined that the event matches a filter, CMIP services determines which manager application program should receive the message in an event report. Note that multiple event reports might be sent to multiple destinations based on a single notification event. This situation might occur when multiple EFD filters are satisfied by a particular notification event.

The event notification data is subject to the same merge process used for the *snapshot* data. See “ACTION(snapshot) update merging” on page 172 for a description of the merge process. The merging of event data is based on the state of the resource being reported. If the state to be reported is a transient state (non-resting state), the event data is held and merged with other event data until the resource is reporting event data with a resting state. As with the *snapshot* merge process, the event merging is timed such that resources that remain in transient states too long are reported.

Merging event data has an additional consideration that does not apply to the *snapshot* update data: the event data specifies the reason for the event. It is possible for event data with different reasons to be merged. In that case, the general rule used by the VTAM topology agent is that the reason for event data that was merged last is used in the reported notification. For example, if an object-creation event occurred but the state was a transient state, the event data is held. Subsequent state-change event data might be merged with the object-creation data. When the event notification is finally sent, the reason specifies state-change. The manager application program can infer the creation of the object by having no previous report of the object.

CMIP services sends the notification data to the manager in the form of a CMIP event-report request. VTAM supports unconfirmed event-reports only (m-EventReport).

Changes affecting network resources result in notifications that might flow to a manager application program. The VTAM topology agent supports notifications for:

- State change
- Object creation
- Object deletion
- LU group change

## Event report data

Data in the m-EventReport request appear in the following structure:

```

managedObjectClass      --object class
managedObjectInstance  --object distinguished name
eventTime               --time stamp
eventType               --event type

--No further info for objectCreation and objectDeletion

--Added for stateChange eventType
eventInfo
    attributeIdentifierList      --new attribute identifiers
    stateChangeDefinition
        nativeStatus           --object attribute
        operationalState      --object attribute
        usageState           --object attribute
        availabilityStatus    --object attribute
        proceduralStatus     --object attribute
        unknownStatus       --object attribute

--Added for luGroupChangeNotif eventType
eventInfo
    notifReason              --reason for LU group change
    luName                   --group member name
    luGroupSize              --group size

```

### **managedObjectClass**

Object classes for the reported resource.

### **managedObjectInstance**

Distinguished name of the reported resource.

### **eventTime**

Time stamp with the current system time when the event report is built from the corresponding notification.

### **eventType**

One of the following events:

- stateChange
- objectCreation
- objectDeletion
- luGroupChangeNotif (for USERVARs, Generic Resources, and IP info attributes for TN3270 connection LUs.)

ObjectCreation of an luGroup object is considered an luGroupChangeNotif event. The VTAM topology agent reports the member that caused the object to be created. The manager application program can infer the creation of the object by monitoring for this event report.

### **attributeIdentifierList**

List of attributes identifiers, also provided in the following stateChangeDefinition field, for which new values are provided.

### **stateChangeDefinition**

Contains six out of seven OSI states in the attribute form, rather than in the OCTET string form. The VTAM topology agent returns all attributes with the current values.

administrativeState is omitted because the value is always assumed to be unlocked.

### **notifReason**

One of the following reasons for LU group change.

- luAdded
- luDeleted

**luName**

Name of member in LU group that caused the event.

**luGroupSize**

Number of members in LU group.

**Event report example**

The following example shows an event report for an LU group change.

The following special identifiers are used in the event report:

**1.3.18.0.0.1803**

luGroup

**1.3.18.0.0.1807**

luGroupName

**1.3.18.0.0.1810**

luGroupChangeNotif

```
msg CMIP-1.R0IVapdu (invokeID 65541, operation-value 0,
argument (managedObjectClass 1.3.18.0.0.1803, managedObjectInstance (d
istinguishedName (RelativeDistinguishedName (AttributeValueAssertion (
attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDisting
uishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, at
tributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAsse
rtion (attributeType 1.3.18.0.0.1807, attributeValue "GENERIC1")))), e
ventTime "1994/10/17-11:08:18.0", eventType 1.3.18.0.0.1810, eventInfo
(notifReason luAdded, luName "NETA.APPL2", luGroupSize 1)))
```

The following translated event data shows that LU NETA.APPL2 has been added to the LU group GENERIC1 (a generic resource name).

```
Resource name      : NETA;SSCP1A;GENERIC1
class              : luGroup
eventTime          : 1994/10/17-11:08:18.0
eventType          : luGroupChangeNotif
eventInfo
  notifReason      : luAdded
  luName           : NETA.APPL2
  luGroupSize      : 1
```

The following example shows an event report for a state change.

The following special identifiers are used in the event report:

**1.3.18.0.0.1829**

logicalUnit

**2.9.3.2.10.14**

stateChange

```
msg CMIP-1.R0IVapdu (invokeID 65551, operation-value 0,
argument (managedObjectClass 1.3.18.0.0.1829, managedObjectInstance (d
istinguishedName (RelativeDistinguishedName (AttributeValueAssertion (
attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDisting
uishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, at
tributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAsse
rtion (attributeType 1.3.18.0.0.1984, attributeValue "NETA.APPL2")))),
eventTime "1995/01/27-14:16:20.0", eventType 2.9.3.2.10.14, eventInfo
(attributeIdentifierList (AttributeId 1.3.18.0.0.2080, AttributeId 2.
9.3.2.7.35, AttributeId 2.9.3.2.7.39, AttributeId 2.9.3.2.7.33, Attrib
uteId 2.9.3.2.7.36, AttributeId 2.9.3.2.7.38), stateChangeDefinition (
(attributeID 1.3.18.0.0.2080, newAttributeValue 0), (attributeID 2.9.3
```

```
.2.7.35, newAttributeValue enabled), (attributeID 2.9.3.2.7.39, newAttr  
ributeValue idle), (attributeID 2.9.3.2.7.33, newAttributeValue ()), (  
attributeID 2.9.3.2.7.36, newAttributeValue ()), (attributeID 2.9.3.2.  
7.38, newAttributeValue FALSE))))))
```

The following translated event data shows that LU NETA.APPL2 has changed state. This event report example was reported because of an EFD set to monitor state changes.

```
Resource name      : NETA;SSCP1A;NETA.APPL2  
Class              : logicalUnit  
eventTime          : 1995/01/27-14:16:20.0  
eventType          : stateChange  
AttributeIdentifierList  
  nativeStatus  
  operationalState  
  usageState  
  availabilityStatus  
  proceduralStatus  
  unknownStatus  
StateChangeDefinition  
  nativeStatus      : newAttributeValue ACTIVE  
  operationalState  : newAttributeValue ENABLED  
  usageState        : newAttributeValue IDLE  
  availabilityStatus : newAttributeValue (  
  proceduralStatus  : newAttributeValue (  
  unknownStatus     : newAttributeValue FALSE
```

---

## Chapter 16. Requesting specific resource data

This chapter describes how the VTAM topology agent gathers information about specific resources. The following topics are included:

- “Requesting specific resource data (GET)”
- “Requesting specific resource data (logicalUnitIndex)” on page 228

---

### Requesting specific resource data (GET)

This section contains the following topics:

- “Overview”
- “GET request”
- “Network-qualified names and GET requests” on page 225
- “GET response” on page 226
- “GET data” on page 227
- “GET data example” on page 227

#### Overview

The CMIP GET operation can be used by a manager application program to obtain resource information for a single named resource. The object class of the resource might not be known, so it is not necessary that the manager application program know the exact object class of a particular resource before using the GET operation to obtain information about that resource. It is necessary, however, that the manager application program know the name of the resource and that the name be properly constructed for the object class containing the resource.

If the VTAM topology agent receives a GET request for a known resource, the VTAM topology agent provides a single GET response containing the requested resource information, as it exists when the GET request is processed.

#### GET request

The GET request contains the following information:

##### object class

If the object class of the resource is known, it can be specified in the request as the object identifier (OI) representing the appropriate class. If the class is not known, the class can be specified as *actualClass* (2.9.3.4.3.42). *actualClass* is a special class specification that tells the VTAM topology agent that the class is unknown and that the VTAM topology agent should return the real object class in the GET response.

The object class can be specified as a class higher in the inheritance tree than the real class of the resource. An object in the lower (real) class can validly respond to a request as if the object were in the higher (requested) class. Another way to state this behavior is that the lower class can act allomorphically to the higher class; it can emulate the higher class. For example, if a VTAM node is an interchange node (combination type 5 node and APPN network node) and the VTAM topology agent at that VTAM node receives a GET request for the VTAM node that specifies the *t5Node* object class, the VTAM topology agent at that node can respond to the

request because the *interchangeNode* class inherits from the *t5Node* class, allowing an object in the *interchangeNode* class to act allomorphically to the *t5Node* class. If the VTAM node is a *t5Node* and the VTAM topology agent received a request specifying an *interchangeNode*, the request is rejected, because a *t5Node* cannot act as an *interchangeNode*.

#### **object instance**

The distinguished name of the object must be provided in the GET request. Although the object class might not be known, the naming attribute used in the object instance name must be a valid naming attribute for the object class in which the resource exists. No generic form exists for naming attribute (similar to *actualClass*) that can apply to any class. Note that the first two relative distinguished names (RDNs) in the distinguished name must be the netID and node name of the VTAM topology agent host.

**scope** The VTAM topology agent does not support the scoping function; therefore, the optional scope information can be omitted from the GET request. If scope is specified in the request, the associated scope value must be specified as '(basicScope 0)'.

**filter** The VTAM topology agent does not support the filtering function; therefore, the optional filter information can be omitted from the GET request. If the filter is specified in the request, the associated filter value must be specified as either '(and ())' or '(or ())'.

#### **attribute list**

The attribute list contains a set of OIs representing the attributes of the object for which the manager application program is requesting information. The attributes must be defined in the requested object class, or the discovered object class if *actualClass* is specified. They must also be among the attributes supported by the VTAM topology agent. For the list of supported attributes, see Appendix E, "VTAM topology agent object and attribute tables," on page 309. The attribute list can be omitted from the GET request. Omitting it indicates to the VTAM topology agent that *all* supported attributes for the object class (specified or discovered) must be provided in the GET response.

The VTAM topology agent supports GET requests for resources in the following object classes:

- *appnEN*
- *appnNN*
- *appnRegisteredLu*
- *crossDomainResource*
- *definitionGroup*
- *interchangeNode*
- *lenNode*
- *logicalLink*
- *logicalUnit*
- *luGroup*
- *migrationDataHost*
- *port*
- *t2-1Node*
- *t4Node*
- *t5Node*



Certain object classes are named with netID and snaNodeName; the object instance names for objects in these classes must be the VTAM topology agent host name for GET requests for these objects to be routed to the VTAM topology agent. For example, a VTAM topology agent at node NETA;SSCP1A might report node NETA;SSCP2A as a type 5 node in a *snaLocalTopo* response. A subsequent GET request sent to object NETA;SSCP2A will not be routed to the VTAM topology agent at node NETA;SSCP1A because the object instance name in the GET request is not named under NETA;SSCP1A, the VTAM topology agent name. This situation applies to the following object classes:

- appnEN
- appnNN
- interchangeNode
- migrationDataHost
- t5Node

## Network-qualified names and GET requests

GET requests for logicalLink, logicalUnit, crossDomainResource, and appnRegisteredLU can specify a network-qualified name as the third RDN in the distinguished name. The name can also be specified without being network qualified. The VTAM topology agent determines whether the name matches the name of a resource at the VTAM topology agent host and verifies that the resource found is the correct type for the naming attribute specified in the GET request.

Rules for matching names by object type are listed here:

### logicalLink

If the linkName attribute is network qualified, the netID must be the same as the netID of the VTAM topology agent host receiving the GET request.

### logicalUnit

If the luName attribute is network qualified, the netID must be the same as the netID that VTAM display commands require for displaying the resource. The VTAM topology agent host netID will always work. For dependent LUs that are attached to a non-native PU type 2.1 node (nonnative network attachment), the netID of the physical unit will also be accepted. A non-network qualified name always has a default netID that is the same as the VTAM topology agent host netID.

For application logical units, the luName attribute can specify the name coded on the ACBNAME operand of the APPL definition statement. For this name to match, it must be either non-network-qualified or network qualified with the netID of the VTAM topology agent host. When a match occurs, the VTAM topology agent host returns data for the application program with the specified ACBNAME.

### crossDomainResource

If the nonLocalResourceName attribute is specified with a network-qualified name, the name and netID must exactly equal the name and netID of the CDRSC for a match to occur. If a non-network-qualified name is given, the name will only match a CDRSC that has been added to the VTAM topology agent host SRT directory.

The nonLocalResourceName attribute can also specify the name coded on the LUALIAS operand of a CDRSC definition. For this name to match, the name must be either non-network-qualified or qualified with the netID of the VTAM topology agent host.

### appnRegisteredLU

If the nonLocalResourceName attribute is specified with a network-qualified name, the name and netID must exactly match the name and netID of the registered LU. If a non-network-qualified name is given, the name will only match a registered LU with the netID of the VTAM topology agent host.

The following example shows a GET request for resource data:

```
msg CMIP-1.ROIVapdu (invokeID 196610, operation-
value 3, argument (baseManagedObjectClass 1.3.18.
0.0.1844, baseManagedObjectInstance (distinguishe
dName (RelativeDistinguishedName (AttributeValueA
ssertion (attributeType 1.3.18.0.2.4.6, attribute
Value "NETA")), RelativeDistinguishedName (Attrib
uteValueAssertion (attributeType 1.3.18.0.0.2032,
attributeValue "SSCP1A")), RelativeDistinguished
Name (AttributeValueAssertion (attributeType 1.3.
18.0.0.2032, attributeValue "NCP3AB8")))), attrib
uteIdList (AttributeId 2.9.3.2.7.33, AttributeId
1.3.18.0.0.2035, AttributeId 1.3.18.0.0.2036, Att
ributeId 1.3.18.0.0.1971, AttributeId 1.3.18.0.0.
2080, AttributeId 2.9.3.2.7.35, AttributeId 2.9.3
.2.7.36, AttributeId 2.9.3.2.7.39)))
```

Note from the example that the class specified is t4Node and that the object instance is NETA;SSCP1A;NCP3AB8. There is no scope or filter specified. The attribute list is specified and contains the following attributes:

- availabilityStatus
- subareaAddress
- subareaLimit
- gatewayNode
- nativeStatus
- operationalState
- proceduralStatus
- usageState

## GET response

When the VTAM topology agent successfully processes a GET request that contains only valid data, the GET response is in the form of a single RORS message. The RORS specifies the object class, object instance, and the list of requested attributes and their values, as they exist when the GET request is processed.

If the real object class is found to be a valid allomorph for the requested object class, then the list of attributes reported in the response is limited to attributes defined in the **requested class**. For example, if requested class is t5Node and an attribute list is not specified in the request, and if the resource is discovered to be an interchangeNode, the GET response includes an object class of interchangeNode, the same object instance name as the request, and the list of attributes defined in the t5Node object class. Attributes of the interchangeNode that are not defined also in the t5Node class are not provided in the response.

If the requested resource is found to be in an object class other than the class specified, and the discovered class is **not** a valid allomorph for the requested class, then the GET response is an ROER error message, with error value of noSuchObjectInstance.

If the naming attribute specified in the object instance name is not valid for the object class specified, the GET response is an ROER, with error value of noSuchObjectInstance. If *actualClass* is specified in the request, and the naming attribute specified in the object instance is not valid for the discovered object class, then the GET response is an ROER error message, with error value of noSuchObjectInstance.

If an attribute list is specified in the GET request, and one of more of the specified attributes are not defined in the requested or discovered class, then the GET response is an ROER, with error value indicating a getListError error. The getListError syntax specifies that each requested attribute be listed in the response, with an indication of whether the attribute is valid or not valid. The valid attributes are then accompanied by their requested values.

If the resource name specified in the object instance of a request is not known to VTAM, the GET response is an ROER message, with error value indicating a noSuchObjectInstance.

Note that it is possible to specify the same attribute multiple times in the attribute list in the GET request. If valid attributes are specified multiple times, the VTAM topology agent ignores the secondary specifications and returns each attribute value only one time in the GET response. If, however, attributes that are not valid are specified multiple times in the GET request, the VTAM topology agent indicates an attribute error in the GET response for each attribute that is not valid.

## GET data

The following shows the major data fields that comprise the GET response:

- object class
- object instance
- attribute list:
  - attribute ID
  - attribute value

## GET data example

The following is an example of the GET response that the VTAM topology agent may return for the GET request example shown previously.

```
msg CMIP-1.RORSapdu (invokeID
  196610, resultOption (operation-value 3, result
    (managedObjectClass 1.3.18.0.0.1844, managedObjec
      tInstance (distinguishedName (RelativeDistinguish
        edName (AttributeValueAssertion (attributeType 1.
          3.18.0.2.4.6, attributeValue "NETA")), RelativeDi
            stinguishedName (AttributeValueAssertion (attribu
              teType 1.3.18.0.0.2032, attributeValue "SSCP1A"))
          ), RelativeDistinguishedName (AttributeValueAssert
            ion (attributeType 1.3.18.0.0.2032, attributeValu
              e "NCP3AB8")))), currentTime "1995/04/24-10:03:50
                .0", attributeList (Attribute (attributeId 2.9.3.
                  2.7.33, attributeValue ()), Attribute (attributeI
                    d 1.3.18.0.0.1971, attributeValue FALSE), Attribu
                      te (attributeId 1.3.18.0.0.2080, attributeValue 0
                        ), Attribute (attributeId 2.9.3.2.7.35, attribute
                          Value enabled), Attribute (attributeId 2.9.3.2.7.
                            36, attributeValue ()), Attribute (attributeId 1.
```

```
3.18.0.0.2035, attributeValue 3), Attribute (attributeId 1.3.18.0.0.2036, attributeValue 255), Attribute (attributeId 2.9.3.2.7.39, attributeValue active))))))
```

Note that the requested attributes were all returned with the following values:

```
availabilityStatus : ()
gatewayNode       : FALSE
nativeStatus      : 0 (means active)
operationalState  : enabled
proceduralStatus  : ()
subareaAddress    : 3
subarealimit      : 255
usageState        : active
```

---

## Requesting specific resource data (logicalUnitIndex)

This section contains the following topics:

- “Overview”
- “Action request”
- “Initial data response” on page 229
- “Action termination” on page 230
- “logicalUnitIndex snapshot data” on page 230
- “logicalUnitIndex snapshot example” on page 231

### Overview

The *logicalUnitIndex* collection object allows a user to request a *snapshot* for all LU-related resources that match a given name.

*logicalUnitIndex* is used to report on LUs, CDRSCs, USERVARs and generic resources, without forcing a manager application program to understand the actual resource class in advance. When a *snapshot* is issued against the *logicalUnitIndex* object, certain information on all resources that match the name supplied by the *snapshot* and that are LUs, CDRSCs, USERVARs or generic resources is returned.

For *logicalUnitIndex*, only the oneTimeOnly *snapshot* action is supported. No update data can be requested or is ever returned for this *snapshot*.

### Action request

A *snapshot* action request is used to request LU-related resource data. The action is sent as an m-Action-Confirmed operation.

The *snapshot* request for *logicalUnitIndex* object can specify whether or not a network search is requested for the target name, in addition to looking for matching resources in the VTAM topology agent host node. The search information is specified in the *snapshot* request through values of a managementExtension with the *luSearchParm* parameter where information is set to 0 for no-search or 1 for search. Without the managementExtension search parameter, the default is not to perform a network search.

The target resource *logicalUnitIndexName* can be network qualified, such as NETA.APPL1.

The following example shows a request with the target name NETA.APPL1, with “no-search” explicitly specified by the 0 value for information in the *luSearchParm* managementExtension.

The following special identifiers are used in the request:

**1.3.18.0.0.2291**

*logicalUnitIndex*

**1.3.18.0.0.2294**

*logicalUnitIndexName*

**1.3.18.0.0.2222**

*snapshot*

**1.3.18.0.0.5946**

*luSearchParm*

```
msg CMIP-1.ROIVapdu (invokeID 196612, operation-value 7,
argument (baseManagedObjectClass 1.3.18.0.0.2291, baseManagedObjectIns
tance (distinguishedName (RelativeDistinguishedName (AttributeValueAss
ertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), Relativ
eDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.
2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeV
alueAssertion (attributeType 1.3.18.0.0.2294, attributeValue "NETA.APPL
1")))), actionInfo (actionType 1.3.18.0.0.2222, actionInfoArg (start o
neTimeOnly, addlInfo (ManagementExtension (identifier 1.3.18.0.0.5946,
significance TRUE, information 0))))))
```

## Initial data response

Several objects can be reported for the target name. For example, any of the following combinations are possible:

- A CDRSC might be found on the local VTAM and the corresponding LU might be found on a remote VTAM.
- Both an LU and a USERVAR of the same name might be found on the local VTAM.
- Different LUs with the same name might be found in different networks.

With the oneTimeOnly action requested, all the data is returned in linked-replies. Then, to indicate that the data for the entire set of LUs has been returned, the VTAM topology agent sends an additional ROIV linked-reply that is an empty set ROIV followed by an RORS response with only the invoke identifier of the original action request.

Table 20. Reported resources for logicalUnitIndex data

Resource	Object class	Notes
Non-SNA terminal	LU	Local terminal
Application	LU	Model ignored
Dependent LU	LU	
CDRSC	CDRSC	Dynamic alias is ignored. Model ignored.
USERVAR	LUgroup	Report USERVAR name and value
Generic resource	LUgroup	Report generic and real members

If no resource is found for the target name in either the VTAM topology agent host or any remote host being searched, the response is an ROER with error value 1 (*noSuchObjectInstance*).

If a search fails because of a normal VTAM failure to have sessions with a remote host, a processingFailure ROER or a linked-reply ROIV with specificErrorInfo of *snaDefinedError* with SNA sense information is sent, possibly after some valid ROIV linked-replies have already been sent for resources found for the target name.

In the following example, an ROER returns SNA sense information because there is no link to the host where the resource was known to be present. (NETAPPL1 has already been reported as a CDRSC owned by SSCP2A).

```
msg CMIP-1.ROERapdu (invokeID 196610, error-value 10
, parameter (managedObjectClass 1.3.18.0.0.2291, managedObjectInstanc
e (distinguishedName (RelativeDistinguishedName (AttributeValueAsserti
on (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeD
istinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2
032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeV
alueAssertion (attributeType 1.3.18.0.0.2294, attributeValue "NETAPPL
1")))), specificErrorInfo (errorId 1.3.18.0.0.2266, errorInfo (senseD
ata 087D0001, productIdentification "ACF/VTAM.4.3.0"))))
```

The translated ROER data follows:

```
error-value           : processingFailure
logicalUnitIndexName : NETA;SSCP1A;NETAPPL1
SpecificErrorInfo
  ErrorID             : snaDefinedError
  ErrorInfo           : senseData 087D0001
                     : productIdentification "ACF/VTAM.4.3.0"
```

## Action termination

The VTAM topology agent terminates a *snapshot* action for the *logicalUnitIndex* object under the following conditions:

- The requested data has been sent.
- An error occurs during *snapshot* processing in VTAM.
- The association that the *snapshot* is using terminates.

## logicalUnitIndex snapshot data

The linked-replies for *logicalUnitIndex* contain data made up of one instance or multiple instances of the following structure:

```
vertex1
  object          LU-related object distinguished name
  class          object class
  states         OSI states for this object
  info
    dependencies          object attribute
    nlrResidentNodePointer object attribute
    luGroupMembers       object attribute
    cdrscRealLuName      object attribute
    userLabel            object attribute
```

The following list describes what each field contains.

### vertex1

Contains all data reported for a single LU-related object.

**class** Monitored LU-related objects are reported under the following object classes:

- logicalUnit
- crossDomainResource
- luGroup (for USERVAR or generic resource)

A remote LU that appears to the VTAM topology agent as a CDRSC is reported as an LU under its owning node if the remote LU is found under that node as a result of a network search.

**states** 14-character string for the following OSI states:

- operationalState
- usageState
- administrativeState
- availabilityStatus
- proceduralStatus
- unknownStatus
- nativeStatus

No states information is returned for luGroup. No states information is returned if the object was found as the result of a network search.

**info** Set of attributes for the LU-related object. The info field and the attributes that follow are not included if the object was found as the result of a network search.

Not all attributes are reported for all object classes or are necessarily reported in the order shown in the above structure. The following chart shows which attributes are possibly reported for an object class.

Table 21. Attributes for logicalUnitIndex reported objects

Attribute	LU	CDRSC	luGroup
<u>dependencies</u>	X	X	
<u>nlrResidentNodePointer</u>		X	
<u>luGroupMembers</u>			X
<u>cdrscRealLuName</u>		X	
<u>userLabel</u>	X	X	

## logicalUnitIndex snapshot example

The following example shows the data response for the target name NETA.APPL1. The example includes vertex1 data for one resource found in SSCP1A.

The following special identifiers are used in the response:

1.3.18.0.0.2291

logicalUnitIndex

1.3.18.0.0.2294

logicalUnitIndexName

1.3.18.0.0.2222

snapshot

### 1.3.18.0.0.2194

#### dependencies

### 0.0.13.3100.0.7.50

#### userLabel

```

msg CMIP-1.R0IVapdu
(invokedID 131077, linked-ID 196612, operation-value 2, argument (actionResult (managedObjectClass 1.3.18.0.0.2291, managedObjectInstance (distinguishedName(RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2294, attributeValue "NETA.APPL1")))), actionReply (actionType 1.3.18.0.0.2222, actionReplyInfo ((vertex1 (object (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.1984, attributeValue "NETA.APPL1")))), class 1.3.18.0.0.1829, states 01000100000000, info (Attribute (attributeId 1.3.18.0.0.2194, attributeValue (dependents (and (DependentS (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2272, attributeValue "APPL1A")))), Dependents (item (distinguishedName (RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.2.4.6, attributeValue "NETA")), RelativeDistinguishedName (AttributeValueAssertion (attributeType 1.3.18.0.0.2032, attributeValue "SSCP1A"))))))))))), Attribute (attributeId 0.0.13.3100.0.7.50, attributeValue "APPL1"))))))))

```

The following translated initial data shows LU NETA.APPL1 was found in SSCP1A (agent host), under application program major node APPL1A:

```

V1: NETA.SSCP1A.NETA.APPL1(LU)
V1: LU expansion

vertex 1 : NETA;SSCP1A;NETA.APPL1
class      : logicalUnit
states
  Operational State : Enabled
  Usage State       : Idle
  Administrative State: Unlocked
  Availability Status : No Status
  Procedural Status  : No Status
  Unknown Status     : False
  Native Status      : Active

info
  userLabel      : APPL1
  dependencies    : NETA;SSCP1A;APPL1A
                  NETA.SSCP1A

```



---

## Part 3. Appendixes





```

#define API_MSG 0 02800000
#define API_REG_ACCEPT 1 02850000
#define API_SVC_COMPLETE 2 02900000
#define API_SVC_ERROR 3 02950000
#define API_TERMINATE_INSTANCE 4 03000000
03050000
/*****/ 03100000
/* The following constants represent the settings of the origin */ 03150000
/* field in the APIhdr structure. */ 03200000
/*****/ 03250000
03300000
#define ORIGIN_OBJ 0 /* The request which initiated 03350000
this message was generated by 03400000
the object which received this 03450000
message. */ 03500000
03550000
#define ORIGIN_REMOTE 1 /* The request which initiated 03600000
this message was generated by 03650000
an object other than the one 03700000
which received this message 03750000
(unless the object generated a 03800000
request to itself). */ 03850000
03900000
/*****/ 03950000
/* The following constants are used for the connection options */ 04000000
/* parameter of MIBConnect. */ 04050000
/*****/ 04100000
04150000
#define NO_CONNECT_OPTIONS 0 04200000
#define SHORT_NAMES 2 04250000
04300000
/*****/ 04350000
/* The following constants represent valid capabilities bits which */ 04400000
/* can be specified in the capabilities parameter of MIBReg(). */ 04450000
/*****/ 04500000
04550000
#define NO_CAPABILITIES 0 /* no special capabilities */ 04600000
04650000
#define SUBTREE_MANAGER 1 /* The object being registered is 04700000
a subtree manager. */ 04750000
04800000
/*****/ 04850000
/* The following constant is used as the value of the name type */ 04900000
/* parameter of MIBSendRegister. */ 04950000
/*****/ 05000000
05050000
#define DN_OF_INSTANCE 0 05100000
05150000
/*****/ 05200000
/* The following constants represent values for the dest type */ 05250000
/* parameter of MIBSendCmipRequest. */ 05300000
/*****/ 05350000
05400000
#define DS_NOT_PROVIDED 0 05450000
#define DS_FULL_DN 1 05500000
#define DS_ASSOC_HANDLE 2 05550000
#define DS_AE_TITLE 3 05600000
05650000
/*****/ 05700000
/* Structures */ 05750000
/*****/ 05800000
05850000
typedef struct APIhdr_tag 05900000
{ 05950000
    unsigned char msg_type; 06000000
    unsigned char api_version; 06050000
    unsigned char origin; 06100000
}

```

```

unsigned char RESERVED1;          /* Applications must not use or    06150000
                                   depend on the value of this      06200000
                                   field in any way.                */ 06250000

unsigned int invokeId;            06300000
unsigned int connectId;          06350000
unsigned int numLocalIds;        06400000
time_t timestamp;                06450000
unsigned short resultCode;        06500000
unsigned char RESERVED2??(???); /* Applications must not use or    06550000
                                   depend on the value of this      06600000
                                   field in any way.                */ 06650000

unsigned int RESERVED3;          /* Applications must not use or    06700000
                                   depend on the value of this      06750000
                                   field in any way.                */ 06800000

unsigned char localIds??(8??);   06850000
} APIHdr;                          06900000
                                   06950000

/*****/ 07000000
/* The following structures are used by CMIP applications using */ 07050000
/* Data Spaces: */ 07100000
/* (1) DataSpaceVector Format (ISTRIV10_t) */ 07150000
/* (2) Interface Control Block (ISTNMICB_t) */ 07200000
/*****/ 07250000

typedef struct ISTRIV10_tag        07300000
{
char RIV10LEN;                    /* VECTOR LENGTH */ 07400000
char RIV10KEY;                    /* VECTOR KEY */ 07450000
char RIV10DSN??(8??);            /* DATA SPACE NAME */ 07500000
char RIV10NMI??(4??);            /* ADDRESS OF ISTNMICB IN DATA
                                   SPACE STORAGE */ 07550000
char RIV10STK??(8??);            /* STOKEN OF DATA SPACE */ 07600000
char reserved1??(4??);           /* reserved - not available */ 07650000
char RIV10CDQ??(4??);            /* Address of Dequeue Routine */ 07700000
char RIV10CRL??(4??);            /* Address of Release Routine */ 07750000
char reserved2??(8??);           /* reserved */ 07800000
} ISTRIV10_t;                      07850000
                                   07900000
                                   07950000

typedef struct ISTNMICB_tag        08000000
{
char reserved1??(4??);           /* reserved - not available */ 08050000
void *NMIPDCDQ;                  /* Address of Dequeue Routine */ 08100000
void *NMIPCRL;                   /* Address of Release Routine */ 08150000
} ISTNMICB_t;                      08200000
                                   08250000
                                   08300000
                                   08350000

/*****/ 08400000
/* The following macro can be used to calculate the size of a given */ 08450000
/* APIHdr (including any local identifiers present). */ 08500000
/*****/ 08550000
                                   08600000
#define APIHdrSize(x,size)        \
((char *)&(x).localIds) - (char *)&(x) + \
(size) * (x).numLocalIds)        08650000
                                   08700000
                                   08750000
                                   08800000

/*****/ 08850000
/* The following type definitions are provided so that the C */ 08900000
/* compiler can perform type checking on the MIB API calls. The */ 08950000
/* address of each MIB API routine should be given one of the */ 09000000
/* following types. */ 09050000
/*****/ 09100000
                                   09150000

typedef int MIBConnect_t(         09200000
unsigned int,                    /* API level */ 09250000
int *,                          /* link id */ 09300000
unsigned int,                   /* max outstanding invoke
ids */ 09350000
const char *,                   /* application name */ 09400000
                                   09450000

```

```

void *, /* TPEND exit */ 09500000
void *, /* read queue exit */ 09550000
unsigned int *, /* SMAE name buffer size */ 09600000
char *, /* SMAE name buffer */ 09650000
unsigned int *, /* System Object name buffer
size */ 09700000
char *, /* System Object name */ 09800000
int, /* user data field */ 09850000
unsigned int *, /* error flag */ 09900000
char **, /* VTAM release level */ 09950000
const char *, /* password */ 10000000
unsigned int, /* length of DS vector */ 10050000
ISTRIV10_t *, /* DS vector */ 10100000
unsigned int, /* local identifier length */ 10150000
unsigned int); /* connection options */ 10200000
10250000
#pragma linkage(MIBConnect_t,OS) 10300000
10350000
typedef int MIBDisconnect_t( 10400000
int, /* link id */ 10450000
unsigned int *); /* return error flag */ 10500000
10550000
#pragma linkage(MIBDisconnect_t,OS) 10600000
10650000
typedef int MIBSendRegister_t( 10700000
int, /* link id */ 10750000
unsigned int *, /* returned invoke id */ 10800000
const void *, /* local id */ 10850000
const char *, /* object class */ 10900000
int, /* name type */ 10950000
const char *, /* distinguished name */ 11000000
const char *, /* name binding oid */ 11050000
unsigned int, /* capability flags */ 11100000
unsigned int, /* allomorphs count */ 11150000
char **, /* allomorphs array */ 11200000
unsigned int, /* create handlers count */ 11250000
char **); /* create handlers array */ 11300000
11350000
#pragma linkage(MIBSendRegister_t,OS) 11400000
11450000
typedef int MIBSendDeleteRegistration_t( 11500000
int, /* link id */ 11550000
unsigned int *, /* returned invoke id */ 11600000
const void *, /* local identifier */ 11650000
const char *); /* DN */ 11700000
11750000
#pragma linkage(MIBSendDeleteRegistration_t,OS) 11800000
11850000
typedef int MIBSendRequest_t( 11900000
int, /* link id */ 11950000
unsigned int *, /* returned invoke id */ 12000000
const void *, /* local identifier */ 12050000
const char *); /* message */ 12100000
12150000
#pragma linkage(MIBSendRequest_t,OS) 12200000
12250000
typedef int MIBSendResponse_t( 12300000
int, /* link id */ 12350000
unsigned int, /* invoke id */ 12400000
const void *, /* local identifier */ 12450000
const char *, /* source */ 12500000
const char *, /* dest association handle */ 12550000
const char *); /* message */ 12600000
12650000
#pragma linkage(MIBSendResponse_t,OS) 12700000
12750000
typedef int MIBSendCmpipRequest_t( 12800000

```

```

        int,                /* link id                */ 12850000
        unsigned int,       /* argument type          */ 12900000
        const char *,       /* argument                */ 12950000
        const void *,       /* local identifier       */ 13000000
        const char *,       /* source                  */ 13050000
        unsigned int,       /* type of destination    */ 13100000
        const char *,       /* destination             */ 13150000
        unsigned int *);    /* returned invoke id     */ 13200000
13250000
#pragma linkage(MIBSendCmipRequest_t,OS) 13300000
13350000
typedef int MIBSendCmipResponse_t(
        int,                /* link id                */ 13450000
        unsigned int,       /* invoke id              */ 13500000
        unsigned int,       /* last in chain?        */ 13550000
        unsigned int,       /* success?               */ 13600000
        unsigned int,       /* argument type          */ 13650000
        const char *,       /* argument                */ 13700000
        const void *,       /* local identifier       */ 13750000
        const char *,       /* source                  */ 13800000
        const char *,       /* dest association handle */ 13850000
        unsigned int *);    /* returned invoke id     */ 13900000
13950000
#pragma linkage(MIBSendCmipResponse_t,OS) 14000000
14050000
/*****/ 14100000
/* The following constants are for the synchronous return codes */ 14150000
/* which may be received from one of the MIB API routines or via */ 14200000
/* an API_SVC_ERROR message from CMIP Services.                  */ 14250000
/*****/ 14300000
14350000
#define MB_ERR_ALLOC 7 14400000
#define MB_ERR_MAX_OUTSTANDING 932 14450000
14500000
/*****/ 14700000
/* The following constants are for the synchronous return codes */ 14750000
/* which may be received only from one of the MIB API routines. */ 14800000
/*****/ 14850000
14900000
#define MB_ERR_INVALID_LINK_ID 918 14946800
#define MB_ERR_NOT_REGISTERED 920 14993600
#define MB_ERR_CONNECT 945 15040400
#define MB_WARN_DATA_SPACE_FULL 1000 15087200
#define MB_WARN_EXIT_FAILURE 1001 15134000
#define MB_DATA_ON_DATA_SPACE 1002 15180800
#define MB_ERR_INVALID_ENVIRONMENT 1003 15227600
#define MB_ERR_INVALID_ARGUMENT 1004 15274400
#define MB_ERR_INVALID_ARGUMENT_TYPE 1005 15321200
#define MB_ERR_INVALID_ASSOC_HANDLE 1006 15368000
#define MB_ERR_INVALID_SMAE_NAME 1007 15414800
#define MB_ERR_CMIP_SERVICES_INACTIVE 1008 15461600
#define MB_ERR_INVALID_DS_VECTOR 1009 15508400
#define MB_ERR_INVALID_DEST_TYPE 1010 15555200
#define MB_ERR_INVALID_DIST_NAME 1011 15602000
#define MB_ERR_INVALID_MAX_INVOKE_IDS 1012 15648800
#define MB_ERR_INVALID_API_LEVEL 1013 15695600
#define MB_ERR_INVALID_APPL_NAME 1014 15742400
#define MB_ERR_INVALID_DS_VECTOR_SIZE 1015 15789200
#define MB_ERR_INVALID_SMAE_NAME_SIZE 1016 15836000
#define MB_ERR_INVALID_INVOKE_ID 1017 15882800
#define MB_ERR_MIBDISCONNECT 1018 15929600
#define MB_ERR_INVALID_MSG 1019 15976400
#define MB_ERR_INVALID_OBJECT_CLASS 1020 16023200
#define MB_ERR_INVALID_READ_QUEUE_EXIT 1021 16070000
#define MB_ERR_INVALID_SYSTEM_NAME_SIZE 1022 16116800
#define MB_ERR_INVALID_LOCAL_ID_SIZE 1023 16163600
#define MB_ERR_TRANSMIT 1024 16210400

```

```

#define MB_ERR_VTAM_INACTIVE 1025 16257200
#define MB_ERR_INVALID_USER_DATA 1026 16304000
#define MB_ERR_INVALID_ERROR_FLAG 1027 16350800
#define MB_ERR_INVALID_RELEASE_LEVEL 1028 16397600
#define MB_ERR_INVALID_PASSWORD 1029 16444400
#define MB_ERR_INVALID_CAPABILITY_FLAGS 1030 16491200
#define MB_ERR_INVALID_TPEND_EXIT 1031 16538000
#define MB_ERR_INVALID_LAST_IN_CHAIN_FLAG 1032 16584800
#define MB_ERR_INVALID_SUCCESS_FLAG 1033 16631600
#define MB_ERR_INVALID_SYSTEM_NAME 1034 16678400
#define MB_ERR_INVALID_CONNECT_OPTIONS 1035 16725200
#define MB_ERR_INVALID_NAME_TYPE 1036 16772000
#define MB_ERR_INVALID_NAME_BINDING 1037 16818800
#define MB_ERR_INVALID_ALLOMORPHS_COUNT 1038 16865600
#define MB_ERR_INVALID_ALLOMORPHS_ARRAY 1039 16912400
#define MB_ERR_INVALID_CREATE_HANDLERS_COUNT 1040 16959200
#define MB_ERR_INVALID_CREATE_HANDLERS_ARRAY 1041 17006000
#define MB_ERR_INVALID_LOCAL_ID 1042 17052800
#define MB_ERR_INVALID_DEST 1043 17099600
17150000
/*****/ 17200000
/* The following return codes are returned from CMIP Services only */ 17250000
/* via API_SVC_ERROR messages. */ 17300000
/*****/ 17350000
17400000
#define PROGRAM_CHECK 8 17433300
17466600
#define AUTHENTICATION_FAILED 250 17499900
#define AUTHENTICATION_INFO_MISSING 251 17533200
#define AUTHENTICATION_MECH_UNKNOWN 252 17566500
17600000
#define BER_BAD_TYPE 300 17650000
#define BER_BAD_MODULE 301 17700000
#define BER_NULL_TYPE 302 17750000
#define BER_NULL_MODULE 303 17800000
#define BER_NULL_STRING 304 17850000
#define BER_NULL_STRUCT 305 17900000
#define BER_BAD_METATABLE 306 17950000
#define BER_UNKNOWN_TYPE 307 18000000
#define BER_UNKNOWN_MEMBER 308 18050000
#define BER_UNKNOWN_ALTERNATIVE 309 18100000
#define BER_NO_END_PARENTHESIS 310 18150000
#define BER_NO_START_PARENTHESIS 311 18200000
#define BER_NO_MORE_STRING 312 18250000
#define BER_PARSE_ERROR 313 18300000
#define BER_IMPLICIT_CHOICE 314 18350000
#define BER_CANNOT_RESOLVE 315 18400000
#define BER_NEED_LABEL 316 18450000
#define BER_MISSING_MEMBER 317 18500000
#define BER_NO_PARENT 319 18550000
#define BER_BAD_DN_PARSE 320 18600000
#define BER_BAD_RESOLUTION_NODE 321 18650000
#define BER_MISSING_RESOLUTION_NODE 322 18700000
#define BER_LABEL_MISMATCH 323 18750000
#define BER_NOT_BOOLEAN 325 18800000
#define BER_NOT_INTEGER 326 18850000
#define BER_NOT_REAL 327 18900000
#define BER_NOT_NULL 328 18950000
#define BER_NOT_BIT_STRING 329 19000000
#define BER_NOT_HEX_STRING 330 19050000
#define BER_BAD_HEX_STRING 331 19100000
#define BER_NOT_OI 332 19150000
#define BER_BAD_TIME 333 19200000
#define BER_BAD_ENUMERATED 334 19250000
#define BER_BAD_PRINTABLE_STRING 335 19300000
#define BER_BAD_NUMERIC_STRING 336 19350000
#define BER_BAD_VISIBLE_STRING 337 19400000

```



```

#define BER_BAD_GRAPHIC_STRING          338          19450000
#define BER_BAD_GENERAL_STRING          339          19500000
#define BER_BAD_IA5_STRING               340          19550000
#define BER_DUPLICATE_MEMBER            341          19600000
#define BER_CANT_DO_REAL                 342          19650000
#define BER_NOT_STRAIGHT_BER            343          19700000
#define BER_UNRESOLVED_EXTERNAL         344          19750000
#define BER_STILL_MORE_STRING           345          19800000
#define BER_DUP_MODULE                   347          19850000
#define BER_UNRESOLVED_MODULE_REF       348          19900000
#define BER_UNRESOLVED_REF              349          19950000
#define BER_FAILED_SUBTYPE              354          20000000
#define BER_BAD_CONSTRUCTED             356          20050000
#define BER_BAD_PRIMITIVE               357          20100000
#define BER_BAD_INITIAL_OCTET           358          20150000
#define BER_BAD_BOOLEAN                 359          20200000
#define BER_BAD_OI                      360          20250000
#define BER_BAD_NULL                    361          20300000
#define BER_BAD_PARAMETERS               363          20400000
#define BER_EMPTY_BIT_STRING            364          20450000
                                           20800000
#define RDN_SEP_AT_BEGIN_OF_DN          375          20847600
#define AVA_SEP_AT_BEGIN_OF_DN          376          20895200
#define SPACE_AT_BEGIN_OF_DN            377          20942800
#define INVALID_CHAR_AT_BEGIN_OF_DN     378          20990400
#define RDN_SEP_AT_BEGIN_OF_RDN         379          21038000
#define AVA_SEP_AT_BEGIN_OF_RDN         380          21085600
#define SPACE_AT_BEGIN_OF_RDN           381          21133200
#define INVALID_CHAR_AT_BEGIN_OF_RDN    382          21180800
#define INVALID_ALPHA_IN_INTEGER_VALUE  383          21228400
#define INVALID_SPACE_IN_INTEGER_VALUE  384          21276000
#define INVALID_CHAR_IN_INTEGER_VALUE   385          21323600
#define INVALID_SPACE_IN_OI_VALUE        386          21371200
#define INVALID_CHAR_IN_OI_VALUE         387          21418800
#define INVALID_SPACE_IN_SYMBOLIC_VALUE  388          21466400
#define INVALID_CHAR_IN_SYMBOLIC_VALUE  389          21514000
#define INVALID_CHAR_IN_ATTR_VALUE       390          21561600
#define INVALID_SPACE_IN_ATTR_VALUE      391          21609200
#define PREMATURE_END_OF_DN              392          21656800
#define INVALID_SPACE_AT_END_OF_RDN     393          21704400
#define BOTH_QUOTE_TYPES_USED            394          21752000
                                           21800000
#define REPL_ERR_INVLD_VERBCODE          400          21850000
#define REPL_ERR_MISSING_ASN1_TREE      401          21900000
#define REPL_ERR_OBJCLASS_MISSING        402          21950000
#define REPL_ERR_OBJCLASS_INVALID        403          22000000
#define REPL_ERR_OBJINST_MISSING         404          22050000
#define REPL_ERR_OBJINST_INVALID        405          22100000
#define REPL_ERR_DUPLICATE_OBJINST      406          22150000
#define REPL_ERR_NO_SUCH_OBJINST         407          22200000
#define REPL_ERR_MOI_OC_MISMATCH         408          22250000
#define REPL_ERR_NAME_CREATE_FAILED      409          22300000
#define REPL_ERR_GDMO_FILE_BAD_VERS     410          22350000
#define REPL_ERR_NOTHING_TO_DELETE      411          22400000
#define REPL_WRN_OBJCLASS                412          22450000
#define REPL_ERR_ALREADY_AN_STM          413          22500000
#define REPL_ERR_INVLD_STM_CHILD         414          22550000
#define REPL_ERR_SCOPES_TO_NOTHING       415          22600000
#define REPL_ERR_INVALID_SCOPE           416          22650000
#define REPL_ERR_COMMITDN_NOTIN_LIST    417          22700000
#define REPL_ERR_NO_ONE_2_SEND_CRT_2    419          22750000
#define REPL_ERR_NOONE_2_SEND_EVNT_2    420          22800000
#define REPL_ERR_ALREADY_EVNT_HNDLR     421          22850000
#define REPL_ERR_NAMEBIND_INVALID        422          22900000
#define REPL_ERR_CRT_FAIL_NB             424          22950000
#define REPL_ERR_CRT_FAIL_NO_NB         425          23000000
#define REPL_ERR_DLT_FAIL_CONTOBJS      426          23050000

```

```

#define REPL_ERR_DLT_FAIL_TO_DCO 427 23100000
#define REPL_ERR_DLT_FAIL_NB 428 23150000
#define REPL_ERR_NO_LOCALDN 429 23200000
#define REPL_ERR_DUPLICATE_LDNH 430 23250000
#define REPL_REG_CREATED 431 23300000
#define REPL_REG_COMPLETED 432 23350000
#define REPL_REG_COMPLETED 433 23400000
#define REPL_REG_SUSPENDED 434 23450000
#define REPL_ERR_ATTRTYPE_MISMATCH 435 23500000
#define REPL_ERR_CANNOT_CHANGE_NB 436 23550000
#define REPL_ERR_BULK_HAD_PROBLEMS 438 23600000
#define REPL_ERR_NB_DISALLOWS_NEWOC 439 23650000
#define REPL_ERR_SYNC_NOT_SUPPORTED 440 23700000
23800000
#define CRC_ERR_INVLD_VERBCODE 500 23836300
#define CRC_ERR_INVLD_SESSHAND 501 23872600
#define CRC_ERR_INVLD_INVOKEID 502 23908900
#define CRC_ERR_DPLCT_INVOKEID 503 23945200
#define CRC_ERR_INVLD_LINKEDID 504 23981500
#define CRC_ERR_UNABLE_TO_BUILD_MSG 505 24017800
#define CRC_ERR_INVLD_ROERRJ_RCVD 506 24054100
#define CRC_ERR_INVLD_CANCELGET 507 24090400
#define CRC_ERR_INVLD_INVOKEID_ON_CANCELGET 508 24126700
#define CRC_DELETE_RORJ_RECEIVED 509 24163000
24200000
#define SSERR_STATE_INVALID 550 24250000
#define SSERR_SPDU_INVALID 551 24300000
#define SSERR_MISSING_PI 552 24350000
#define SSERR_MISSING_UI 553 24400000
#define SSERR_VERB_INVALID 554 24450000
#define SSERR_INVALID_SUR 556 24500000
#define SSERR_USERDATA_SIZE 557 24550000
#define SSERR_TDISC_UNSPECIFIED 558 24600000
#define SSERR_TDISC_CONGESTED 559 24650000
#define SSERR_TDISC_UNATTACHED 560 24700000
#define SSERR_TDISC_ADDRESS 561 24750000
#define SSERR_VERSION 562 24800000
#define SSERR_PARTNER_ABORT 563 24850000
#define SSERR_ENCLOSURE_ITEM 564 24900000
25000000
#define MD_ERR_BAD_MDSMU 568 25050000
#define MD_ERR_SNACR_BEING_SENT 573 25100000
#define MD_ERR_SNACR_RECEIVED 574 25150000
25200000
#define SSERR_GIVE_TOKEN_NO_DATA 578 25250000
#define SSERR_DUPLICATE 581 25300000
25750000
#define ACF_EVENT_LOOP 802 25789300
#define ACF_INVALID_ASSOC_ID 803 25828600
#define ACF_INVALID_PARAMETERS 804 25867900
#define ACF_INVALID_USER_ID 806 25907200
#define ACF_RSP_BUILD_SEND_FAILED 807 25946500
#define ACF_ERR_KILL_LOC_ASSOC 808 25985800
#define ACF_UNSUPPORTED_VERB 809 26025100
#define ACF_INVALID_DEST_FORMAT 810 26064400
#define ACF_BAD_AE_TITLE_FORMAT 812 26103700
#define ACF_CANNOT_FIND_INST 814 26143000
#define ACF_NO_DESTINATION 815 26182300
#define ACF_NO_ASSOC_TEMP 817 26221600
#define ACF_MSG_REJECTED 818 26260900
#define ACF_EMPTY_DEF_LIST_RESULT 819 26300200
#define ACF_QUEUED_MESSAGE 823 26339500
#define ACF_ASSOC_ID_WRAP 824 26378800
#define ACF_AUTO_ASSOC_TEARDOWN_TERM 825 26418100
#define ACF_TOO_MANY_LOCAL ASSOCS 826 26457400
#define ACF_DUPLICATE_AE 827 26496700
#define ACF_REMOTE_AE 828 26536000

```

```

#define ACF_INVALID_STATE_TO_RELEASE      829      26575300
#define ACF_INVALID_AE                    830      26614600
#define ACF_BAD_P_MODE                    831      26653900
#define ACF_BAD_P_PROTOCOL_VERSION        832      26693200
#define ACF_BAD_CMIP_VERSION              833      26732500
#define ACF_BAD_APPL_CONTEXT              834      26771800
#define ACF_NO_APPL_CONTEXT               835      26811100
#define ACF_NO_APPL_INFO                  836      26850400
#define ACF_BAD_DEF_LIST                  837      26889700
#define ACF_WRONG_AE_TITLE                838      26929000
#define ACF_ALREADY_CONFIRMED             839      26968300
#define ACF_NO_AE_QUALIFIER               840      27007600
                                           27050000

#define MB_ERR_PROCFAIL_NOT_OPTIONAL      900      27100000
#define MB_ERR_COMPXLIM_NOT_OPTIONAL     901      27150000
#define MB_ERR_INVALID_TYPENAME          903      27200000
#define MB_ERR_NOT_CONNECTED             904      27250000
#define MB_ERR_WRONG_LENGTH              906      27300000
#define MB_ERR_INVALID_API_TAG           907      27350000
#define MB_ERR_MISSING_API_TAG           909      27400000
#define MB_ERR_UNSUPPORTED_MSG_TYPE      913      27450000
#define MB_ERR_DELETE_PROTOCOL_ERROR     914      27500000
#define MB_ERR_DUPLICATE_TAGS            915      27550000
#define MB_ERR_CONNECTION_CONFLICT       916      27600000
#define MB_ERR_HEADER_NOT_PRESENT        917      27650000
#define MB_ERR_INVALID_STATE             919      27700000
#define MB_ERR_CMIP_ERR_RESP_ILLEGAL     921      27750000
#define MB_ERR_CMIP_ERR_RESP_STKCHK     922      27800000
#define MB_TRY_XMIT_RESP                 923      27850000
#define MB_ERR_LOST_CONNECTION           925      27900000
#define MB_ERR_INVALID_NUMLOCALIDS       926      27950000
#define MB_ERR_MISSING_LOCAL_ID          928      28000000
#define MB_ERR_LOCAL_ID_ALREADY_REGISTERED 929      28050000
#define MB_ERR_INVALID_MSG_TYPE          930      28150000
#define MB_ERR_SOURCE_NOT_IN_SUBTREE     931      28200000
#define MB_ERR_CMIP_ERR_NOT_STM          933      28250000
#define MB_ERR_NOT_SUBTREE_MGR           934      28300000
#define MB_ERR_DIDNT_USE_AMPER_IID       935      28350000
#define MB_ERR_CMIP_ERR_NOTASROIV        936      28400000
#define MB_ERR_INVALID_MSG_FORMAT        937      28450000
#define MB_ERR_EMPTY_ROIV_INVALID        938      28500000
#define MB_ERR_INVALID_RESP              939      28550000
#define MB_ERR_CANCELGET_RESP_INVALID    941      28600000
                                           28650000

#define HDR_SYNTAX_ERROR                  952      28700000
#define INVALID_HDR_DEST_TYPE             953      28750000
#define INVALID_HDR_SRC_TYPE             954      28800000
#define UNRECOGNIZED_HDR_LABEL           955      28850000
#define KEY_IS_NULL                       956      28900000
#define KEY_NOT_FOUND                     957      28950000
#define MIB_VAR_NOT_LOADED                958      29000000
                                           29100000

#define LABV_END_QUOTE_NOT_FOUND          961      29150000
#define LABV_NULL_VALUE                   962      29200000
#define LABV_INVALID_CHAR_IN_VALUE        963      29250000
#define LABV_INVALID_GROUP_DELIMITER     964      29300000
#define LABV_EMPTY_STRING                 965      29350000
                                           29400000

#endif                                     /* ifndef ACYAPHDH_INCLUDED */ 29450000

```





```

--          Joint-iso-ccitt 9 0 1 1
SMASEUserData ::= SEQUENCE
{smfuPackages SET OF FunctionalUnitPackage OPTIONAL,
-- shall be present on request/indication if SMFU
-- negotiation is proposed and on response/confirm if it
-- is accepted, otherwise it shall be omitted
reason Reason OPTIONAL,
-- may only be present on the response/confirm.
-- When SMFU negotiation fails
--           results in a reduction of proposed SMFUs
--           or the association request is rejected
-- this parameter may carry a reason for this
systemsManagementUserInformation GraphicString OPTIONAL
-- a text bucket for implementations to use to distinguish
-- between different implementation environments.
-- not subject to conformance test.
}

Reason ::= INTEGER
{smfusNotSupported      (0),
-- one or more of the proposed SMFUS is not supported
smfuCombinationNotSupported (1),
-- the individual SMFUS are supported, but not in the
-- proposed combination on a single association
smfusRequiredNotAvailable (2),
-- one or more required SMFUS have been negotiated away
smfuNegotiationRefused    (3)
-- responder refuses to negotiate SMFUS without saying why
}

FunctionalUnitPackage ::= SEQUENCE
{functionUnitPackageId FunctionalUnitPackageId,
managerRoleFunctionalUnit [0] IMPLICIT BIT STRING DEFAULT {},
-- if not present implies role not supported for this functional unit package
agentRoleFunctionalUnit [1] IMPLICIT BIT STRING DEFAULT {}
-- if not present implies role not supported for this functional unit package
}

FunctionalUnitPackageId ::= OBJECT IDENTIFIER
-- the values for the functionalUnitPackageId are
-- joint-iso-ccitt 9 2 X 1 where x is the defined by the standard (likely equal to the 10164-x)
-- so far, this is the case.

-- Request
-- (smfuPackages ((2.9.2.1.1,managerRoleFunctionalUnit 1111, agentRoleFunctionalUnit 1111),
--               (2.9.2.2.1, managerRoleFunctionalUnit 1, agentRoleFunctionalUnit 1),
--               (2.9.2.3.1, managerRoleFunctionalUnit 1, agentRoleFunctionalUnit 1),
--               (2.9.2.4.1, managerRoleFunctionalUnit 1, agentRoleFunctionalUnit 1),
--               (2.9.2.5.1, managerRoleFunctionalUnit 11, agentRoleFunctionalUnit 11),
--               (2.9.2.6.1, managerRoleFunctionalUnit 00, agentRoleFunctionalUnit 00) -- -- NO LOGGING
--             )
-- )
-- response

-- (smfuPackages ((2.9.2.1.1,managerRoleFunctionalUnit (1111), agentRoleFunctionalUnit ()),
--               (2.9.2.2.1, managerRoleFunctionalUnit (1), agentRoleFunctionalUnit ()),
--               (2.9.2.3.1, managerRoleFunctionalUnit (1), agentRoleFunctionalUnit ()),
--               (2.9.2.4.1, managerRoleFunctionalUnit (1), agentRoleFunctionalUnit ()),
--               (2.9.2.5.1, managerRoleFunctionalUnit (11), agentRoleFunctionalUnit ()),
--               (2.9.2.6.1, managerRoleFunctionalUnit (00), agentRoleFunctionalUnit ()), -- -- NO LOGGING
--             ),
--           reason 0
-- )
END

-- Rose defines its ASE id to be joint-iso-ccitt 4 3
-- BER is joint-iso-ccitt 1 1 for the transfer syntax. this will always be used.

CMIP-A-ASSOCIATE-Information {joint-iso-ccitt ms(9) cmip(1) modules(0)aAssociateUserInfo(1)}
DEFINITIONS ::= BEGIN
--EXPORTS everything

FunctionalUnits ::= BIT STRING --+ VL-NAME = CMIS-Functional-Units
{ multipleObjectSelection (0)
--+ ELEM-NAME = multiple-Object-Selection
--+ H-ELEM-NAME = "MP_T_FU_MULTIPLE_FUNCTIONAL_UNITS"
--+ H-ELEM-ID = 4
,
filter (1)
--+ ELEM-NAME = filter
--+ H-ELEM-NAME = "MP_T_FU_FILTER"
--+ H-ELEM-ID = 2
,
multipleReply (2)
--+ ELEM-NAME = multiple-Reply
--+ H-ELEM-NAME = "MP_T_FU_MULTIPLE_REPLY"
--+ H-ELEM-ID = 16
,
extendedService (3)
--+ ELEM-NAME = extended-Service

```

```

        --+ H-ELEM-NAME = "MP_T_FU_EXTENDED_SERVICE"
        --+ H-ELEM-ID = 8
    },
    cancelGet (4)
    --+ ELEM-NAME = cancel-Get
    --+ H-ELEM-NAME = "MP_T_FU_CANCEL_GET"
    --+ H-ELEM-ID = 1
}

-- Functional unit i is supported if and only if bit i is one.
-- information carried in user-information parameter of A-ASSOCIATE

CMIPUserInfo ::= SEQUENCE {
    protocolVersion [0] IMPLICIT ProtocolVersion DEFAULT { version1 },
    functionalUnits [1] IMPLICIT FunctionalUnits DEFAULT {},
    accessControl [2] EXTERNAL OPTIONAL,
    userInfo [3] EXTERNAL OPTIONAL }

ProtocolVersion ::= BIT STRING {
    version1 (0),
    version2 (1) }

END

CMIP-A-ABORT-Information {joint-iso-ccitt ms(9) cmip(1) modules(0)aAbortUserInfo(2)}
DEFINITIONS ::= BEGIN

-- information carried in user-information parameter of A-ABORT

CMIPAbortInfo ::= SEQUENCE {
    abortSource [0] IMPLICIT CMIPAbortSource,
    userInfo [1] EXTERNAL OPTIONAL }

CMIPAbortSource ::= ENUMERATED {
    cmiseServiceUser (0),
    cmiseServiceProvider (1) }

END

CMIP-1 {joint-iso-ccitt ms(9) cmip(1) modules(0) protocol(3)}
DEFINITIONS ::= BEGIN

-- The IMPORTS statement was removed to allow compilation without ROSE.asn
-- IMPORTS InvokeIDType, Operation, Error
-- FROM Remote-Operations-APDUs ;
-- EXPORTS everything

-- Directory Service definitions
IMPORTS RDNSequence, DistinguishedName
FROM InformationFramework {joint-iso-ccitt ds(5) modules(1) informationFramework(1)};

-- EXPORTS DistinguishedName, RDN;

-- added to allow compilation of the CMP file without ROSE
-- and without the rose macros.
InvokeIDType ::= INTEGER
Operation ::= INTEGER
Error ::= INTEGER

-- ADDED to allow extern information for access control
ExternDefault ::= [UNIVERSAL 8] IMPLICIT SEQUENCE {
    direct-reference OBJECT IDENTIFIER OPTIONAL,
    indirect-reference INTEGER OPTIONAL,
    encoding CHOICE {
        single-ASN1-type [0] ANY,
        octet-aligned [1] IMPLICIT OCTET STRING,
        arbitrary [2] IMPLICIT BIT STRING
    }
}

-- Added to allow the missingAttributeValue error syntax to be resolved
-- The parameter template says SET OF AttributeId - not a very friendly type.
AttributeIds ::= SET OF AttributeId

ROSEapdus ::= CHOICE {
    roiv-apdu [1] IMPLICIT ROIVapdu,
    rors-apdu [2] IMPLICIT RORSapdu,
    roer-apdu [3] IMPLICIT ROERapdu,
    rorj-apdu [4] IMPLICIT RORJapdu
}

ROIVapdu ::= [1] IMPLICIT SEQUENCE
{
    invokeID InvokeIDType,
    linked-ID [0] IMPLICIT InvokeIDType OPTIONAL,
    operation-value Operation,
    argument ANY DEFINED BY operation-value --% ANY_TABLE_REF(Operations) %-- OPTIONAL
}

```

```

--% Operations ANY_TABLE ::=
--% {
--%   m-EventReport          EventReportArgument,
--%   m-EventReport-Confirmed EventReportArgument,
--%   m-Linked-Reply         LinkedReplyArgument,
--%   m-Get                  GetArgument,
--%   m-Set                  SetArgument,
--%   m-Set-Confirmed        SetArgument,
--%   m-Action               ActionArgument,
--%   m-Action-Confirmed     ActionArgument,
--%   m-Create               CreateArgument,
--%   m-Delete               DeleteArgument,
--%   m-CancelGet            InvokeIDType
--% }

m-EventReport          Operation ::= 0
m-EventReport-Confirmed Operation ::= 1
m-Linked-Reply         Operation ::= 2
m-Get                  Operation ::= 3
m-Set                  Operation ::= 4
m-Set-Confirmed        Operation ::= 5
m-Action               Operation ::= 6
m-Action-Confirmed     Operation ::= 7
m-Create               Operation ::= 8
m-Delete               Operation ::= 9
m-CancelGet            Operation ::= 10

RORSapdu ::= [2] IMPLICIT SEQUENCE
  {invokeID      InvokeIDType,
   resultOption SEQUENCE
   {operation-value Operation,
    result          ANY DEFINED BY operation-value --% ANY_TABLE_REF(Results)
   } OPTIONAL
  }

-- Note that m-CancelGet is not included in the list. This message does not
-- have an associated parameter and should only be responded to with an invokeID
--% Results ANY_TABLE ::=
--% {
--%   m-Action-Confirmed   ActionResult,
--%   m-Create             CreateResult,
--%   m-Delete             DeleteResult,
--%   m-EventReport-Confirmed EventReportResult,
--%   m-Get                GetResult,
--%   m-Set-Confirmed      SetResult
--% }

ROERapdu ::= [3] IMPLICIT SEQUENCE
  {invokeID      InvokeIDType,
   error-value   Error,
   parameter     ANY DEFINED BY error-value --% ANY_TABLE_REF(Errors) %-- OPTIONAL
  }

-- Note that the errors accessDenied, mistypedOperation and operationCancelled
-- are not included in the following list. These errors do not have information
-- associated with them so the 'parameter' field should never be present.
--% Errors ANY_TABLE ::=
--% {
--%   classInstanceConflict   BaseManagedObjectId,
--%   complexityLimitation    ComplexityLimitation,
--%   duplicateManagedObjectInstance ObjectInstance,
--%   getListError            GetListError,
--%   invalidArgumentValue    InvalidArgumentValue,
--%   invalidAttributeValue   Attribute,
--%   invalidFilter            CMISFilter,
--%   invalidObjectInstance   ObjectInstance,
--%   invalidScope            Scope,
--%   missingAttributeValue   AttributeIds,
--%   noSuchAction            NoSuchAction,
--%   noSuchArgument          NoSuchArgument,
--%   noSuchAttribute         AttributeId,
--%   noSuchEventType        NoSuchEventType,
--%   noSuchInvokeId         InvokeIDType,
--%   noSuchObjectClass       ObjectClass,
--%   noSuchObjectInstance    ObjectInstance,
--%   noSuchReferenceObject   ObjectInstance,
--%   processingFailure       ProcessingFailure,
--%   setListError            SetListError,
--%   syncNotSupported        CMISSync
--% }

accessDenied           Error ::= 2
classInstanceConflict  Error ::= 19
complexityLimitation   Error ::= 20
duplicateManagedObjectInstance Error ::= 11
getListError           Error ::= 7
invalidArgumentValue   Error ::= 15
invalidAttributeValue  Error ::= 6
invalidFilter          Error ::= 4
invalidObjectInstance  Error ::= 17
invalidOperation       Error ::= 24
invalidScope           Error ::= 16

```



```

missingAttributeValue      Error ::= 18
mistypedOperation         Error ::= 21
noSuchAction              Error ::= 9
noSuchArgument            Error ::= 14
noSuchAttribute           Error ::= 5
noSuchEventType           Error ::= 13
noSuchInvokeId           Error ::= 22
noSuchObjectClass        Error ::= 0
noSuchObjectInstance     Error ::= 1
noSuchReferenceObject     Error ::= 12
operationCancelled        Error ::= 23
processingFailure         Error ::= 10
setListError              Error ::= 8
syncNotSupported          Error ::= 3

-- Labels have been added to the problem CHOICE to allow it to be correctly processed
RORJapdu ::= [4] IMPLICIT SEQUENCE
{
  invokeID CHOICE{InvokeIDType,NULL},
  problem CHOICE
  {
    generalProblem [0] IMPLICIT GeneralProblem,
    invokeProblem  [1] IMPLICIT InvokeProblem,
    returnResultProblem [2] IMPLICIT ReturnResultProblem,
    returnErrorProblem [3] IMPLICIT ReturnErrorProblem
  }
}

-- The following problems are detected by ROSE-providers:
GeneralProblem ::= INTEGER
{
  unrecognisedAPDU(0),
  mistypedAPDU(1),
  badlyStructuredAPDU(2)
}

-- The following problems are detected by ROSE-users:
InvokeProblem ::= INTEGER
{
  duplicateInvocation(0),
  unrecognisedOperation(1),
  mistypedArgument(2),
  resourceLimitation(3),
  initiatorReleasing(4),
  unrecognisedLinkedID(5),
  linkedResponseUnexpected(6),
  unexpectedChildOperation(7)
}

ReturnResultProblem ::= INTEGER
{
  unrecognisedInvocation(0),
  resultResponseUnexpected(1),
  mistypedResponse(2)
}

ReturnErrorProblem ::= INTEGER
{
  unrecognisedInvocation(0),
  errorResponseUnexpected(1),
  unrecognisedError(2),
  unexpectedError(3),
  mistypedParameter(4)
}

AccessControl ::= --+ CL-NAME = Access-Control
--+ CL-TYPE = 5
--+ H-CL-NAME = "OMP_O_MP_C_ACCESS_CONTROL"
--+ H-CL-ID = 1001
ExternDefault -- EXTERNAL in 9596

ActionArgument ::= --+ SUPER-CLASS = Action-Argument
--+ CL-NAME = CMIS-Action-Argument
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_ACTION_ARGUMENT"
--+ H-CL-ID = 2012
SEQUENCE {
  baseManagedObjectClass ObjectClass
  --+ ATTR-NAME = base-Managed-Object-Class
  --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_CLASS"
  --+ H-ATTR-ID = 2023
  --+ ATTR-SYNTAX = 127 "Object-Class"
  --+ VALUE-NUMBER = 1
  ,
  baseManagedObjectInstance ObjectInstance
  --+ ATTR-NAME = base-Managed-Object-Instance
  --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_INSTANCE"
  --+ H-ATTR-ID = 2024
  --+ ATTR-SYNTAX = 127 "Object-Instance"
  --+ VALUE-NUMBER = 1
}

```

```

    ,
    accessControl [5] AccessControl OPTIONAL
    --+ ATTR-NAME = access-Control
    --+ H-ATTR-NAME = "MP_ACCESS_CONTROL"
    --+ H-ATTR-ID = 1001
    --+ ATTR-SYNTAX = 127 "Access-Control"
    --+ VALUE-NUMBER = 0
    ,
    synchronization [6] IMPLICIT CMISync DEFAULT bestEffort
    --+ ATTR-NAME = synchronization
    --+ H-ATTR-NAME = "MP_SYNCHRONIZATION"
    --+ H-ATTR-ID = 2080
    --+ ATTR-SYNTAX = 10 "CMIS-Sync"
    --+ VALUE-NUMBER = 0
    ,
    scope [7] Scope DEFAULT basicScope : baseObject
    --+ ATTR-NAME = scope
    --+ H-ATTR-NAME = "MP_SCOPE"
    --+ H-ATTR-ID = 2070
    --+ ATTR-SYNTAX = 127 "Scope"
    --+ VALUE-NUMBER = 0
    ,
    filter CMISFilter DEFAULT and:{}
    --+ ATTR-NAME = filter
    --+ H-ATTR-NAME = "MP_FILTER"
    --+ H-ATTR-ID = 2043
    --+ ATTR-SYNTAX = 127 "CMIS-Filter"
    --+ VALUE-NUMBER = 0
    ,
    actionInfo [12] IMPLICIT ActionInfo
    --+ ATTR-NAME = action-Info
    --+ H-ATTR-NAME = "MP_ACTION_INFO"
    --+ H-ATTR-ID = 2005
    --+ ATTR-SYNTAX = 127 "Action-Info"
    --+ VALUE-NUMBER = 1
    }
}

ActionError ::= --+ CL-NAME = Action-Error
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_ACTION_ERROR"
--+ H-CL-ID = 2001
SEQUENCE {
    managedObjectClass ObjectClass OPTIONAL
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 0
    ,
    managedObjectInstance ObjectInstance OPTIONAL
    --+ ATTR-NAME = managed-Object-Instance
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2058
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
    ,
    currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
    --+ ATTR-NAME = current-Time
    --+ H-ATTR-NAME = "MP_CURRENT_TIME"
    --+ H-ATTR-ID = 2027
    --+ ATTR-SYNTAX = 24
    -- Time
    --+ VALUE-NUMBER = 0
    ,
    actionErrorInfo [6] ActionErrorInfo
    --+ ATTR-NAME = action-Error-Info
    --+ H-ATTR-NAME = "MP_ACTION_ERROR_INFO"
    --+ H-ATTR-ID = 2003
    --+ ATTR-SYNTAX = 127 "Action-Error-Info"
    --+ VALUE-NUMBER = 1
    }
}

ActionErrorInfo ::= --+ CL-NAME = Action-Error-Info
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_ACTION_ERROR_INFO"
--+ H-CL-ID = 2002
SEQUENCE {
    errorStatus ENUMERATED --+ VL-NAME = Error-Status
    {
        accessDenied (2)
        --+ ELEM-NAME = access-Denied
        --+ H-ELEM-NAME = "MP_E_ACCESS_DENIED"
        --+ H-ELEM-ID = 2
        ,
        noSuchAction (9)
        --+ ELEM-NAME = no-Such-Action
        --+ H-ELEM-NAME = "MP_E_NO_SUCH_ACTION"
        --+ H-ELEM-ID = 9
        ,
        noSuchArgument (14)
        --+ ELEM-NAME = no-Such-Argument
        --+ H-ELEM-NAME = "MP_E_NO_SUCH_ARGUMENT"
    }
}

```

```

--+ H-ELEM-ID = 14
    ,
    invalidArgumentValue (15)
--+ ELEM-NAME = invalid-Argument-Value
--+ H-ELEM-NAME = "MP_E_INVALID_ARGUMENT_VALUE"
--+ H-ELEM-ID = 15
    }
--+ ATTR-NAME = error-Status
--+ H-ATTR-NAME = "MP_ERROR_STATUS"
--+ H-ATTR-ID = 2035
--+ ATTR-SYNTAX = 10 "Error-Status"
--+ VALUE-NUMBER = 1
    ,
    errorInfo CHOICE { actionType ActionTypeId
--+ ATTR-NAME = action-Type
--+ H-ATTR-NAME = "MP_ACTION_TYPE"
--+ H-ATTR-ID = 2010
--+ ATTR-SYNTAX = 127 "Action-Type-Id"
--+ VALUE-NUMBER = 0
        ,
        actionArgument [0] NoSuchArgument
--+ ATTR-NAME = action-Argument
--+ H-ATTR-NAME = "MP_ACTION_ARGUMENT"
--+ H-ATTR-ID = 2001
--+ ATTR-SYNTAX = 127 "No-Such-Argument"
--+ VALUE-NUMBER = 0
        ,
        argumentValue [1] InvalidArgumentValue
--+ ATTR-NAME = argument-Value
--+ H-ATTR-NAME = "MP_ARGUMENT_VALUE"
--+ H-ATTR-ID = 2014
--+ ATTR-SYNTAX = 127 "Invalid-Argument-Value"
--+ VALUE-NUMBER = 0
    }
--+ ATTR-NAME = error-Info
--+ H-ATTR-NAME = "MP_ERROR_INFO"
--+ H-ATTR-ID = 2034
--+ ATTR-SYNTAX = 127 "Error-Info"
--+ VALUE-NUMBER = 1
--+ CL-NAME = Error-Info
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_ERROR_INFO"
--+ H-CL-ID = 2033
    }
}

ActionInfo ::= --+ CL-NAME = Action-Info
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_ACTION_INFO"
--+ H-CL-ID = 2003
SEQUENCE { actionType ActionTypeId
--+ ATTR-NAME = action-Type
--+ H-ATTR-NAME = "MP_ACTION_TYPE"
--+ H-ATTR-ID = 2010
--+ ATTR-SYNTAX = 127 "Action-Type-Id"
--+ VALUE-NUMBER = 1
    ,
    actionInfoArg [4] ANY DEFINED BY actionType
--% ANY_TABLE_REF(ActionInfoTableMod.ActionInfoTypes) %-- OPTIONAL
--+ ATTR-NAME = action-Info-Arg
--+ H-ATTR-NAME = "MP_ACTION_INFO_ARG"
--+ H-ATTR-ID = 2006
--+ ATTR-SYNTAX = 8
--+ VALUE-NUMBER = 0
    }
}

ActionReply ::= --+ CL-NAME = Action-Reply
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_ACTION_REPLY"
--+ H-CL-ID = 2004
SEQUENCE { actionType ActionTypeId
--+ ATTR-NAME = action-Type
--+ H-ATTR-NAME = "MP_ACTION_TYPE"
--+ H-ATTR-ID = 2010
--+ ATTR-SYNTAX = 127 "Action-Type-Id"
--+ VALUE-NUMBER = 1
    ,
    actionReplyInfo [4] ANY DEFINED BY actionType
--% ANY_TABLE_REF(ActionReplyTableMod.ActionReplyTypes)
--+ ATTR-NAME = action-Reply-Info
--+ H-ATTR-NAME = "MP_ACTION_REPLY_INFO"
--+ H-ATTR-ID = 2008
--+ ATTR-SYNTAX = 8
--+ VALUE-NUMBER = 1
    }
}

ActionResult ::= --+ SUPER-CLASS = Action-Result
--+ CL-NAME = CMIS-Action-Result
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_ACTION_RESULT"

```

```

--+ H-CL-ID = 2013
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 0
    ,
    managedObjectInstance ObjectInstance OPTIONAL
    --+ ATTR-NAME = managed-Object-Instance
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2058
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
    ,
    currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
    --+ ATTR-NAME = current-Time
    --+ H-ATTR-NAME = "MP_CURRENT_TIME"
    --+ H-ATTR-ID = 2027
    --+ ATTR-SYNTAX = 24
    --+ VALUE-NUMBER = 0
    ,
    actionReply [6] IMPLICIT ActionReply OPTIONAL
    --+ ATTR-NAME = action-Reply
    --+ H-ATTR-NAME = "MP_ACTION_REPLY"
    --+ H-ATTR-ID = 2007
    --+ ATTR-SYNTAX = 127 "Action-Reply"
    --+ VALUE-NUMBER = 0
}

-- This has been adapted to align with the comments below.
-- The CHOICE has been eliminated to simplify processing
-- and the use of the API.
ActionTypeId ::= [2] IMPLICIT OBJECT IDENTIFIER
-- This [Recommendation | part of ISO/IEC 9596] does not allocate any values for
-- localForm.
-- Where this alternative is used, the permissible values for the integers
-- and their meanings shall be defined as part of the application context
-- in which they are used.

Attribute ::= --+ CL-NAME = Attribute
    --+ CL-TYPE = 3
    --+ H-CL-NAME = "OMP_O_MP_C_ATTRIBUTE"
    --+ H-CL-ID = 2006
    SEQUENCE { attributeId AttributeId
        --+ ATTR-NAME = attribute-Id
        --+ H-ATTR-NAME = "MP_ATTRIBUTE_ID"
        --+ H-ATTR-ID = 2017
        --+ ATTR-SYNTAX = 127 "Attribute-Id"
        --+ VALUE-NUMBER = 1
        ,
        attributeValue ANY DEFINED BY attributeId
        --% ANY_TABLE_REF(AttributeTableMod.AttributeTypes)
        --+ ATTR-NAME = attribute-Value
        --+ H-ATTR-NAME = "MP_ATTRIBUTE_VALUE"
        --+ H-ATTR-ID = 2022
        --+ ATTR-SYNTAX = 8
        --+ VALUE-NUMBER = 1
    }

AttributeError ::= --+ CL-NAME = Attribute-Error
    --+ CL-TYPE = 3
    --+ H-CL-NAME = "OMP_O_MP_C_ATTRIBUTE_ERROR"
    --+ H-CL-ID = 2007
    SEQUENCE { errorStatus ENUMERATED --+ VL-NAME = Error-Status
        { accessDenied (2),
          noSuchAttribute (5)
          --+ ELEM-NAME = no-Such-Attribute
          --+ H-ELEM-NAME = "MP_E_NO_SUCH_ATTRIBUTE"
          --+ H-ELEM-ID = 5
          ,
          invalidAttributeValue (6)
          --+ ELEM-NAME = invalid-Attribute-Value
          --+ H-ELEM-NAME = "MP_E_INVALID_ATTRIBUTE_VALUE"
          --+ H-ELEM-ID = 6
          ,
          invalidOperation (24)
          --+ ELEM-NAME = invalid-Operation
          --+ H-ELEM-NAME = "MP_E_INVALID_OPERATION"
          --+ H-ELEM-ID = 24
          ,
          invalidOperator (25)
          --+ ELEM-NAME = invalid-Operator
          --+ H-ELEM-NAME = "MP_E_INVALID_OPERATOR"
          --+ H-ELEM-ID = 25
        }
        --+ ATTR-NAME = error-Status
        --+ H-ATTR-NAME = "MP_ERROR_STATUS"
        --+ H-ATTR-ID = 2035
        --+ ATTR-SYNTAX = 10 "Error-Status"
    }

```

```

        --+ VALUE-NUMBER = 1
    ,
    modifyOperator [2] IMPLICIT ModifyOperator OPTIONAL
        --+ ATTR-NAME = modify-Operator
        --+ H-ATTR-NAME = "MP_MODIFY_OPERATOR"
        --+ H-ATTR-ID = 2060
        --+ ATTR-SYNTAX = 10 "Modify-Operator"
        --+ VALUE-NUMBER = 0
    ,
    attributeId AttributeId
        --+ ATTR-NAME = attribute-Id
        --+ H-ATTR-NAME = "MP_ATTRIBUTE_ID"
        --+ H-ATTR-ID = 2017
        --+ ATTR-SYNTAX = 127 "Attribute-Id"
        --+ VALUE-NUMBER = 1
    ,
    attributeValue ANY DEFINED BY attributeId
        --% ANY_TABLE_REF(AttributeTableMod.AttributeTypes) %-- OPTIONAL
        --+ ATTR-NAME = attribute-Value
        --+ H-ATTR-NAME = "MP_ATTRIBUTE_VALUE"
        --+ H-ATTR-ID = 2022
        --+ ATTR-SYNTAX = 8
        --+ VALUE-NUMBER = 0
    }
}

-- This has been adapted to align with the comments below.
-- The CHOICE has been eliminated to simplify processing
-- and the use of the API.
AttributeId ::= [0] IMPLICIT OBJECT IDENTIFIER
-- This [Recommendation | part of ISO/IEC 9596] does not allocate any values for
-- localForm.
-- Where this alternative is used, the permissible values for the integers
-- and their meanings shall be defined as part of the application context
-- in which they are used.

AttributeIdError ::= --+ CL-NAME = Attribute-Id-Error
                    --+ CL-TYPE = 3
                    --+ H-CL-NAME = "OMP_O_MP_C_ATTRIBUTE_ID_ERROR"
                    --+ H-CL-ID = 2009
                    SEQUENCE { errorStatus ENUMERATED { accessDenied (2),
                                                            noSuchAttribute (5) }
                                --+ ATTR-NAME = error-Status
                                --+ H-ATTR-NAME = "MP_ERROR_STATUS"
                                --+ H-ATTR-ID = 2035
                                --+ ATTR-SYNTAX = 10 "Error-Status"
                                --+ VALUE-NUMBER = 1
                            ,
                            attributeId AttributeId
                                --+ ATTR-NAME = attribute-Id
                                --+ H-ATTR-NAME = "MP_ATTRIBUTE_ID"
                                --+ H-ATTR-ID = 2017
                                --+ ATTR-SYNTAX = 127 "Attribute-Id"
                                --+ VALUE-NUMBER = 1
                            }
}

BaseManagedObjectId ::= --+ CL-NAME = Base-Managed-Object-Id
                        --+ CL-TYPE = 3
                        --+ H-CL-NAME = "OMP_O_MP_C_BASE_MANAGED_OBJETC_ID"
                        --+ H-CL-ID = 2011
                        SEQUENCE { baseManagedObjectClass ObjectClass
                                    --+ ATTR-NAME = base-Managed-Object-Class
                                    --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_CLASS"
                                    --+ H-ATTR-ID = 2023
                                    --+ ATTR-SYNTAX = 127 "Object-Class"
                                    --+ VALUE-NUMBER = 1
                                ,
                                baseManagedObjectInstance ObjectInstance
                                    --+ ATTR-NAME = base-Managed-Object-Instance
                                    --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_INSTANCE"
                                    --+ H-ATTR-ID = 2024
                                    --+ ATTR-SYNTAX = 127 "Object-Instance"
                                    --+ VALUE-NUMBER = 1
                                }
}

CMISFilter ::= --+ CL-NAME = CMIS-Filter
              --+ CL-TYPE = 0
              --+ H-CL-NAME = "OMP_O_MP_C_CMIS_FILTER"
              --+ H-CL-ID = 2021
              CHOICE { item [8] FilterItem
                        --+ ATTR-NAME = item
                        --+ H-ATTR-NAME = "MP_ITEM"
                        --+ H-ATTR-ID = 2053
                        --+ ATTR-SYNTAX = 127 "Filter-Item"
                        --+ VALUE-NUMBER = 0
                    ,
                    and [9] IMPLICIT SET OF CMISFilter
                        --+ ATTR-NAME = and
                        --+ H-ATTR-NAME = "MP_AND"
                        --+ H-ATTR-ID = 2012
                        --+ ATTR-SYNTAX = 127 "CMIS-Filter"
                    }
}

```

```

--+ VALUE-NUMBER = 2
,
or [10] IMPLICIT SET OF CMISFilter
--+ ATTR-NAME = or
--+ H-ATTR-NAME = "MP_OR"
--+ H-ATTR-ID = 2065
--+ ATTR-SYNTAX = 127 "CMIS-Filter"
--+ VALUE-NUMBER = 2
,
not [11] CMISFilter
--+ ATTR-NAME = not
--+ H-ATTR-NAME = "MP_NOT"
--+ H-ATTR-ID = 2064
--+ ATTR-SYNTAX = 127 "CMIS-Filter"
--+ VALUE-NUMBER = 0
}
}

CMISSync ::= ENUMERATED --+ VL-NAME = CMIS-Sync
{
  bestEffort (0)
  --+ ELEM-NAME = best-effort
  --+ H-ELEM-NAME = "MP_T_BEST_EFFORT"
  --+ H-ELEM-ID = 0
  ,
  atomic (1)
  --+ ELEM-NAME = atomic
  --+ H-ELEM-NAME = "MP_T_ATOMIC"
  --+ H-ELEM-ID = 1
}
}

ComplexityLimitation ::= --+ CL-NAME = Complexity-Limitation
--+ CL-TYPE = 1
--+ H-CL-NAME = "OMP_O_MP_C_COMPLEXITY_LIMITATION"
--+ H-CL-ID = 2030
SET {
  scope [0] Scope OPTIONAL
  --+ ATTR-NAME = scope
  --+ H-ATTR-NAME = "MP_SCOPE"
  --+ H-ATTR-ID = 2070
  --+ ATTR-SYNTAX = 127 "Scope"
  --+ VALUE-NUMBER = 0
  ,
  filter [1] CMISFilter OPTIONAL
  --+ ATTR-NAME = filter
  --+ H-ATTR-NAME = "MP_FILTER"
  --+ H-ATTR-ID = 2043
  --+ ATTR-SYNTAX = 127 "CMIS-Filter"
  --+ VALUE-NUMBER = 0
  ,
  sync [2] CMISSync OPTIONAL
  --+ ATTR-NAME = synchronization
  --+ H-ATTR-NAME = "MP_SYNCHRONIZATION"
  --+ H-ATTR-ID = 2080
  --+ ATTR-SYNTAX = 10 "CMIS-Sync"
  --+ VALUE-NUMBER = 0
}
}

CreateArgument ::= --+ SUPER-CLASS = Create-Argument
--+ CL-NAME = CMIS-Create-Argument
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_CREATE_ARGUMENT"
--+ H-CL-ID = 2015
SEQUENCE {
  managedObjectClass ObjectClass
  --+ ATTR-NAME = managed-Object-Class
  --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
  --+ H-ATTR-ID = 2057
  --+ ATTR-SYNTAX = 127 "Object-Class"
  --+ VALUE-NUMBER = 1
  ,
  CHOICE {
    managedObjectInstance ObjectInstance
    --+ ATTR-NAME = managed-Object-Instance
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2058
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
    ,
    superiorObjectInstance [8] ObjectInstance
    --+ ATTR-NAME = superior-Object-Instance
    --+ H-ATTR-NAME = "MP_SUPERIOR_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2078
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
  } OPTIONAL
  --+ ATTR-NAME = create-Object-Instance
  --+ H-ATTR-NAME = "MP_CREATE_OBJECT_INSTANCE"
  --+ H-ATTR-ID = 2026
  --+ ATTR-SYNTAX = 127 "Create-Object-Instance"
  --+ VALUE-NUMBER = 0
  --+ CL-NAME = Create-Object-Instance
  --+ CL-TYPE = 0
  --+ H-CL-NAME = "OMP_O_MP_C_CREATE_OBJECT_INSTANCE"
  --+ H-CL-ID = 2031
}
}

```

```

    ,
    accessControl [5] AccessControl OPTIONAL
    --+ ATTR-NAME = access-Control
    --+ H-ATTR-NAME = "MP_ACCESS_CONTROL"
    --+ H-ATTR-ID = 1001
    --+ ATTR-SYNTAX = 127 "Access-Control"
    --+ VALUE-NUMBER = 0
    ,
    referenceObjectInstance [6] ObjectInstance OPTIONAL
    --+ ATTR-NAME = reference-Object-Instance
    --+ H-ATTR-NAME = "MP_REFERENCE_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2068
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
    ,
    attributeList [7] IMPLICIT SET OF Attribute OPTIONAL
    --+ ATTR-NAME = attribute-List
    --+ H-ATTR-NAME = "MP_ATTRIBUTE_LIST"
    --+ H-ATTR-ID = 2021
    --+ ATTR-SYNTAX = 127 "Attribute"
    --+ VALUE-NUMBER = 2
    }
}

CreateResult ::= --+ SUPER-CLASS = Create-Result
--+ CL-NAME = CMIS-Create-Result
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_CREATE_RESULT"
--+ H-CL-ID = 2016
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 0
    ,
    managedObjectInstance ObjectInstance OPTIONAL
    --+ ATTR-NAME = managed-Object-Instance
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2058
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
    ,
    -- shall be returned if omitted from CreateArgument
    currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
    --+ ATTR-NAME = current-Time
    --+ H-ATTR-NAME = "MP_CURRENT_TIME"
    --+ H-ATTR-ID = 2027
    --+ ATTR-SYNTAX = 24
    --+ VALUE-NUMBER = 0
    ,
    attributeList [6] IMPLICIT SET OF Attribute OPTIONAL
    --+ ATTR-NAME = attribute-List
    --+ H-ATTR-NAME = "MP_ATTRIBUTE_LIST"
    --+ H-ATTR-ID = 2021
    --+ ATTR-SYNTAX = 127 "Attribute"
    --+ VALUE-NUMBER = 2
    }
}

DeleteArgument ::= --+ SUPER-CLASS = Delete-Argument
--+ CL-NAME = CMIS-Delete-Argument
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_DELETE_ARGUMENT"
--+ H-CL-ID = 2017
SEQUENCE { baseManagedObjectClass ObjectClass
    --+ ATTR-NAME = base-Managed-Object-Class
    --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2023
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 1
    ,
    baseManagedObjectInstance ObjectInstance
    --+ ATTR-NAME = base-Managed-Object-Instance
    --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2024
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 1
    ,
    accessControl [5] AccessControl OPTIONAL
    --+ ATTR-NAME = access-Control
    --+ H-ATTR-NAME = "MP_ACCESS_CONTROL"
    --+ H-ATTR-ID = 1001
    --+ ATTR-SYNTAX = 127 "Access-Control"
    --+ VALUE-NUMBER = 0
    ,
    synchronization [6] IMPLICIT CMISync DEFAULT bestEffort
    --+ ATTR-NAME = synchronization
    --+ H-ATTR-NAME = "MP_SYNCHRONIZATION"
    --+ H-ATTR-ID = 2080
    --+ ATTR-SYNTAX = 10 "CMIS-Sync"
}

```

```

        --+ VALUE-NUMBER = 0
    ,
    scope [7] Scope DEFAULT basicScope : baseObject
        --+ ATTR-NAME = scope
        --+ H-ATTR-NAME = "MP_SCOPE"
        --+ H-ATTR-ID = 2070
        --+ ATTR-SYNTAX = 127 "Scope"
        --+ VALUE-NUMBER = 0
    ,
    filter CMISFilter DEFAULT and:({}
        --+ ATTR-NAME = filter
        --+ H-ATTR-NAME = "MP_FILTER"
        --+ H-ATTR-ID = 2043
        --+ ATTR-SYNTAX = 127 "CMIS-Filter"
        --+ VALUE-NUMBER = 0
    )
}

DeleteError ::= --+ CL-NAME = Delete-Error
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_DELETE_ERROR"
--+ H-CL-ID = 2032
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 0
,
managedObjectInstance ObjectInstance OPTIONAL
    --+ ATTR-NAME = managed-Object-Instance
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2058
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
,
currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
    --+ ATTR-NAME = current-Time
    --+ H-ATTR-NAME = "MP_CURRENT_TIME"
    --+ H-ATTR-ID = 2027
    --+ ATTR-SYNTAX = 24
    --+ VALUE-NUMBER = 0
,
deleteErrorInfo [6] ENUMERATED --+ VL-NAME = Delete-Error-Info
    { accessDenied (2)
        --+ ELEM-NAME = access-Denied
        --+ H-ELEM-NAME = "MP_E_ACCESS_DENIED"
        --+ H-ELEM-ID = 2
    }
    --+ ATTR-NAME = delete-Error-Info
    --+ H-ATTR-NAME = "MP_DELETE_ERROR_INFO"
    --+ H-ATTR-ID = 2029
    --+ ATTR-SYNTAX = 10 "Delete-Error-Info"
    --+ VALUE-NUMBER = 1
}

DeleteResult ::= --+ SUPER-CLASS = Delete-Result
--+ CL-NAME = CMIS-Delete-Result
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_DELETE_RESULT"
--+ H-CL-ID = 2018
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 0
,
managedObjectInstance ObjectInstance OPTIONAL
    --+ ATTR-NAME = managed-Object-Instance
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2058
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 0
,
currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
    --+ ATTR-NAME = current-Time
    --+ H-ATTR-NAME = "MP_CURRENT_TIME"
    --+ H-ATTR-ID = 2027
    --+ ATTR-SYNTAX = 24
    --+ VALUE-NUMBER = 0
}

EventReply ::= --+ CL-NAME = Event-Reply
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_EVENT_REPLY"
--+ H-CL-ID = 2034
SEQUENCE { eventType EventTypeId
    --+ ATTR-NAME = event-Type

```



```

    --+ H-ATTR-NAME = "MP_EVENT_TYPE"
    --+ H-ATTR-ID = 2041
    --+ ATTR-SYNTAX = 127 "Event-Type-Id"
    --+ VALUE-NUMBER = 1
  ,
  eventReplyInfo [8] ANY DEFINED BY eventType
  --% ANY_TABLE_REF (NotificationReplyTableMod.NotificationReplyTypes)
  --% OPTIONAL
  --+ ATTR-NAME = event-Reply-Info
  --+ H-ATTR-NAME = "MP_EVENT_REPLY_INFO"
  --+ H-ATTR-ID = 2039
  --+ ATTR-SYNTAX = 8
  --+ VALUE-NUMBER = 0
}

EventReportArgument ::= --+ SUPER-CLASS = Event-Report-Argument
--+ CL-NAME = CMIS-Event-Report-Argument
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_EVENT_REPORT_ARGUMENT"
--+ H-CL-ID = 2019
SEQUENCE { managedObjectClass ObjectClass
  --+ ATTR-NAME = managed-Object-Class
  --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
  --+ H-ATTR-ID = 2057
  --+ ATTR-SYNTAX = 127 "Object-Class"
  --+ VALUE-NUMBER = 1
  ,
  managedObjectInstance ObjectInstance
  --+ ATTR-NAME = managed-Object-Instance
  --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
  --+ H-ATTR-ID = 2058
  --+ ATTR-SYNTAX = 127 "Object-Instance"
  --+ VALUE-NUMBER = 1
  ,
  eventTime [5] IMPLICIT GeneralizedTime OPTIONAL
  --+ ATTR-NAME = event-Time
  --+ H-ATTR-NAME = "MP_EVENT_TIME"
  --+ H-ATTR-ID = 2040
  --+ ATTR-SYNTAX = 24
  -- Time
  --+ VALUE-NUMBER = 0
  ,
  eventType EventTypeId
  --+ ATTR-NAME = event-Type
  --+ H-ATTR-NAME = "MP_EVENT_TYPE"
  --+ H-ATTR-ID = 2041
  --+ ATTR-SYNTAX = 127 "Event-Type-Id"
  --+ VALUE-NUMBER = 1
  ,
  eventInfo [8] ANY DEFINED BY eventType
  --% ANY_TABLE_REF (NotificationInfoTableMod.NotificationTypes)
  --% OPTIONAL
  --+ ATTR-NAME = event-Info
  --+ H-ATTR-NAME = "MP_EVENT_INFO"
  --+ H-ATTR-ID = 2037
  --+ ATTR-SYNTAX = 8
  --+ VALUE-NUMBER = 0
}

EventReportResult ::= --+ SUPER-CLASS = Event-Report-Result
--+ CL-NAME = CMIS-Event-Report-Result
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_EVENT_REPORT_RESULT"
--+ H-CL-ID = 2020
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
  --+ ATTR-NAME = managed-Object-Class
  --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
  --+ H-ATTR-ID = 2057
  --+ ATTR-SYNTAX = 127 "Object-Class"
  --+ VALUE-NUMBER = 0
  ,
  managedObjectInstance ObjectInstance OPTIONAL
  --+ ATTR-NAME = managed-Object-Instance
  --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
  --+ H-ATTR-ID = 2058
  --+ ATTR-SYNTAX = 127 "Object-Instance"
  --+ VALUE-NUMBER = 0
  ,
  currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
  --+ ATTR-NAME = current-Time
  --+ H-ATTR-NAME = "MP_CURRENT_TIME"
  --+ H-ATTR-ID = 2027
  --+ ATTR-SYNTAX = 24
  --+ VALUE-NUMBER = 0
  ,
  eventReply EventReply OPTIONAL
  --+ ATTR-NAME = event-Reply
  --+ H-ATTR-NAME = "MP_EVENT_REPLY"
  --+ H-ATTR-ID = 2038
}

```

```

        --+ ATTR-SYNTAX = 127 "Event-Reply"
        --+ VALUE-NUMBER = 0
    }

-- This has been adapted to align with the comments below.
-- The CHOICE has been eliminated to simplify processing
-- and the use of the API.
EventTypeId ::= [6] IMPLICIT OBJECT IDENTIFIER
-- This [Recommendation | part of ISO/IEC 9596] does not allocate any values for
-- localForm.
-- Where this alternative is used, the permissible values for the integers
-- and their meanings shall be defined as part of the application context
-- in which they are used.

FilterItem ::= --+ CL-NAME = Filter-Item
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_FILTER_ITEM"
--+ H-CL-ID = 2036
CHOICE { equality [0] IMPLICIT Attribute
--+ ATTR-NAME = equality
--+ H-ATTR-NAME = "MP_EQUALITY"
--+ H-ATTR-ID = 2032
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
,
substrings [1] IMPLICIT SEQUENCE OF Substrings
--+ ATTR-NAME = substrings
--+ H-ATTR-NAME = "MP_SUBSTRINGS"
--+ H-ATTR-ID = 2077
--+ ATTR-SYNTAX = 127 "Substrings"
--+ VALUE-NUMBER = 2
,
greaterOrEqual [2] IMPLICIT Attribute -- asserted value >= attribute value
--+ ATTR-NAME = greater-Or-Equal
--+ H-ATTR-NAME = "MP_GREATER_OR_EQUAL"
--+ H-ATTR-ID = 2050
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
,
lessOrEqual [3] IMPLICIT Attribute -- asserted value <= attribute value
--+ ATTR-NAME = less-Or-Equal
--+ H-ATTR-NAME = "MP_LESS_OR_EQUAL"
--+ H-ATTR-ID = 2054
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
,
present [4] AttributeId
--+ ATTR-NAME = present
--+ H-ATTR-NAME = "MP_PRESENT"
--+ H-ATTR-ID = 2066
--+ ATTR-SYNTAX = 127 "Attribute-Id"
--+ VALUE-NUMBER = 0
,
subsetOf [5] IMPLICIT Attribute -- asserted value is a subset of attribute value
--+ ATTR-NAME = subset-Of
--+ H-ATTR-NAME = "MP_SUBSET_OF"
--+ H-ATTR-ID = 2076
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
,
supersetOf [6] IMPLICIT Attribute -- asserted value is a superset of attribute value
--+ ATTR-NAME = superset-Of
--+ H-ATTR-NAME = "MP_SUPERSET_OF"
--+ H-ATTR-ID = 2079
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
,
nonNullSetIntersection [7] IMPLICIT Attribute
--+ ATTR-NAME = non-Null-Set-Intersection
--+ H-ATTR-NAME = "MP_NON_NULL_SET_INTERSECTION"
--+ H-ATTR-ID = 2062
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
}

Substring ::= --+ CL-NAME = Substring
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_SUBSTRING"
--+ H-CL-ID = 2053
SEQUENCE { attributeId AttributeId
--+ ATTR-NAME = attribute-Id
--+ H-ATTR-NAME = "MP_ATTRIBUTE_ID"
--+ H-ATTR-ID = 2017
--+ ATTR-SYNTAX = 127 "Attribute-Id"
--+ VALUE-NUMBER = 1
,
string ANY DEFINED BY attributeId
--% ANY_TABLE_REF(AttributeTableMod.AttributeTypes)
--+ ATTR-NAME = string
--+ H-ATTR-NAME = "MP_STRING"

```

```

        --+ H-ATTR-ID = 1039
        --+ ATTR-SYNTAX = 27
        --+ VALUE-NUMBER = 3
    }
}

Substrings ::= --+ CL-NAME = Substrings
--+ CL-TYPE = 4
--+ H-CL-NAME = "OMP_O_MP_C_SUBSTRINGS"
--+ H-CL-ID = 2054
CHOICE {
    initialString [0] IMPLICIT Substring
        --+ ATTR-NAME = initial-String
        --+ H-ATTR-NAME = "MP_INITIAL_STRING"
        --+ H-ATTR-ID = 2052
        --+ ATTR-SYNTAX = 127 "Substring"
        --+ VALUE-NUMBER = 0
    ,
    anyString [1] IMPLICIT Substring
        --+ ATTR-NAME = any-Substring
        --+ H-ATTR-NAME = "MP_ANY_STRING"
        --+ H-ATTR-ID = 2013
        --+ ATTR-SYNTAX = 127 "Substring"
        --+ VALUE-NUMBER = 0
    ,
    finalString [2] IMPLICIT Substring
        --+ ATTR-NAME = final-String
        --+ H-ATTR-NAME = "MP_FINAL_STRING"
        --+ H-ATTR-ID = 2044
        --+ ATTR-SYNTAX = 127 "Substring"
        --+ VALUE-NUMBER = 0
}

GetArgument ::= --+ SUPER-CLASS = Get-Argument
--+ CL-NAME = CMIS-Get-Argument
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_GET_ARGUMENT"
--+ H-CL-ID = 2022
SEQUENCE {
    baseManagedObjectClass ObjectClass
        --+ ATTR-NAME = base-Managed-Object-Class
        --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_CLASS"
        --+ H-ATTR-ID = 2023
        --+ ATTR-SYNTAX = 127 "Object-Class"
        --+ VALUE-NUMBER = 1
    ,
    baseManagedObjectInstance ObjectInstance
        --+ ATTR-NAME = base-Managed-Object-Instance
        --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_INSTANCE"
        --+ H-ATTR-ID = 2024
        --+ ATTR-SYNTAX = 127 "Object-Instance"
        --+ VALUE-NUMBER = 1
    ,
    accessControl [5] AccessControl OPTIONAL
        --+ ATTR-NAME = access-Control
        --+ H-ATTR-NAME = "MP_ACCESS_CONTROL"
        --+ H-ATTR-ID = 1001
        --+ ATTR-SYNTAX = 127 "Access-Control"
        --+ VALUE-NUMBER = 0
    ,
    synchronization [6] IMPLICIT CMISync DEFAULT bestEffort
        --+ ATTR-NAME = synchronization
        --+ H-ATTR-NAME = "MP_SYNCHRONIZATION"
        --+ H-ATTR-ID = 2080
        --+ ATTR-SYNTAX = 10 "CMIS-Sync"
        --+ VALUE-NUMBER = 0
    ,
    scope [7] Scope DEFAULT basicScope : baseObject
        --+ ATTR-NAME = scope
        --+ H-ATTR-NAME = "MP_SCOPE"
        --+ H-ATTR-ID = 2070
        --+ ATTR-SYNTAX = 127 "Scope"
        --+ VALUE-NUMBER = 0
    ,
    filter CMISFilter DEFAULT and:{}
        --+ ATTR-NAME = filter
        --+ H-ATTR-NAME = "MP_FILTER"
        --+ H-ATTR-ID = 2043
        --+ ATTR-SYNTAX = 127 "CMIS-Filter"
        --+ VALUE-NUMBER = 0
    ,
    attributeIdList [12] IMPLICIT SET OF AttributeId OPTIONAL
        --+ ATTR-NAME = attribute-Id-List
        --+ H-ATTR-NAME = "MP_ATTRIBUTE_ID_LIST"
        --+ H-ATTR-ID = 2020
        --+ ATTR-SYNTAX = 127 "Attribute-Id-List"
        --+ VALUE-NUMBER = 0
        --+ CL-NAME = Attribute-Id-List
        --+ CL-TYPE = 2
        --+ H-CL-NAME = "OMP_O_MP_C_ATTRIBUTE_ID_LIST"
        --+ H-CL-ID = 2010
        --+ ATTR-NAME = attribute-Id
        --+ H-ATTR-NAME = "MP_ATTRIBUTE_ID"
}

```

```

--+ H-ATTR-ID = 2017
--+ ATTR-SYNTAX = 127 "Attribute-Id"
--+ VALUE-NUMBER = 2
}

GetInfoStatus::= --+ CL-NAME = Get-Info-Status
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_GET_INFO_STATUS"
--+ H-CL-ID = 2037
CHOICE { attributeIdError [0] IMPLICIT AttributeIdError
--+ ATTR-NAME = attribute-Id-Error
--+ H-ATTR-NAME = "MP_ATTRIBUTE_ID_ERROR"
--+ H-ATTR-ID = 2019
--+ ATTR-SYNTAX = 127 "Attribute-Id-Error"
--+ VALUE-NUMBER = 0
,
attribute [1] IMPLICIT Attribute
--+ ATTR-NAME = attribute
--+ H-ATTR-NAME = "MP_ATTRIBUTE"
--+ H-ATTR-ID = 2015
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 0
}

GetListError::= --+ SUPER-CLASS = Get-List-Error
--+ CL-NAME = CMIS-Get-List-Error
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_GET_LIST_ERROR"
--+ H-CL-ID = 2023
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
--+ ATTR-NAME = managed-Object-Class
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
--+ H-ATTR-ID = 2057
--+ ATTR-SYNTAX = 127 "Object-Class"
--+ VALUE-NUMBER = 0
,
managedObjectInstance ObjectInstance OPTIONAL
--+ ATTR-NAME = managed-Object-Instance
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
--+ H-ATTR-ID = 2058
--+ ATTR-SYNTAX = 127 "Object-Instance"
--+ VALUE-NUMBER = 0
,
currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
--+ ATTR-NAME = current-Time
--+ H-ATTR-NAME = "MP_CURRENT_TIME"
--+ H-ATTR-ID = 2027
--+ ATTR-SYNTAX = 24
--+ VALUE-NUMBER = 0
,
getInfoList [6] IMPLICIT SET OF GetInfoStatus
--+ ATTR-NAME = get-Info-List
--+ H-ATTR-NAME = "MP_GET_INFO_LIST"
--+ H-ATTR-ID = 2045
--+ ATTR-SYNTAX = 127 "Get-Info-Status"
--+ VALUE-NUMBER = 3
}

GetResult::= --+ SUPER-CLASS = Get-Result
--+ CL-NAME = CMIS-Get-Result
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_GET_RESULT"
--+ H-CL-ID = 2024
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
--+ ATTR-NAME = managed-Object-Class
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
--+ H-ATTR-ID = 2057
--+ ATTR-SYNTAX = 127 "Object-Class"
--+ VALUE-NUMBER = 0
,
managedObjectInstance ObjectInstance OPTIONAL
--+ ATTR-NAME = managed-Object-Instance
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
--+ H-ATTR-ID = 2058
--+ ATTR-SYNTAX = 127 "Object-Instance"
--+ VALUE-NUMBER = 0
,
currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
--+ ATTR-NAME = current-Time
--+ H-ATTR-NAME = "MP_CURRENT_TIME"
--+ H-ATTR-ID = 2027
--+ ATTR-SYNTAX = 24
--+ VALUE-NUMBER = 0
,
attributeList [6] IMPLICIT SET OF Attribute OPTIONAL
--+ ATTR-NAME = attribute-List
--+ H-ATTR-NAME = "MP_ATTRIBUTE_LIST"
--+ H-ATTR-ID = 2021
--+ ATTR-SYNTAX = 127 "Attribute"
}

```

```

--+ VALUE-NUMBER = 2
}

InvalidArgumentValue ::= --+ CL-NAME = Invalid-Argument-Value
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_INVALID_ARGUMENT_VALUE"
--+ H-CL-ID = 2038
CHOICE {
  actionValue [0] IMPLICIT ActionInfo
    --+ ATTR-NAME = action-Value
    --+ H-ATTR-NAME = "MP_ACTION_VALUE"
    --+ H-ATTR-ID = 2011
    --+ ATTR-SYNTAX = 127 "Action-Info"
    --+ VALUE-NUMBER = 0
  ,
  eventValue [1] IMPLICIT SEQUENCE {
    eventType EventTypeId,
    eventInfo [8] ANY DEFINED BY eventType
    --% ANY_TABLE_REF
  }
}

(NotificationInfoTableMod.NotificationReplyTypes) %-- OPTIONAL }
--+ ATTR-NAME = event-Value
--+ H-ATTR-NAME = "MP_EVENT_VALUE"
--+ H-ATTR-ID = 2042
--+ ATTR-SYNTAX = 127 "Event-Reply"
--+ VALUE-NUMBER = 0
}

LinkedReplyArgument ::= --+ SUPER-CLASS = Linked-Reply-Argument
--+ CL-NAME = CMIS-Linked-Reply-Argument
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_LINKED_REPLY_ARGUMENT"
--+ H-CL-ID = 2025
CHOICE {
  getResult [0] IMPLICIT GetResult
    --+ ATTR-NAME = get-Result
    --+ H-ATTR-NAME = "MP_GET_RESULT"
    --+ H-ATTR-ID = 2048
    --+ ATTR-SYNTAX = 127 "CMIS-Get-Result"
    --+ VALUE-NUMBER = 0
  ,
  getListError [1] IMPLICIT GetListError
    --+ ATTR-NAME = get-List-Error
    --+ H-ATTR-NAME = "MP_GET_LIST_ERROR"
    --+ H-ATTR-ID = 2047
    --+ ATTR-SYNTAX = 127 "CMIS-Get-List-Error"
    --+ VALUE-NUMBER = 0
  ,
  setResult [2] IMPLICIT SetResult
    --+ ATTR-NAME = set-Result
    --+ H-ATTR-NAME = "MP_SET_RESULT"
    --+ H-ATTR-ID = 2074
    --+ ATTR-SYNTAX = 127 "CMIS-Set-Result"
    --+ VALUE-NUMBER = 0
  ,
  setListError [3] IMPLICIT SetListError
    --+ ATTR-NAME = set-List-Error
    --+ H-ATTR-NAME = "MP_SET_LIST_ERROR"
    --+ H-ATTR-ID = 2072
    --+ ATTR-SYNTAX = 127 "CMIS-Set-List-Error"
    --+ VALUE-NUMBER = 0
  ,
  actionResult [4] IMPLICIT ActionResult
    --+ ATTR-NAME = action-Result
    --+ H-ATTR-NAME = "MP_ACTION_RESULT"
    --+ H-ATTR-ID = 2009
    --+ ATTR-SYNTAX = 127 "CMIS-Action-Result"
    --+ VALUE-NUMBER = 0
  ,
  processingFailure [5] IMPLICIT ProcessingFailure
    --+ ATTR-NAME = processing-Failure
    --+ H-ATTR-NAME = "MP_PROCESSING_FAILURE"
    --+ H-ATTR-ID = 2067
    --+ ATTR-SYNTAX = 127 "Processing-Failure"
    --+ VALUE-NUMBER = 0
  ,
  deleteResult [6] IMPLICIT DeleteResult
    --+ ATTR-NAME = delete-Result
    --+ H-ATTR-NAME = "MP_DELETE_RESULT"
    --+ H-ATTR-ID = 2030
    --+ ATTR-SYNTAX = 127 "CMIS-Delete-Result"
    --+ VALUE-NUMBER = 0
  ,
  actionError [7] IMPLICIT ActionError
    --+ ATTR-NAME = action-Error
    --+ H-ATTR-NAME = "MP_ACTION_ERROR"
    --+ H-ATTR-ID = 2002
    --+ ATTR-SYNTAX = 127 "Action-Error"
    --+ VALUE-NUMBER = 0
  ,
  deleteError [8] IMPLICIT DeleteError
    --+ ATTR-NAME = delete-Error
    --+ H-ATTR-NAME = "MP_DELETE_ERROR"

```

```

        --+ H-ATTR-ID = 2028
        --+ ATTR-SYNTAX = 127 "Delete-Error"
        --+ VALUE-NUMBER = 0
    }

ModifyOperator ::= INTEGER --+ VL-NAME = Modify-Operator
{
    replace (0)
    --+ ELEM-NAME = replace
    --+ H-ELEM-NAME = "MP_T_REPLACE"
    --+ H-ELEM-ID = 0
    ,
    addValues (1)
    --+ ELEM-NAME = add-Values
    --+ H-ELEM-NAME = "MP_T_ADD_VALUES"
    --+ H-ELEM-ID = 1
    ,
    removeValues (2)
    --+ ELEM-NAME = remove-Values
    --+ H-ELEM-NAME = "MP_T_REMOVE_VALUES"
    --+ H-ELEM-ID = 2
    ,
    setToDefault (3)
    --+ ELEM-NAME = set-To-Default
    --+ H-ELEM-NAME = "MP_T_SET_TO_DEFAULT"
    --+ H-ELEM-ID = 3
}

NoSuchAction ::= --+ CL-NAME = No-Such-Action
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_NO_SUCH_ACTION"
--+ H-CL-ID = 2042
SEQUENCE {
    managedObjectClass ObjectClass
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 1
    ,
    actionType ActionTypeId
    --+ ATTR-NAME = action-Type
    --+ H-ATTR-NAME = "MP_ACTION_TYPE"
    --+ H-ATTR-ID = 2010
    --+ ATTR-SYNTAX = 127 "Action-Type-Id"
    --+ VALUE-NUMBER = 1
}

NoSuchArgument ::= --+ CL-NAME = No-Such-Argument
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_NO_SUCH_ARGUMENT"
--+ H-CL-ID = 2044
CHOICE {
    actionId [0] IMPLICIT SEQUENCE {
        managedObjectClass ObjectClass OPTIONAL
        --+ ATTR-NAME = managed-Object-Class
        --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
        --+ H-ATTR-ID = 2057
        --+ ATTR-SYNTAX = 127 "Object-Class"
        --+ VALUE-NUMBER = 0
        ,
        actionType ActionTypeId
        --+ ATTR-NAME = action-Type
        --+ H-ATTR-NAME = "MP_ACTION_TYPE"
        --+ H-ATTR-ID = 2010
        --+ ATTR-SYNTAX = 127 "Action-Type-Id"
        --+ VALUE-NUMBER = 1
    }
    --+ ATTR-NAME = action-Id
    --+ H-ATTR-NAME = "MP_ACTION_ID"
    --+ H-ATTR-ID = 2004
    --+ ATTR-SYNTAX = 127 "No-Such-Action-Id"
    --+ VALUE-NUMBER = 0
    --+ CL-NAME = No-Such-Action-Id
    --+ CL-TYPE = 3
    --+ H-CL-NAME = "OMP_O_MP_C_NO_SUCH_ACTION_ID"
    --+ H-CL-ID = 2043
    ,
    eventId [1] IMPLICIT SEQUENCE {
        managedObjectClass ObjectClass OPTIONAL
        --+ ATTR-NAME = managed-Object-Class
        --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
        --+ H-ATTR-ID = 2057
        --+ ATTR-SYNTAX = 127 "Object-Class"
        --+ VALUE-NUMBER = 0
        ,
        eventType EventTypeId
        --+ ATTR-NAME = event-Type
        --+ H-ATTR-NAME = "MP_EVENT_TYPE"
        --+ H-ATTR-ID = 2041
        --+ ATTR-SYNTAX = 127 "Event-Type-Id"
        --+ VALUE-NUMBER = 1
    }
}
--+ ATTR-NAME = event-Id

```

```

        --+ H-ATTR-NAME = "MP_EVENT_ID"
        --+ H-ATTR-ID = 2036
        --+ ATTR-SYNTAX = 127 "No-Such-Event-Id"
        --+ VALUE-NUMBER = 0
        --+ CL-NAME = No-Such-Event-Id
        --+ CL-TYPE = 3
        --+ H-CL-NAME = "OMP_O_MP_C_NO_SUCH_EVENT_ID"
        --+ H-CL-ID = 2045
    }
}

NoSuchEventType ::= --+ CL-NAME = No-Such-Event-Type
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_NO_SUCH_EVENT_TYPE"
--+ H-CL-ID = 2046
SEQUENCE { managedObjectClass ObjectClass
    --+ ATTR-NAME = managed-Object-Class
    --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
    --+ H-ATTR-ID = 2057
    --+ ATTR-SYNTAX = 127 "Object-Class"
    --+ VALUE-NUMBER = 1
    ,
    eventType EventTypeId
    --+ ATTR-NAME = event-Type
    --+ H-ATTR-NAME = "MP_EVENT_TYPE"
    --+ H-ATTR-ID = 2041
    --+ ATTR-SYNTAX = 127 "Event-Type-Id"
    --+ VALUE-NUMBER = 1
}

-- ADDED to allow support for allomorphic Notifications
-- The first production is used by the Infrastructure to parse the
-- notification as a complete unit. This gets around the resolution
-- of the argument to EventReportArgument in the ROIV production.
-- The second production is used in the place of EventReportArgument
-- when applications wish to emit notifications
Notification ::= [1] IMPLICIT SEQUENCE
{ invokeID      InvokeIDType,
  linked-ID    [0] IMPLICIT InvokeIDType OPTIONAL,
  operation-value Operation,
  argument      NotificationArg
}

NotificationArg ::= SEQUENCE
{
  allomorphs SET OF ObjectClass OPTIONAL,
  managedObjectClass ObjectClass,
  managedObjectInstance ObjectInstance,
  eventTime [5] IMPLICIT GeneralizedTime OPTIONAL,
  eventType EventTypeId,
  eventInfo [8] ANY DEFINED BY eventType
  --% ANY_TABLE_REF (NotificationInfoTableMod.NotificationTypes) %-- OPTIONAL
}
-- End of Notification addition

-- This is actually a CHOICE of OBJECT IDENTIFIER or INTEGER
-- but we only support OBJECT IDENTIFIER, so the syntax was simplified
-- to shorten the strings at the API
ObjectClass ::= [0] IMPLICIT OBJECT IDENTIFIER
-- This [Recommendation | part of ISO/IEC 9596] does not allocate any values for
-- localForm.
-- Where this alternative is used, the permissible values for the integers
-- and their meanings shall be defined as part of the application context
-- in which they are used.

ObjectInstance ::= --+ CL-NAME = Object-Instance
--+ CL-TYPE = 0
--+ H-CL-NAME = "OMP_O_MP_C_OBJECT_INSTANCE"
--+ H-CL-ID = 2048
CHOICE { distinguishedName [2] IMPLICIT DistinguishedName
    --+ ATTR-NAME = distinguished-Name
    --+ H-ATTR-NAME = "MP_DISTINGUISHED_NAME"
    --+ H-ATTR-ID = 2031
    --+ ATTR-SYNTAX = 127 "DS-DN"
    --+ VALUE-NUMBER = 0
    ,
    nonSpecificForm [3] IMPLICIT OCTET STRING
    --+ ATTR-NAME = non-Specific-Form
    --+ H-ATTR-NAME = "MP_NON_SPECIFIC_FORM"
    --+ H-ATTR-ID = 2063
    --+ ATTR-SYNTAX = 4
    --+ VALUE-NUMBER = 0
    ,
    localDistinguishedName [4] IMPLICIT RDNSSequence
    --+ ATTR-NAME = local-DN
    --+ H-ATTR-NAME = "MP_LOCAL_DN"
    --+ H-ATTR-ID = 2055
    --+ ATTR-SYNTAX = 127 "DS-DN"
    --+ VALUE-NUMBER = 0
}

```

```

-- localDistinguishedName is that portion of the distinguished name that is
-- necessary to unambiguously identify the managed object within the context
-- of communication between the open systems

ProcessingFailure ::= --+ CL-NAME = Processing-Failure
                    --+ CL-TYPE = 3
                    --+ H-CL-NAME = "OMP_O_MP_C_PROCESSING_FAILURE"
                    --+ H-CL-ID = 2049
                    SEQUENCE { managedObjectClass ObjectClass
                                --+ ATTR-NAME = managed-Object-Class
                                --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
                                --+ H-ATTR-ID = 2057
                                --+ ATTR-SYNTAX = 127 "Object-Class"
                                --+ VALUE-NUMBER = 1
                                ,
                                managedObjectInstance ObjectInstance OPTIONAL
                                --+ ATTR-NAME = managed-Object-Instance
                                --+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
                                --+ H-ATTR-ID = 2058
                                --+ ATTR-SYNTAX = 127 "Object-Instance"
                                --+ VALUE-NUMBER = 0
                                ,
                                specificErrorInfo [5] SpecificErrorInfo
                                --+ ATTR-NAME = specific-Error-Info
                                --+ H-ATTR-NAME = "MP_SPECIFIC_ERROR_INFO"
                                --+ H-ATTR-ID = 2075
                                --+ ATTR-SYNTAX = 127 "Specific-Error-Info"
                                --+ VALUE-NUMBER = 1
                                }

Scope ::= --+ CL-NAME = Scope
          --+ CL-TYPE = 0
          --+ H-CL-NAME = "OMP_O_MP_C_SCOPE"
          --+ H-CL-ID = 2050
          CHOICE { basicScope INTEGER --+ VL-NAME = Scope
                  { baseObject (0)
                    --+ ELEM-NAME = base-Object
                    --+ H-ELEM-NAME = "MP_T_BASE_OBJECT"
                    --+ H-ELEM-ID = 0
                    ,
                    firstLevelOnly (1)
                    --+ ELEM-NAME = first-Level-Only
                    --+ H-ELEM-NAME = "MP_T_FIRST_LEVEL_ONLY"
                    --+ H-ELEM-ID = 1
                    ,
                    wholeSubtree (2)
                    --+ ELEM-NAME = whole-Subtree
                    --+ H-ELEM-NAME = "MP_T_WHOLE_SUBTREE"
                    --+ H-ELEM-ID = 2
                    }
                  --+ ATTR-NAME = named-Numbers
                  --+ H-ATTR-NAME = "MP_NAMED_NUMBERS"
                  --+ H-ATTR-ID = 2061
                  --+ ATTR-SYNTAX = 10 "Scope"
                  --+ VALUE-NUMBER = 0
                  ,
                  individualLevels [1] IMPLICIT INTEGER
                  -- POSITIVE integer that indicates the level to be selected
                  --+ ATTR-NAME = individual-Levels
                  --+ H-ATTR-NAME = "MP_INDIVIDUAL_LEVELS"
                  --+ H-ATTR-ID = 2051
                  --+ ATTR-SYNTAX = 2
                  --+ VALUE-NUMBER = 0
                  ,
                  baseToNthLevel [2] IMPLICIT INTEGER
                  -- POSITIVE integer that indicates the range of levels (0-N) is to be selected
                  --+ ATTR-NAME = base-To-Nth-Level
                  --+ H-ATTR-NAME = "MP_BASE_TO_NTH_LEVEL"
                  --+ H-ATTR-ID = 2025
                  --+ ATTR-SYNTAX = 2
                  --+ VALUE-NUMBER = 0
                  }
          }

-- with individualLevels and baseToNthLevel, a value of 0 has the same semantics
-- as baseObject
-- with individualLevels, a value of 1 has the same semantics as firstLevelOnly

SetArgument ::= --+ SUPER-CLASS = Set-Argument
               --+ CL-NAME = CMIS-Set-Argument
               --+ CL-TYPE = 3
               --+ H-CL-NAME = "OMP_O_MP_C_CMIS_SET_ARGUMENT"
               --+ H-CL-ID = 2027
               SEQUENCE { baseManagedObjectClass ObjectClass
                         --+ ATTR-NAME = base-Managed-Object-Class
                         --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_CLASS"
                         --+ H-ATTR-ID = 2023
                         --+ ATTR-SYNTAX = 127 "Object-Class"
                         --+ VALUE-NUMBER = 1

```



```

    ,
    baseManagedObjectInstance ObjectInstance
    --+ ATTR-NAME = base-Managed-Object-Instance
    --+ H-ATTR-NAME = "MP_BASE_MANAGED_OBJECT_INSTANCE"
    --+ H-ATTR-ID = 2024
    --+ ATTR-SYNTAX = 127 "Object-Instance"
    --+ VALUE-NUMBER = 1

    ,
    accessControl [5] AccessControl OPTIONAL
    --+ ATTR-NAME = access-Control1
    --+ H-ATTR-NAME = "MP_ACCESS_CONTROL"
    --+ H-ATTR-ID = 1001
    --+ ATTR-SYNTAX = 127 "Access-Control1"
    --+ VALUE-NUMBER = 0

    ,
    synchronization [6] IMPLICIT CMISync DEFAULT bestEffort
    --+ ATTR-NAME = synchronization
    --+ H-ATTR-NAME = "MP_SYNCHRONIZATION"
    --+ H-ATTR-ID = 2080
    --+ ATTR-SYNTAX = 10 "CMIS-Sync"
    --+ VALUE-NUMBER = 0

    ,
    scope [7] Scope DEFAULT basicScope : baseObject
    --+ ATTR-NAME = scope
    --+ H-ATTR-NAME = "MP_SCOPE"
    --+ H-ATTR-ID = 2070
    --+ ATTR-SYNTAX = 127 "Scope"
    --+ VALUE-NUMBER = 0

    ,
    filter CMISFilter DEFAULT and:({
    --+ ATTR-NAME = filter
    --+ H-ATTR-NAME = "MP_FILTER"
    --+ H-ATTR-ID = 2043
    --+ ATTR-SYNTAX = 127 "CMIS-Filter"
    --+ VALUE-NUMBER = 0

    ,
    modificationList [12] IMPLICIT SET OF
    --+ CL-NAME = Modification
    --+ CL-TYPE = 3
    --+ H-CL-NAME = "OMP_O_MP_C_MODIFICATION"
    --+ H-CL-ID = 2040
    SEQUENCE { modifyOperator [2]
    IMPLICIT ModifyOperator DEFAULT replace
    --+ ATTR-NAME = modify-Operator
    --+ H-ATTR-NAME = "MP_MODIFY_OPERATOR"
    --+ H-ATTR-ID = 2060
    --+ ATTR-SYNTAX = 10 "Modify-Operator"
    --+ VALUE-NUMBER = 0

    ,
    attributeId AttributeId
    --+ ATTR-NAME = attribute-Id
    --+ H-ATTR-NAME = "MP_ATTRIBUTE_ID"
    --+ H-ATTR-ID = 2017
    --+ ATTR-SYNTAX = 127 "Attribute-Id"
    --+ VALUE-NUMBER = 1

    ,
    attributeValue ANY DEFINED BY attributeId
    --% ANY_TABLE_REF(AttributeTableMod.AttributeTypes)
    %-- OPTIONAL -- absent for setToDefault
    --+ ATTR-NAME = attribute-Value
    --+ H-ATTR-NAME = "MP_ATTRIBUTE_VALUE"
    --+ H-ATTR-ID = 2022
    --+ ATTR-SYNTAX = 8
    --+ VALUE-NUMBER = 0
    }
    --+ ATTR-NAME = modification-List
    --+ H-ATTR-NAME = "MP_MODIFICATION_LIST"
    --+ H-ATTR-ID = 2059
    --+ ATTR-SYNTAX = 127 "Modification"
    --+ VALUE-NUMBER = 2
    }

SetInfoStatus ::= --+ CL-NAME = Set-Info-Status
    --+ CL-TYPE = 0
    --+ H-CL-NAME = "OMP_O_MP_C_SET_INFO_STATUS"
    --+ H-CL-ID = 2051
    CHOICE { attributeError [0] IMPLICIT AttributeError
    --+ ATTR-NAME = attribute-Error
    --+ H-ATTR-NAME = "MP_ATTRIBUTE_ERROR"
    --+ H-ATTR-ID = 2016
    --+ ATTR-SYNTAX = 127 "Attribute-Error"
    --+ VALUE-NUMBER = 0

    ,
    attribute [1] IMPLICIT Attribute
    --+ ATTR-NAME = attribute
    --+ H-ATTR-NAME = "MP_ATTRIBUTE"
    --+ H-ATTR-ID = 2015
    --+ ATTR-SYNTAX = 127 "Attribute"
    --+ VALUE-NUMBER = 0
    }

```

```

SetListError::= --+ SUPER-CLASS = Set-List-Error
--+ CL-NAME = CMIS-Set-List-Error
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_SET_LIST_ERROR"
--+ H-CL-ID = 2028
SEQUENCE { managedObjectClass ObjectClass OPTIONAL
--+ ATTR-NAME = managed-Object-Class
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
--+ H-ATTR-ID = 2057
--+ ATTR-SYNTAX = 127 "Object-Class"
--+ VALUE-NUMBER = 0
,
managedObjectInstance ObjectInstance OPTIONAL
--+ ATTR-NAME = managed-Object-Instance
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
--+ H-ATTR-ID = 2058
--+ ATTR-SYNTAX = 127 "Object-Instance"
--+ VALUE-NUMBER = 0
,
currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
--+ ATTR-NAME = current-Time
--+ H-ATTR-NAME = "MP_CURRENT_TIME"
--+ H-ATTR-ID = 2027
--+ ATTR-SYNTAX = 24
--+ VALUE-NUMBER = 0
,
setInfoList [6] IMPLICIT SET OF SetInfoStatus
--+ ATTR-NAME = set-Info-List
--+ H-ATTR-NAME = "MP_SET_INFO_LIST"
--+ H-ATTR-ID = 2071
--+ ATTR-SYNTAX = 127 "Set-Info-Status"
--+ VALUE-NUMBER = 3
}

SetResult::= --+ SUPER-CLASS = Set-Result
--+ CL-NAME = CMIS-Set-Result
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_CMIS_SET_RESULT"
--+ H-CL-ID = 2029

SEQUENCE { managedObjectClass ObjectClass OPTIONAL
--+ ATTR-NAME = managed-Object-Class
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_CLASS"
--+ H-ATTR-ID = 2057
--+ ATTR-SYNTAX = 127 "Object-Class"
--+ VALUE-NUMBER = 0
,
managedObjectInstance ObjectInstance OPTIONAL
--+ ATTR-NAME = managed-Object-Instance
--+ H-ATTR-NAME = "MP_MANAGED_OBJECT_INSTANCE"
--+ H-ATTR-ID = 2058
--+ ATTR-SYNTAX = 127 "Object-Instance"
--+ VALUE-NUMBER = 0
,
currentTime [5] IMPLICIT GeneralizedTime OPTIONAL
--+ ATTR-NAME = current-Time
--+ H-ATTR-NAME = "MP_CURRENT_TIME"
--+ H-ATTR-ID = 2027
--+ ATTR-SYNTAX = 24
--+ VALUE-NUMBER = 0
,
attributeList [6] IMPLICIT SET OF Attribute OPTIONAL
--+ ATTR-NAME = attribute-List
--+ H-ATTR-NAME = "MP_ATTRIBUTE_LIST"
--+ H-ATTR-ID = 2021
--+ ATTR-SYNTAX = 127 "Attribute"
--+ VALUE-NUMBER = 2
}

SpecificErrorInfo::= --+ CL-NAME = Specific-Error-Info
--+ CL-TYPE = 3
--+ H-CL-NAME = "OMP_O_MP_C_SPECIFC_ERROR_INFO"
--+ H-CL-ID = 2052
SEQUENCE { errorId OBJECT IDENTIFIER
--+ ATTR-NAME = error-Id
--+ H-ATTR-NAME = "MP_ERROR_ID"
--+ H-ATTR-ID = 2033
--+ ATTR-SYNTAX = 6
--+ VALUE-NUMBER = 1
,
errorInfo ANY DEFINED BY errorId --% ANY_TABLE_REF(ParameterTableMod.
ParameterTypes)
--+ ATTR-NAME = error-Info
--+ H-ATTR-NAME = "MP_ERROR_INFO"
--+ H-ATTR-ID = 2034
--+ ATTR-SYNTAX = 8
--+ VALUE-NUMBER = 1
}

```

```
}
```

```
END -- CMIP definitions
```



---

## Appendix C. Error codes sent by CMIP services

This appendix includes descriptions of error codes from ACYAPHDH, which is shipped in the AMACLIB data set of the SYS1.MACLIB data set. These errors can be received in the following:

- MIB.ServiceError strings
- CMER VTAM internal trace (VIT) entries

---

### MIB.ServiceError error codes

These errors can be received in MIB.ServiceError strings.

---

**0** (Indicates success.)

**Explanation:** This is used to denote normal, correct processing.

**Programmer response:** None, everything is working correctly.

---

**7** MB\_ERR\_ALLOC

**Explanation:** An attempt was made to allocate memory for the processing of a message. The operating system returned an error. The platform will halt processing of this message and attempt to recover. This message will be lost. If the condition was transient, all later messages may work correctly.

**Programmer response:** This should occur only if the system is reaching a private or common storage area (CSA) storage limit. If this is encountered and does not seem to be transient, you will need to increase the limit causing the problem. If this error is received by the application program from an API function and there is a corresponding REQS record in the VIT with a nonzero return code, the LPBUF pool is not large enough and should be increased.

---

**8** PROGRAM\_CHECK

**Explanation:** A condition that should not be able to happen has occurred.

**Programmer response:** Call IBM Service. Please provide the error log and as much information about what was being processed as possible. This includes:

- The trace, if one exists
- The message being processed
- The set of instantiated objects
- The list of associations
- The set of outstanding CMIP operations

---

**250** AUTHENTICATION\_FAILED

**Explanation:** The association could not be established because of security.

**Programmer response:** Consult the directory definition file on both systems to resolve inconsistencies.

---

**251** AUTHENTICATION\_INFO\_MISSING

**Explanation:** Either data encryption standard (DES) based security or application-program-to-application-program security is required. The association could not be established because of security.

---

---

**252 AUTHENTICATION\_MECH\_UNKNOWN**

**Explanation:** There is a mismatch in the ASN.1 for the association request between the two systems.

**Programmer response:** Call IBM Service.

---

**300 BER\_BAD\_TYPE**

**Explanation:** The encode/decode functions of CMIP services were called to parse a message. They were told to parse it using the syntax defined as an identified module and type. The module is one that is loaded, the type name is not.

**Programmer response:** If the message being processed is a CMIP message, and the application program uses only MIBSendCmipRequest and MIBSendCmipResponse, call IBM Service. If the message being parsed was one that was passed to the platform with MIBSendServiceRequest or MIBSendRequest, correct the type name in the message to be one that is contained in the indicated module.

---

**301 BER\_BAD\_MODULE**

**Explanation:** The encode/decode functions of CMIP services were called to parse a message. They were told to parse it using the syntax defined as an identified module and type. The module is one that is not loaded.

**Programmer response:** If the message being processed is a CMIP message, and the application program uses only MIBSendCmipRequest and MIBSendCmipResponse, call IBM Service. If the message being parsed was one that was passed to the platform with MIBSendServiceRequest or MIBSendRequest, correct the module name in the message.

---

**302 BER\_NULL\_TYPE**

**Explanation:** The portion of CMIP services that calls the encode/decode functions passed in a NULL type name to be processed.

**Programmer response:** Call IBM Service.

---

**303 BER\_NULL\_MODULE**

**Explanation:** The portion of CMIP services that calls the encode/decode functions passed in a NULL module name to be processed.

**Programmer response:** Call IBM Service.

---

**304 BER\_NULL\_STRING**

**Explanation:** The string passed to the encode/decode component of CMIP services was NULL.

**Programmer response:** Call IBM Service

---

**305 BER\_NULL\_STRUCT**

**Explanation:** The data structure passed to the encode/decode component of CMIP services to contain the result was NULL.

**Programmer response:** Call IBM Service.

---

**306 BER\_BAD\_METATABLE**

**Explanation:** The ASN.1 data set is not correct.

**Programmer response:** Reload the ISTASN1 data set from the distribution media.

---

---

**307 BER\_UNKNOWN\_TYPE**

**Explanation:** The data type derived for a node in the tree constructed while parsing a message is unrecognized. Because these are the base types defined in ASN.1, this should not happen.

**Programmer response:** Call IBM Service.

---

**308 BER\_UNKNOWN\_MEMBER**

**Explanation:** While processing a SET or SEQUENCE, the encode/decode component of CMIP services encountered an element that did not belong in the SET or SEQUENCE.

**Programmer response:** If this occurred while processing a string value generated by the application, correct the application program to send a valid value. If this occurred while processing a received BER buffer from a peer entity, the syntaxes on the two systems do not match. You will need to analyze the differences, determine which version is correct and load the corrected syntaxes on one or both systems.

---

**309 BER\_UNKNOWN\_ALTERNATIVE**

**Explanation:** While processing a CHOICE, the encode/decode component of CMIP services encountered an element that did not represent one of the valid alternatives for the CHOICE.

**Programmer response:** If this occurred while processing a string value generated by the application, correct the application program to send a valid value. If this occurred while processing a received BER buffer from a peer entity, the syntaxes on the two systems do not match. You will need to analyze the differences, determine which version is correct and load the corrected syntaxes on one or both systems.

---

**310 BER\_NO\_END\_PARENTHESIS**

**Explanation:** While parsing the string message from an application program CMIP services determined that there should have been a closing parenthesis at the indicated location in the string. This represents the end of a SET, SEQUENCE or CHOICE.

**Programmer response:** Correct the string message.

---

**311 BER\_NO\_START\_PARENTHESIS**

**Explanation:** While parsing the string message from an application program CMIP services determined that there should have been an opening parenthesis at the indicated location in the string. This represents the beginning of a SET, SEQUENCE or CHOICE.

**Programmer response:** Correct the string message.

---

**312 BER\_NO\_MORE\_STRING**

**Explanation:** Additional information was expected in the string buffer. The buffer terminated prematurely. There were either missing mandatory elements or (at least) some missing closing parentheses in the string.

**Programmer response:** Correct the string value.

---

**313 BER\_PARSE\_ERROR**

**Explanation:** An error occurred during the parsing of the message. The message is invalid. This error is only issued when no more specific error is encountered.

**Programmer response:** Correct the string value.

---

**314 BER\_IMPLICIT\_CHOICE**

**Explanation:** While parsing the string message the encode/decode component of CMIP services encountered an IMPLICIT CHOICE. This is not legal in ASN.1. This should have been caught and converted to an EXPLICIT CHOICE by the ASN.1 compiler.

**Programmer response:** Correct the string value.

---

---

**315 BER\_CANNOT\_RESOLVE**

**Explanation:** An ANY DEFINED BY was encountered for which an ANY TABLE was defined. This table defines all of the values that will be understood for ANY DEFINED BY resolution. The table did not include the value provided.

**Programmer response:** Correct the value in the string or add the value to the ANY DEFINED BY table.

---

**316 BER\_NEED\_LABEL**

**Explanation:** Either a CHOICE was encountered where the user tried to omit the label of the chosen alternative, or a SET was encountered in which the user failed to specify the label of an element. Both of these require labels in order to provide unambiguous resolution of the string.

**Programmer response:** Add the required label to the string.

---

**317 BER\_MISSING\_MEMBER**

**Explanation:** A mandatory element was omitted from a SET or SEQUENCE, or the label for the mandatory element was misspelled.

**Programmer response:** Correct the string.

---

**319 BER\_NO\_PARENT**

**Explanation:** In order to resolve an ANY DEFINED BY it is necessary to find the element of the syntax that contains the value to be used to do the resolution. Because ASN.1 requires that this be a mandatory member of the same SEQUENCE, the parsing code goes to the “parent” of the ANY DEFINED BY and searches for the resolution node. The ANY DEFINED BY did not contain a valid reference to a parent.

**Programmer response:** Call IBM Service.

---

**320 BER\_BAD\_DN\_PARSE**

**Explanation:** While parsing a DistinguishedName some kind of error occurred. This error will be logged before the log of BER\_BAD\_DN\_PARSE. This error serves to narrow the investigation to a DN if the problem is difficult to isolate.

**Programmer response:** See the previously logged errors and fix the error in the syntax of the name.

---

**321 BER\_BAD\_RESOLUTION\_NODE**

**Explanation:** There are only two data types that can be used to provide resolution for an ANY DEFINED BY. These are INTEGER and OBJECT IDENTIFIER. A case was found while processing this message where the element of the syntax being used for ANY DEFINED BY resolution was another data type.

**Programmer response:** Correct the syntax of the resolution node in the ASN.1 syntax. If the syntax is determined to be correct, call IBM Service.

---

**322 BER\_MISSING\_RESOLUTION\_NODE**

**Explanation:** An ANY DEFINED BY was encountered while processing the message that does not reference an ANY TABLE to allow resolution of data types. If the message is being decoded, any application program to which the message is sent will receive the contents of this ANY DEFINED BY in BER. This is probably not what the application program s are expecting.

**Programmer response:** Add an ANY TABLE REF and ANY TABLE to this syntax in the ASN.1.

---

**323 BER\_LABEL\_MISMATCH**

**Explanation:** The string being parsed by the encode/decode component of CMIP services contains an initial label that does not match any of the possible initial labels for the module.type being parsed.

**Programmer response:** Correct the string.

---



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**325 BER\_NOT\_BOOLEAN**

**Explanation:** The accepted BOOLEAN values are 'TRUE', 'true', 'FALSE', 'false' and any ASN.1 value references that are defined to be BOOLEAN values.

**Programmer response:** Correct the value in the string.

---

**326 BER\_NOT\_INTEGER**

**Explanation:** The accepted INTEGER values are composed of digits optionally prepended with a '+' or '-' sign character, or a defined ASN.1 value reference.

**Programmer response:** Correct the value in the string.

---

**327 BER\_NOT\_REAL**

**Explanation:** The syntax expected for a REAL value is exactly the syntax accepted by the C standard function scanf using the format string "%lg". Anything else will be rejected.

**Programmer response:** Correct the value in the string.

---

**328 BER\_NOT\_NULL**

**Explanation:** The accepted NULL values are 'NULL', 'null' or a defined ASN.1 value reference to a value of type NULL.

**Programmer response:** Correct the value in the string.

---

**329 BER\_NOT\_BIT\_STRING**

**Explanation:** The accepted BIT STRING values are composed of zero or more '1' and '0' characters or a value reference to a value of the type BIT STRING.

**Programmer response:** Correct the value in the string.

---

**330 BER\_NOT\_HEX\_STRING**

**Explanation:** The value being parsed as an OCTET STRING was composed of characters other than legal hexadecimal digits so it was assumed to be a value reference. The value reference was not found.

**Programmer response:** Correct the value in the string.

---

**331 BER\_BAD\_HEX\_STRING**

**Explanation:** The value specified for an OCTET STRING was not a legal value. It must be an even number of hex digits.

**Programmer response:** Correct the value in the string.

---

**332 BER\_NOT\_OI**

**Explanation:** The value encountered for an OBJECT IDENTIFIER does not conform to the dotted-decimal notation and is not a value reference. All values for OBJECT IDENTIFIERS must be composed of digits and periods, and they must contain at least 2 components. Legal values: '1.3.18.0.2.4.5', '1.2' Illegal values: '1', 'joint-iso-ccitt.9.3.2.7.4'

**Programmer response:** Correct the value in the string.

---

**333 BER\_BAD\_TIME**

**Explanation:** If a string is being processed, the value specified did not conform to the format specified for times in the string API documentation. If a BER-encoded buffer is being processed, the value does not represent a valid time in BER format.

**Programmer response:** Correct the value in the string.

---

---

**334 BER\_BAD\_ENUMERATED**

**Explanation:** The value encountered was not a valid ENUMERATED.

**Programmer response:** If the value being processed is a string, correct the string. If the value is a BER buffer, the syntaxes understood by the two systems are different. Align the syntax definitions on the two systems.

---

**335 BER\_BAD\_PRINTABLE\_STRING**

**Explanation:** The value encountered was defined to be a PrintableString. It contained characters that are not allowed in the specification of the PrintableString type. The allowed values for Printable string are:

A-Z, a-z, 0-9, space, '\', '(', '0', '+',  
, '!', '-', '.', '/', ':', '=', and '?'

**Programmer response:** Correct the value to be a valid PrintableString.

---

**336 BER\_BAD\_NUMERIC\_STRING**

**Explanation:** The value encountered was not a valid NumericString. NumericStrings can only contain digits and spaces.

**Programmer response:** Correct the value to be a valid NumericString.

---

**337 BER\_BAD\_VISIBLE\_STRING**

**Explanation:** The value encountered was defined to be of type VisibleString. It contained one or more characters that are not allowed in this data type. The allowed characters are: A-Z, a-z, space and punctuation.

**Programmer response:** Correct the value to be a valid VisibleString.

---

**338 BER\_BAD\_GRAPHIC\_STRING**

**Explanation:** The value encountered for a GraphicString contained a character that is not presently supported by CMIP services for GraphicString. At the present time the platform only supports the printable characters in a normal ASCII character set.

**Programmer response:** Correct the value to be within the set supported by the platform.

---

**339 BER\_BAD\_GENERAL\_STRING**

**Explanation:** The value encountered was not a valid general string.

**Programmer response:** Correct the value.

---

**340 BER\_BAD\_IA5\_STRING**

**Explanation:** The value encountered was not a valid IA5 string.

**Programmer response:** Correct the value.

---

**341 BER\_DUPLICATE\_MEMBER**

**Explanation:** A SET is allowed to contain each element only once. While parsing the message a member was found twice in the SET.

**Programmer response:** Correct the value to include only one occurrence of each member in the SET.

---

**343 BER\_NOT\_STRAIGHT\_BER**

**Explanation:** Encoding an ANY is impossible with only the information in the metadata. It might contain a value of literally any type - each of which would be encoded differently. The ANY type is deprecated and should not be used.

**Programmer response:** Change the syntax to an ANY DEFINED BY if possible. Avoid the use of the syntax. If you

must flow a value of this syntax, it must be provided in BER format. The BER format is an even number of hex digits surrounded by <>.

---

#### 344 BER\_UNRESOLVED\_EXTERNAL

**Explanation:** An imported symbol was not found in the ASN.1 while processing a message. This will not be the case if CMIP services is initialized normally (all syntaxes are checked for completeness when the platform is initialized if they are contained in the normal set). If you added syntaxes to the user syntax section of the presentation initialization file, there may be unresolved externals. These will have been indicated by a warning message when the platform was started. If you have added syntaxes after initialization, these may not have been complete.

**Programmer response:** Load additional syntaxes.

---

#### 345 BER\_STILL\_MORE\_STRING

**Explanation:** After parsing a message using the syntax information loaded, there was extra data in the buffer. The buffer must include exactly one syntactic construct - a complete message and no more. This will often happen if a string value includes too many closing parentheses at the end.

**Programmer response:** If this is encountered in string processing, correct the string. If it is encountered while decoding a BER buffer, the syntaxes understood by the two systems is different. Align the syntaxes.

---

#### 347 BER\_DUP\_MODULE

**Explanation:** The ASN.1 module you attempted to load is a duplicate of one already loaded. The name of the file that contained the duplicate module will be traced.

**Programmer response:** Reload the ISTASN1 data set from the distribution media.

---

#### 348 BER\_UNRESOLVED\_MODULE\_REF

**Explanation:** While trying to resolve all of the imported symbols in the syntaxes loaded an entire module was not found. All references to it will be unresolved.

**Programmer response:** Reload the ISTASN1 data set from the distribution media.

---

#### 349 BER\_UNRESOLVED\_REF

**Explanation:** An external reference cannot be resolved in the ASN.1 syntax loaded. The module that was supposed to contain the type was found, but there was no such type name defined in the module. The list of all of the unresolved references will be written to the VTAM internal trace.

**Programmer response:** The external reference that tried to use the type is likely wrong. Verify that you are trying to use a type that is defined in the module from which you are referencing it.

---

#### 354 BER\_FAILED\_SUBTYPE

**Explanation:** The value provided was not allowed by the subtype specification.

**Programmer response:** Change the value to be one of the value allowed by the subtype.

---

#### 356 BER\_BAD\_CONSTRUCTED

**Explanation:** An element of the received BER buffer indicated in its tag that the value was a constructed value. The corresponding syntax loaded in CMIP services is a data type that cannot be constructed. These types are:

- INTEGER
- ENUMERATED
- BOOLEAN
- NULL

**Programmer response:** Align the syntaxes in use by the peer systems.

---

**357 BER\_BAD\_PRIMITIVE**

**Explanation:** The value in the BER buffer for an explicit tag is encoded as a primitive type. It is not possible to have an explicit tag that is primitive because it must contain the other tag and a value.

**Programmer response:** Align the syntaxes in use by the peer systems. Fix the peer system's encoding for explicit tags.

---

**358 BER\_BAD\_INITIAL\_OCTET**

**Explanation:** The first octet of a BER buffer received from a peer application program is not correct. It does not represent a valid value for the data type being decoded.

**Programmer response:** Align the syntaxes in use by the peer systems. It may be that the peer sent a message that is valid, but not within the scope of CMIP services.

---

**359 BER\_BAD\_BOOLEAN**

**Explanation:** A value received from a peer application program was being decoded as a BOOLEAN type. Its length was not 1 octet, which is required by BER.

**Programmer response:** Align the syntaxes used by the peer application programs. Correct the encoding performed by the peer system.

---

**360 BER\_BAD\_OI**

**Explanation:** An OI value contained in a message being processed by the encode/decode component of CMIP services is not valid. If the message being processed is a string message from an application program the OI is not a legal dotted-decimal value. If the message is a BER buffer from a peer application program we have to trust the peer to have encoded a valid OI (it is only bits, after all). If this happens it will be preceded by one of two messages. One (PROGRAM\_CHECK) indicates that the peer sent us an OI that will take more than 300 bytes to store in the string form. The other (MALLOC\_ERROR) indicates we could not allocate memory.

**Programmer response:** If the message was a string message, fix the value. If a MALLOC\_ERROR happened, solve that problem. If you need to encode OIs that will be longer than 300 bytes in string form, call IBM Service.

---

**361 BER\_BAD\_NULL**

**Explanation:** A value for the type NULL contained in the BER buffer is not valid. The length is not zero. The peer system is not encoding values correctly or the syntaxes understood by the two systems are not the same.

**Programmer response:** Align the syntaxes. If they are already aligned correct the peer application.

---

**362 BER\_EMPTY\_BIT\_STRING**

**Explanation:** A received BER buffer contained a BIT STRING of length zero. The peer system is not encoding values correctly or the syntaxes understood by the two systems are not the same.

**Programmer response:** Align the syntaxes. If they are already aligned correct the peer application program.

---

**363 BER\_BAD\_PARAMETERS**

**Explanation:** The encode/decode functions in CMIP services were called with an invalid parameter.

**Programmer response:** Call IBM Service.

---

**375 RDN\_SEP\_AT\_BEGIN\_OF\_DN**

**Explanation:** An RDN separator (;) was found at the beginning of a short-form DN.

**Programmer response:** Correct the first character of the short-form DN.

---

---

**376 AVA\_SEP\_AT\_BEGIN\_OF\_DN**

**Explanation:** An AVA separator (=) was found at the beginning of a short-form DN.

**Programmer response:** Correct the first character of the short-form DN.

---

**377 SPACE\_AT\_BEGIN\_OF\_DN**

**Explanation:** A space was encountered at the beginning of a short-form DN. A short-form DN must begin with an OBJECT IDENTIFIER or a value reference (a label).

**Programmer response:** Correct the first character of the short-form DN.

---

**378 INVALID\_CHAR\_AT\_BEGIN\_OF\_DN**

**Explanation:** An invalid character was found at the beginning of a short-form DN. The first character of the short-form DN was not a digit, an alphabetic character, an RDN separator (;), an AVA separator (=), or a space.

**Programmer response:** Correct the first character of the short-form DN.

---

**379 RDN\_SEP\_AT\_BEGIN\_OF\_RDN**

**Explanation:** An RDN separator (;) was found at the beginning of an RDN.

**Programmer response:** Correct the value of the short-form DN.

---

**380 AVA\_SEP\_AT\_BEGIN\_OF\_RDN**

**Explanation:** An AVA separator (=) was found at the beginning of an RDN.

**Programmer response:** Correct the value of the short-form DN.

---

**381 SPACE\_AT\_BEGIN\_OF\_RDN**

**Explanation:** A space was found at the beginning of an RDN while parsing a short-form DN.

**Programmer response:** Correct the value of the short-form DN.

---

**382 INVALID\_CHAR\_AT\_BEGIN\_OF\_RDN**

**Explanation:** There is an invalid character at the beginning of an RDN in a short-form DN.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**383 INVALID\_ALPHA\_IN\_INTEGER\_VALUE**

**Explanation:** An alphabetic character was found while processing an INTEGER form attribute type in a short-form DN.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**384 INVALID\_SPACE\_IN\_INTEGER\_VALUE**

**Explanation:** A space was found while processing an INTEGER form attribute type in a short-form DN.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**385 INVALID\_CHAR\_IN\_INTEGER\_VALUE**

**Explanation:** An invalid character was found while processing an INTEGER form attribute type in a short-form DN. This character was not an alphabetic character, a space or an AVA separator (an equals sign).

**Programmer response:** Correct the attribute type in the short-form DN.

---

---

**386**      **INVALID\_SPACE\_IN\_OI\_VALUE**

**Explanation:** While parsing the attribute type in a short-form DN a space was encountered. The only valid characters are digits and period.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**387**      **INVALID\_CHAR\_IN\_OI\_VALUE**

**Explanation:** While parsing the attribute type in a short-form DN an invalid character was encountered. The only valid characters are digits and period.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**388**      **INVALID\_SPACE\_IN\_SYMBOLIC\_VALUE**

**Explanation:** While parsing an attribute type in a short-form DN, a symbolic value was found that contains a space. The attribute type must be either a valid OBJECT IDENTIFIER value (in dotted-decimal) or a symbol reference. The attribute type MUST be immediately followed by an equals sign.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**389**      **INVALID\_CHAR\_IN\_SYMBOLIC\_VALUE**

**Explanation:** While parsing an attribute type in a short-form DN, a symbolic value was found that contains characters other than letters and digits. It is possible that the attribute type was supposed to be an OBJECT IDENTIFIER, but its first character was a letter so it was interpreted as a symbolic value.

**Programmer response:** Correct the attribute type in the short-form DN.

---

**390**      **INVALID\_CHAR\_IN\_ATTR\_VALUE**

**Explanation:** One of the two following errors occurred while parsing a short-form DN: a character other than the RDN separator (semi-colon) was found after close quote. A non-printable character was found in a value.

**Programmer response:** Correct the value for the short-form DN.

---

**391**      **INVALID\_SPACE\_IN\_ATTR\_VALUE**

**Explanation:** A value portion of an RDN in the short-form DN contained a space and the value was not surrounded by quotes. This is ambiguous; the platform does not know whether the space is part of the value, or merely white space.

**Programmer response:** Correct the value of the short-form DN by eliminating the space or surrounding the value in quotes.

---

**392**      **PREMATURE\_END\_OF\_DN**

**Explanation:** A short-form DN value was incompletely specified. A short-form DN must be composed of complete RDNs. Each RDN must include a type (OI), an equals sign and a value. This may have occurred because of a dangling semicolon at the end of the name, or it may be because of an RDN with a type but no value.

**Programmer response:** Correct the value of the short-form name.

---

**393**      **INVALID\_SPACE\_AT\_END\_OF\_RDN**

**Explanation:** While parsing a short-form DN, CMIP services found a space immediately following the RDN separator (the semi-colon). This is not allowed. This must be the beginning of the next object identifier and object identifiers cannot contain spaces.

**Programmer response:** Correct the name value by deleting any spaces in the OI portions of all RDNs.

---

---

**394 BOTH\_QUOTE\_TYPES\_USED**

**Explanation:** A short-form DN value was contained both kinds of quotes and the attempt to surround it with quotes (during transformation to long-form) failed.

**Programmer response:** Correct the value of the short-form name.

---

**400 REPL\_ERR\_INVLD\_VERBCODE**

**Explanation:** This indicates that a message is being passed through CMIP services which is not of a known type. In general, CMIP services expects CMIP messages or a small handful of internal utility messages. The message that CMIP services just received was not one of the types that the code can process.

**Programmer response:** Call IBM Service.

---

**401 REPL\_ERR\_MISSING\_ASN1\_TREE**

**Explanation:** This indicates that a message was received that was basically valid (i.e. CMIP services recognized the message type and a couple of header fields), but the ASN.1 parse tree (which is required for all processing) was missing from the message. Processing on this message cannot continue.

**Programmer response:** Call IBM Service.

---

**402 REPL\_ERR\_OBJCLASS\_MISSING**

**Explanation:** The object class is a required field in virtually all CMIP messages. If the CMIP message that CMIP services is processing requires an object class and one is not present, this error will be logged. The fact that a required attribute is missing should have been noticed prior to CMIP services receiving the message, therefore this indicates an internal error.

**Programmer response:** Call IBM Service.

---

**403 REPL\_ERR\_OBJCLASS\_INVALID**

**Explanation:** The value of the managed object class component in the message is not recognized as a valid value. This can either mean that the valid GDMO definition has not been loaded by CMIP services, or a truly invalid value was specified.

**Programmer response:** Correct the object class.

---

**404 REPL\_ERR\_OBJINST\_MISSING**

**Explanation:** This indicates that either a CMIP message that requires the managed object instance component did not have one, or (more likely) that a locally generated request that requires the managed object instance attribute did not specify one.

**Programmer response:** Include a valid managed object instance in the request.

---

**405 REPL\_ERR\_OBJINST\_INVALID**

**Explanation:** This indicates that the specified managed object instance is in an invalid format and could not be encoded. There are a number of cases where this can occur:

- During CMIP message processing
- During processing of a locally generated request

**Programmer response:** Verify the specified managed object instance against the associated naming rules in the name bindings used to construct the name.

---

---

**406 REPL\_ERR\_DUPLICATE\_OBJINST**

**Explanation:** This indicates that either a CMIP message was received which tried to create an instance that already exists, or a local registration was attempted for an instance that already exists.

---

**407 REPL\_ERR\_NO\_SUCH\_OBJINST**

**Explanation:** This indicates that the managed object instance specified in the CMIP message or local request could not be found in the current instance tree. This could mean that some of this instances parents were not present in the tree either.

---

**408 REPL\_ERR\_MOI\_OC\_MISMATCH**

**Explanation:** During the processing of a non-create CMIP message CMIP services determined that the managed object class specified in the message was not the actual class object identifier (2.9.3.4.3.42), nor the actual managed object class of the specified instance, nor one of the allomorphic object classes of the specified instance.

**Programmer response:** Change the original CMIP request to either 2.9.3.4.3.42 or to a correct managed object class for the specified managed object instance.

---

**409 REPL\_ERR\_NAME\_CREATE\_FAILED**

**Explanation:** An error occurred creating an object instance.

**Programmer response:** Look at CMER records in the VTAM internal trace for additional information.

---

**410 REPL\_ERR\_GDMO\_FILE\_BAD\_VERS**

**Explanation:** This indicates that CMIP services attempted to load an initialization file with a version number different from the version currently implemented in CMIP services.

**Programmer response:** Reload the ISTGDMO data set from the distribution media.

---

**411 REPL\_ERR\_NOTHING\_TO\_DELETE**

**Explanation:** This indicates that the delete was directed at a specific managed object, but that managed object (which exists) cannot be deleted for some reason. The main reasons for this are all related to name binding rules. The managed object instance may not be deleteable, or it might only be deleteable if it contains no instances (and does contain instances), or it should delete contained instances but one or more of them is not deleteable.

**Programmer response:** Verify the name binding rules for the managed object instance that was to be deleted to determine why the instance could not be deleted. You might need to specify a scope in order to delete the whole sub-tree. Perhaps you shouldn't be attempting to delete this instance at all.

---

**412 REPL\_WRN\_OBJCLASS**

**Explanation:** This indicates that one or more of the object classes that were specified in the list of allomorphs or create handlers on a local registration are either unknown (invalid) or do not allow creates (for create handler list).

**Programmer response:** During run time the application program should determine if the object classes that were rejected are a problem. If so, the object should probably be deleted. If it is not a problem, nothing needs to be done because the object was registered without the erroneous classes. For future runs the application program code should be fixed to use a valid set of managed object classes. This means that the managed object class object identifiers should all be loaded in the CMIP services initialization file, and that all of the managed object classes specified in the create handlers list should be createable.

---

**413 REPL\_ERR\_ALREADY\_AN\_STM**

**Explanation:** This indicates that during the final phase of registration for a new instance, which was requesting to be a subtree manager, a parent instance was found which was already a subtree manager. Nested subtree managers are not legal.

**Programmer response:** You should check to see if the parental subtree manager is one you expected to be there. If it



is, then you either need to move the new subtree manager to a new location (or don't register it as a subtree manager). If the existing subtree manager is not supposed to be there, try to figure out how it got there and get rid of it.

#### 414 REPL\_ERR\_INVLD\_STM\_CHILD

**Explanation:** Once a subtree manager has registered control of a portion of the naming tree, only instances registered over the same application program connection are allowed on that subtree. If an instance from another application program connection tries to register under a subtree reserved by a different application, the new registration will be refused.

**Programmer response:** Do not attempt to register a new instance under some other application program's subtree.

#### 415 REPL\_ERR\_SCOPES\_TO\_NOTHING

**Explanation:** This indicates that there was a scoped message which could have addressed multiple instances but in the end addressed none. The list could be pared down because of name binding rules (for deletes), or access control.

**Programmer response:** If there were instances that you wanted this to be sent to, consider altering the scope to try to include the instances. Perhaps you should re-evaluate to determine if you are actually able to address the instances that you were trying to.

#### 416 REPL\_ERR\_INVALID\_SCOPE

**Explanation:** This indicates that either the scope is syntactically incorrect, or that the destination was GlobalRoot (i.e. a NULL distinguished name) and the scope included level 0 (level zero does not exist for GlobalRoot scoping).

**Programmer response:** Compare your scope to the standards. Verify that it does not include level 0 for a GlobalRoot scope and that it is syntactically correct according to the standards.

#### 417 REPL\_ERR\_COMMITDN\_NOTIN\_LIST

**Explanation:** This indicates that an attempt was made to process an instance which was thought to be pending registration (either to complete the registration, or to terminate the registration). This instance was not found on the list of pending creations.

**Programmer response:** There is no recovery action for this. It indicates that either invalid instance information was passed in, or that the pending instance was removed during the cleanup processing of a related instance.

#### 419 REPL\_ERR\_NO\_ONE\_2\_SEND\_CRT\_2

**Explanation:** A create was received for a managed object class which does not have a registered create handler for it. A create handler is an instance that indicates that it is capable of receiving, processing, and responding to CMIP create messages for a specified managed object class. If there is no create handler registered for a specified managed object class, CMIP services does not know where to send the create for processing.

**Programmer response:** If you do not wish to handle creations for the specified managed object class, then nothing needs to be done. If you would like to be able to accept creates for the specified managed object class, then an application program must register an instance with CMIP services as a create handler for the specified managed object class.

#### 420 REPL\_ERR\_NOONE\_2\_SEND\_EVNT\_2

**Explanation:** An event report or notification was received which had no specific destination associated with it (an unambiguous AE title) and there was no event handler registered with CMIP services.

**Programmer response:** Call IBM Service.

---

**421 REPL\_ERR\_ALREADY\_EVNT\_HNDLR**

**Explanation:** An attempt was made to register an instance with the event handler capability set, but there is already an event handler registered. CMIP services only supports the existence of one event handler at a time.

**Programmer response:** Call IBM Service.

---

**422 REPL\_ERR\_NAMEBIND\_INVALID**

**Explanation:** This indicates that the name binding that was specified was either in an invalid format (primarily this means length 0), or that the value specified could not be found in the tables of valid name bindings. The tables are loaded by CMIP services at initialization time.

**Programmer response:** Check to make sure that a valid name binding value was specified.

---

**424 REPL\_ERR\_CRT\_FAIL\_NB**

**Explanation:** Either the name binding that was specified does not allow creation via CMIP create messages, or there was no name binding specified and one could not be found that allowed CMIP create messages.

**Programmer response:** Either specify a different name binding (one that allows CMIP creates), or rethink whether you should be trying to remotely create an instance of this managed object class.

---

**425 REPL\_ERR\_CRT\_FAIL\_NO\_NB**

**Explanation:** This indicates that there is either no name binding to create an instance of the specified managed object class under the managed object class of the specified parent instance, or there is no legal name binding which has a naming attribute that matches the requested naming attribute of the new instance.

**Programmer response:** First check that there is a name binding that uses the desired naming attribute, and verify that this name binding is being loaded in CMIP services initialization file. Second check that the desired name binding allows creation of an instance of the specified managed object class under the managed object class of the parent. If it doesn't, consider picking a different parent, a different managed object class for the new instance, a different name binding (or perhaps specify a name binding if you were not), or change the attribute type of the final RDN to one that matches a useful name binding.

---

**426 REPL\_ERR\_DLT\_FAIL\_CONTOBJS**

**Explanation:** This indicates that the base instance that this delete was sent to (either no scope, or a base only scope) only allows deletes if the instance does not contain any child instances - and the instance does contain child instances.

**Programmer response:** Either delete all of the kids specifically, or include a scope with the delete in order to wipe out all instances at and below the base instance.

---

**427 REPL\_ERR\_DLT\_FAIL\_TO\_DCO**

**Explanation:** This indicates that some instance inside of the sub tree of the base instance cannot be deleted (even though the base instance's name binding indicates that it should delete contained instances). This could be because of access control, or because the name binding of the child instance does not allow deletes in some way (no deletes at all, only if no contained objects and it contains objects).

**Programmer response:** Try deleting the child instances individually, or with a scope that includes the whole subtree.

---

**428 REPL\_ERR\_DLT\_FAIL\_NB**

**Explanation:** This indicates that the instance is not allowed to be deleted by use of CMIP delete messages. The name binding indicates that this instance cannot be deleted.

**Programmer response:** You cannot delete the specified instance. Perhaps the instance should not be deleted, or perhaps it should have been created with a different name binding.

---

---

**429 REPL\_ERR\_NO\_LOCALDN**

**Explanation:** A CMIP message was sent with the local DN form of distinguished name specified, but there is no instance registered as a local DN handler for the AE title of the association that this message was received over. Local instances can register with CMIP services indicating that their distinguished name can be used as the initial RDNs for any local DN form message received over an association with a specified AE title.

**Programmer response:** Either a local DN handler should be registered for the desired AE title, or the CMIP message should not use local DN form of distinguished name.

---

**430 REPL\_ERR\_DUPLICATE\_LDNH**

**Explanation:** An instance tried to register as a local DN handler for an AE-Title that already had another instance registered as a local DN handler for it. CMIP services does not allow multiple Local DN handlers to register for the same AE-Title because there is no way to determine which one to choose.

**Programmer response:** Determine which of the instances should be the Local DN handler and register it first (or only register that valid one). If you don't care about receiving the error message, but want to make sure that there is a Local DN handler for the AE-Title, then by all means, make as many registration attempts as you want.

---

**431 REPL\_REG\_CREATED**

**Explanation:** This is an internal error code. It should never be externalized.

**Programmer response:** If this error is logged or externalized, a programming error exists in CMIP services. Call IBM Service.

---

**432 REPL\_CRT\_COMPLETED**

**Explanation:** This is an internal error code. It should never be externalized.

**Programmer response:** If this error is logged or externalized, a programming error exists in CMIP services. Call IBM Service.

---

**433 REPL\_REG\_COMPLETED**

**Explanation:** This is an internal error code. It should never be externalized.

**Programmer response:** If this error is logged or externalized, a programming error exists in CMIP services. Call IBM Service.

---

**434 REPL\_REG\_SUSPENDED**

**Explanation:** This is an internal error code. It should never be externalized.

**Programmer response:** If this error is logged or externalized, a programming error exists in CMIP services. Call IBM Service.

---

**435 REPL\_ERR\_ATTRTYPE\_MISMATCH**

**Explanation:** The attribute type of the final RDN did not match the object identifier of the naming attribute for the specified name binding. If you specify a name binding and a full distinguished name (including the new final RDN) CMIP services checks to make sure that they are internally consistent. Receiving this error indicates that you provided inconsistent values.

**Programmer response:** Provide a consistent name binding and distinguished name.

---

**436 REPL\_ERR\_CANNOT\_CHANGE\_NB**

**Explanation:** During the first phase of processing for CMIP create requests, a name binding is either specified or selected for any non-auto instance naming forms of creates. The name binding is specified or chosen based on a number of factors including the validity of the naming attribute and the name binding's ability to be created. If this value is changed in the second phase of create processing to something that changes some of these values (such as

changing the naming attribute), the values may not be legal any more. It is illegal to select a name binding that would invalidate the instance creation information.

**Programmer response:** If you must change the name binding value, select a value that uses the same naming attribute, allows instance creation, and allows the same managed object class to be instantiated under the same parent managed object class.

#### 439 REPL\_ERR\_NB\_DISALLOWS\_NEWOC

**Explanation:** There are three points to this triangle of validation. Two of these points are fixed. First is the managed object class of the parent (which is fixed). The second is the name binding (which is also fixed). The third is the managed object class of the instance being registered (this is what you just tried to change from the original value). The new managed object class must allow the use of the original name binding to create a new instance of the new managed object class under an instance of the parents managed object class.

**Programmer response:** Either use the original managed object class, or pick a managed object class that allows the use of the old name binding under the existing parent instance.

#### 440 REPL\_ERR\_SYNC\_NOT\_SUPPORTED

**Explanation:** Atomic synchronization is not currently supported by CMIP services. Atomic synchronization is rejected if that option is specified and the scope of the message includes any children of the baseManagedObjectInstance. The default for the synchronization field is bestEffort.

**Programmer response:** Specify bestEffort, remove the synchronization field and allow it to default, or trim the scope to include only the baseManagedObjectInstance.

#### 500 CRC\_ERR\_INVLD\_VERBCODE

**Explanation:** This indicates that a message is being passed through CMIP services which is not of a known type. In general, CMIP services expects CMIP messages or a small handful of internal utility messages. The message that the CMIP component just received was not one of the types that the code can process.

**Programmer response:** There is not much that can be done about this. Primarily this means that there was an internal error of some kind that should be reported back to IBM. Please note all of the information that is logged along with this error code (as well as any logs immediately before and after this one). CMIP services will attempt to reject this message and continue processing.

#### 501 CRC\_ERR\_INVLD\_SESSHAND

**Explanation:** This indicates that somehow the CMIP component received a message that contained a Association or Session handle which was not a valid value. In most cases this indicates an aborted session, but application programs are allowed to specify the Association/Session to use for routing the message. This error might be reported because an invalid value was specified by the application. It is rare that this error is caught in the CMIP component because the messages pass through other components which validate these fields before it gets to the CMIP component.

**Programmer response:** If the application program selected a bad value, the application program should be fixed. If the application program s value was valid or the application program did not specify a value, then it is likely that the Association/Session was aborted. CMIP services will reject this message and continue processing.

#### 502 CRC\_ERR\_INVLD\_INVOKEID

**Explanation:** This means one of the following:

- A CMIP CancelGet was attempted using an invoke id that was not for a get request.
- The invoke id field was missing from the message.
- The invoke id on a response/confirm does not match any of the outstanding indication/request invoke ids.

There are two primary causes of this set of problems:

- The application program specified a bad invoke id value.
- The Association/Session over which this message was traveling has been aborted.

**Programmer response:** Determine if this is an application program error (if the application program returns a

different invoke id value than was passed to it in the original message). Fix the application program error if that's what it was. If the invoke id value was valid, check to see if there were any error messages logged to indicate that the Association/Session was aborted. If it was, determine if there is any action you can take to prevent it from happening again. If there was no error logged, then the Association/Session was aborted in a "normal way". CMIP services will reject the message and continue processing.

#### 503 CRC\_ERR\_DPLCT\_INVOKEID

**Explanation:** This indicates that an application program (local or remote) tried to re-use an invoke id that has not yet been completed. CMIP services does not time out invoke ids or re-use invoke ids in any way. But an application program can specify its own invoke ids, or the remote application program may be using a stack other than CMIP services which does time out and re-use invoke ids. In this event an outstanding invoke id, which has not yet completed processing may be re-used by an application. This is an error. The CMIP standards do not provide a way for invoke ids to be timed out therefore CMIP services does not time them out. The most likely cause of this problem is that the local application program is either taking too long to process the message or has an error, and the remote requester times out the invoke id then tries to re-use it.

**Programmer response:** First you should check why the application program might be taking too long to answer. Fix this if you can. Second you can try to extend the timeout length of the remote stack, or eliminate timeouts all together. CMIP services will reject this message and continue processing.

#### 504 CRC\_ERR\_INVLD\_LINKEDID

**Explanation:** This indicates that an attempt was made to send a linked reply using an invoke id value (invoke id of the original request/indication that is) in the response that is not an outstanding invoke id. In other words the application program is attempting to send linked replies to an unknown request. The most likely cause of this is that the Association/Session was aborted and the messages on that Association/Session were cleaned up. It is also possible that the application program filled in the wrong linked id value in the linked response. Note that the linked id being passed back in the linked reply should be the same value as the invoke id of the original message.

**Programmer response:** Determine if this is an application program error (if the application program returns a different invoke id value than was passed to it in the original message). Fix the application program error if that's what it was. If the invoke id value was valid, check to see if there were any error messages logged to indicate that the Association/Session was aborted. If it was, determine if there is any action you can take to prevent it from happening again. If there was no error logged, then the Association/Session was aborted in a "normal way". CMIP services will reject the message and continue processing.

#### 505 CRC\_ERR\_UNABLE\_TO\_BUILD\_MSG

**Explanation:** This indicates that the CMIP component is attempting to construct the final full message (which may be a reject or error response) to pass on to the next stage of processing, but is unable to complete the construction of the message. The most likely cause of this is an out of memory condition, but it could also be related to an internal error. An out of memory condition will be logged in a separate error log message from the component that discovered it.

**Programmer response:** Refer to other errors in the trace.

#### 506 CRC\_ERR\_INVLD\_ROERRJ\_RCVD

**Explanation:** This can occur when an application program goes away (primarily a manager application), or an Association/Session is aborted and one of the partners doesn't realize it yet. The response is sent and the invoke id is cleaned up locally, then the partner rejects the message back because the partner is not present. When the invoke id is looked up, it cannot be found. The condition is logged and the message is ignored (no further processing is possible). CMIP services will continue processing.

**Programmer response:** There is no action that can or needs to be taken for this.

#### 507 CRC\_ERR\_INVLD\_CANCELGET

**Explanation:** The application program issued a CancelGet request for an outstanding invoke id. The outstanding invoke id was located, however, it was not a Get Verb. This is a violation of the CMISE standard. For a CancelGet

request, the request is rejected back to the application. For a CancelGet indication, an ROER is sent back to the application program which generated the CancelGet.

**Programmer response:** Ensure that the application program responsible for generating the CancelGet request is correctly inserting the invoke id of the Get to be canceled into the CancelGet.

#### 508 CRC\_ERR\_INVLD\_INVOKEID\_ON\_CANCELGET

**Explanation:** The application program issued a CancelGet request for an invoke id that could not be located by CMISE. For CancelGet requests, the request is rejected back to the application. For CancelGet indications, an ROER is sent back to the application program which generated the CancelGet.

**Programmer response:** The original Get request may have completed processing before the CancelGet processing had begun.

#### 509 CRC\_DELETE\_RORJ\_RECEIVED

**Explanation:** Because delete operations cannot be backed out, by the time the CMISE protocol machine receives an RORJ from the peer protocol machine indicating that the delete response is invalid it is too late to terminate the delete. So the RORJ is ignored and this message is logged as a warning.

**Programmer response:** Determine why the peer entity rejected the delete response. No action is required on CMIP services system logging the warning.

#### 550 SSERR\_STATE\_INVALID

**Explanation:** A message was received in the Session Layer that implies a violation of the Session Layer protocol. This may be any verb received out-of-sequence on an established connection, or any verb other than an S-Connect received when the identified session does not exist. This will only occur if the peer entity does not implement its Session protocols correctly, or during the short period while a session is being torn down abruptly. If all Sessions/Associations are terminated with the graceful Release protocols, this will never occur. When one side of a communication dies, it is possible that one or more messages will flow from the upper layers of CMIP services before this is noticed. This will cause the messages that cause this error to be logged to be lost, just as they will be after the upper layers are notified, because the session/association they need to use is no longer in existence.

**Programmer response:** No action is required.

#### 551 SSERR\_SPDU\_INVALID

**Explanation:** A received SPDU (Session Protocol Data Unit) was invalid. It was not correctly formed according to the rules for Session Layer headers and data. The peer entity is producing bad SPDUs or the underlying Transport layer (which is supposed to provide a reliable packet delivery service) has corrupted the message.

**Programmer response:** This really should never happen. We have never seen it happen with any of the partner implementations. If it does happen, that data stream will need to be analyzed to determine whether the messages (specifically this one and the message before and after it) conform to the definition of SPDUs. If they do not, the sender or underlying transport need to be analyzed to determine the cause. If they do, a trace of the traffic for this connection should be sent to IBM Service.

#### 552 SSERR\_MISSING\_PI

**Explanation:** A mandatory piece of information was omitted from an SPDU. This was either the reason on an S-Refuse or the Transport disconnect on an S-Abort. In either case the connection will be terminated (as it would have been if the flows had been correctly formatted). This will be logged to indicate that the peer entity is not conforming to the defined protocol.

**Programmer response:** Check the S-Refuse and S-Abort messages produced by the peer. Correct them to conform to the protocol. The overall result will be correct in either case - a session that should have been terminated will be terminated.

---

**553 SSERR\_MISSING\_UI**

**Explanation:** An S-Data indication was received from a peer entity that included no data. Because this is an error (and a waste of the network to be sending packets that contain nothing) the connection will be closed.

**Programmer response:** Correct the peer application.

---

**554 SSERR\_VERB\_INVALID**

**Explanation:** A message received by the Session Layer from another layer in CMIP services was invalid. This is an internal error in CMIP services.

**Programmer response:** Collect all log information and any re-creation scenario possible and call IBM Service.

---

**581 SSERR\_DUPLICATE**

**Explanation:** A duplicate session identifier has been assigned by the Session Layer. This is an internal error in the platform.

**Programmer response:** Call IBM Service.

---

**557 SSERR\_USERDATA\_SIZE**

**Explanation:** The protocol and profiles specify limits on the size of the user data included in the various Session Layer PDUs. One of these limits has been violated. Normally this is the limit specified the profile of 10240 octets of data on an S-Data message.

**Programmer response:** Decrease the size of the data provided in a single message.

---

**559 SSERR\_TDISC\_CONGESTED**

**Explanation:** There was insufficient storage available to transmit the data on the connection. Congestion has occurred locally or remotely. In an attempt to relieve this congestion this message will be discarded and the connection terminated.

**Programmer response:** Eliminate some of the traffic between these two systems or increase the resources allocated to communication between the two systems. This is often a transient error, and merely re-establishing the connection will work.

---

**560 SSERR\_TDISC\_UNATTACHED**

**Explanation:** A connection could not be established with the peer system. Either the system is not running, or the platform is not running on the system.

**Programmer response:** Check the address included in the log for this error. If it is correct check for connectivity with the system and make sure a platform is running on the system. If it is incorrect you need to determine why the address was chosen. It is derived from the destination information contained in the original message. There is a two step mapping performed - mapping instance name to AE-Title and AE-Title to address. The original name may be incorrect, the mapping from name to AE-Title may have produced an unexpected AE-Title, or the mapping from the AE-Title to address may have produced an unexpected result.

---

**561 SSERR\_TDISC\_ADDRESS**

**Explanation:** The remote address is not recognized for network routing. Either the address is incorrect, or the system is not running.

**Programmer response:** Check the address included in the log for this error. If it is correct check for connectivity with the system. If it is incorrect you need to determine why the address was chosen. It is derived from the destination information contained in the original message. There is a two step mapping performed - mapping instance name to AE-Title and AE-Title to address. The original name may be incorrect, the mapping from name to AE-Title may have produced an unexpected AE-Title, or the mapping from the AE-Title to address may have produced an unexpected result. See the description of the naming service and directory mappings to correct this.

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---

**562 SSERR\_VERSION**

**Explanation:** The session version indicator received on an S-Accept is not version 2. Only version 2 is supported. This is the version specified in the profiles for management systems.

**Programmer response:** Correct the peer application program to implement or use version 2 protocols for the Session Layer.

---

**563 SSERR\_PARTNER\_ABORT**

**Explanation:** An abort was received from the peer entity. The session is being torn down. This may represent normal operation - if the partner issued an abort. This condition is logged to allow problem determination to know that CMIP services received an S-Abort from the peer system.

---

**564 SSERR\_ENCLOSURE\_ITEM**

**Explanation:** The enclosure item was found in an SPDU, but segmenting is not supported. This should not happen - we negotiate away segmentation.

**Programmer response:** Correct the peer application program to eliminate segmentation.

---

**568 MD\_ERR\_BAD\_MDSMU**

**Explanation:** A badly formed MDS-MU was received. The single place that traces this error will also trace the sense code (what was wrong with the MDSMU) and the entire MDSMU trace.

**Programmer response:** Fix the message sent by the partner application.

---

**573 MD\_ERR\_SNACR\_BEING\_SENT**

**Explanation:** An SNA condition report is being sent to the partner application program indicating an error has occurred. The log will include the sense code of the error and the SNA condition report (SNACR) being sent to the partner.

**Programmer response:** Correct the condition indicated by the sense code.

---

**574 MD\_ERR\_SNACR\_RECEIVED**

**Explanation:** MDS interface received a SNACR. The sense code and SNACR are included in the log.

**Programmer response:** Analyze the sense code and SNACR to determine what error has occurred in the underlying SNA transport.

---

**578 SSERR\_GIVE\_TOKEN\_NO\_DATA**

**Explanation:** A Session Give Token PDU was received with no data following it. This is invalid for the kernel of the Session Layer.

**Programmer response:** Correct the peer application.

---

**802 ACF\_EVENT\_LOOP**

**Explanation:** Sending the event to the indicated AE-Title would cause an infinite loop in event processing. It is not being sent. This event report attempted to use an association that is local. This would cause the event to be routed back to CMIP services for processing causing an infinite loop. The destination of an EFD must contain either the name of a local instance or the AE-Title of a remote AE.

**Programmer response:** Change the destination on the EFD to represent a local instance or a remote AE.

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**803**      **ACF\_INVALID\_ASSOC\_ID**

**Explanation:** A message was received by CMIP services from one of its application programs. This message included an association identifier (either because it was a response or because the initiator wished to use a specific association for the request). The association identifier does not represent a currently active association, so the message cannot be sent. This may have occurred because:

- The application program used an invalid handle that never represented a valid association.
- The application program is trying to use the same association for all of its requests and the association has been terminated.
- The application program is attempting to respond to an indication and the association terminated between the time the indication was received and the response was sent.

**Programmer response:** For responses, use the correct association handle, exactly the information provided in the source of the indication. For requests use normal routing (do not include an association handle) or correct the handle value.

---

**806**      **ACF\_INVALID\_USER\_ID**

**Explanation:** An object asked to terminate an association which was started by another object explicitly. This is not allowed. When an object asks to start an association using the ACF.Associate message and that object has registered as an AE, the association is reserved for its use. No other object will be allowed to use it or terminate it.

**Programmer response:** Send the termination request from the correct object.

---

**807**      **ACF\_RSP\_BUILD\_SEND\_FAILED**

**Explanation:** A message could not be built because the ASN.1 data sets are incorrect.

**Programmer response:** Reload the ISTASN1 data set from the distribution media.

---

**808**      **ACF\_ERR\_KILL\_LOC\_ASSOC**

**Explanation:** The association is used to provide local (logical) connectivity to local Application Entities. They are automatically established and terminated when Application entities are registered and terminated. These associations do not represent any real network resources, so there is no reason to terminate them.

**Programmer response:** Do not try to terminate these associations.

---

**812**      **ACF\_BAD\_AE\_TITLE\_FORMAT**

**Explanation:** The AE-Title provided as the value for CMIP services could not be encoded or processed by the current set of ASN.1 definitions.

**Programmer response:** Reload ISTASN1 from the distribution media.

---

**814**      **ACF\_CANNOT\_FIND\_INST**

**Explanation:** The instance name provided with this message (in the baseManagedObjectInstance field of most CMIP requests) cannot be resolved into a potential serving AE-Title, so CMIP services does not know where to send the message.

**Programmer response:** Possible actions include:

- Correct the instance name if it is incorrect.
- Add an entry to define a mapping for this name to AE-Title in the directory definition file and restart the platform.
- Add an explicit AE-Title as the destination of the request.
- Add an explicit association handle as the destination of the request.

---

**815**      **ACF\_NO\_DESTINATION**

**Explanation:** This error will be returned if a message does not include any of the following types of destination information:

- An association handle
- An AE-Title
- A DistinguishedName
- An instance name in the CMIP message

The only way this should be possible is if the request is sent to 'GlobalRoot' (an instance name with no RDNs) and no other information is provided to direct the message to the correct system.

**Programmer response:** Put some type of destination information in the message. If this CMIP message is trying to use 'GlobalRoot', you must provide one of the other types of destination. This is the only case where additional destination information is required.

---

**817**      **ACF\_NO\_ASSOC\_TEMP**

**Explanation:** The required association could not be established. There are several possible causes for this, each of which will cause additional errors to be logged. The causes include:

- There is no CMIP platform running on the designated target machine.
- The address does not represent a real machine at all.
- There is a CMIP platform running but its capabilities do not match those in use by this platform.

**Programmer response:** Look for other trace entries to determine the real cause of the error.

---

**819**      **ACF\_EMPTY\_DEF\_LIST\_RESULT**

**Explanation:** While trying to negotiate a common set of syntaxes with a potential peer system we discovered that the two systems have NO syntaxes in common. Because this will not result in any communication, we will not establish the association. This should not ever happen if we are actually trying to connect to another system that implements CMIP. It could happen if we mistakenly try to connect to an implementation of X.500 or X.400, so we really do not want such an association to be established.

---

**823**      **ACF\_QUEUED\_MESSAGE**

**Explanation:** This should not occur in an error message. It may occur in a trace. This is the normal mode of operation when a new association needs to be established.

---

**824**      **ACF\_ASSOC\_ID\_WRAP**

**Explanation:** The identifiers assigned to associations have just wrapped. Unpredictable behavior may occur if there are collisions. Collisions are extremely unlikely because they are assigned sequentially from a 32bit space. If they do collide the platform will begin to route messages incorrectly.

**Programmer response:** Restart CMIP services.

---

**826**      **ACF\_TOO\_MANY\_LOCAL ASSOCS**

**Explanation:** Local associations are limited to 100 at any given time.

**Programmer response:** Possible actions:

- Terminate a local association.
- Terminate a local AE.

---

**827**      **ACF\_DUPLICATE\_AE**

**Explanation:** An attempt was made to register a local AE-Title for an object instance. This AE-Title is already in use by another instance on this system.

**Programmer response:** Change the AE-Title or terminate the previous object using this AE-Title.

---

**828**      **ACF\_REMOTE\_AE**

**Explanation:** An application program attempted to register a local AE-Title that is identical to the AE-Title currently being used by a remote Application Entity.

**Programmer response:** Choose a different AE-Title, or terminate the associations with the remote entity (and make sure it never re-connects using the same AE-Title).

---

**829**      **ACF\_INVALID\_STATE\_TO\_RELEASE**

**Explanation:** An application program attempted to cause CMIP services to Release an association. When the association was checked it was determined that it was not in the associated state. A Release message can only be sent when an association is in the ASSOCIATED state without causing a protocol violation.

**Programmer response:** If you really want to terminate the association, use an Abort instead of Release.

---

**830**      **ACF\_INVALID\_AE**

**Explanation:** An instance was attempting to register itself as the local DN handler for all messages that are received on associations to a specific AE-Title. The AE-Title it specified is not one of those currently supported by the local system, so it will never be used.

**Programmer response:** Choose the correct AE-Title (possibly &AET) or register the AE-Title and retry the request.

---

**831**      **ACF\_BAD\_P\_MODE**

**Explanation:** Only normal mode Presentation layer protocols are supported by CMIP services. The peer entity tried to establish a connection using some other mode.

**Programmer response:** Change the peer to use normal mode Presentation Layer protocols.

---

**832**      **ACF\_BAD\_P\_PROTOCOL\_VERSION**

**Explanation:** Only version 1 Presentation layer protocols are supported by CMIP services. The peer entity tried to establish a connection using some other version.

**Programmer response:** Change the peer to use version 1 Presentation Layer protocols.

---

**833**      **ACF\_BAD\_CMIP\_VERSION**

**Explanation:** This implementation only supports version 2 of the CMIP protocol.

**Programmer response:** Use CMIP version 2 for management flows. Change the peer to negotiate version 2 of CMIP.

---

**834**      **ACF\_BAD\_APPL\_CONTEXT**

**Explanation:** CMIP services supports a specific set of application program contexts to assure the platform that the peer is actually talking the same language. The supported contexts are:

- ISO
- CCITT
- NM Forum

**Programmer response:** Try to connect from CMIP services to the peer - maybe it will accept the ISO context (or the appropriate CMOT context if using CMOT). Adapt the peer to support one of these protocols. Support for additional contexts should not be necessary - these are all of the common contexts for OSI management. If additional contexts are necessary, contact IBM Service

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**835**      **ACF\_NO\_APPL\_CONTEXT**

**Explanation:** The A-Associate indication received from a peer Application Entity did not include any application program context. This does not allow us to confirm that it is actually using CMIP, or even how to resolve the details of the A-Associate indication. This association will be rejected.

**Programmer response:** Establish the association to the peer (maybe it will accept our context) or adapt the peer to send an application program context CMIP services supports.

---

**836**      **ACF\_NO\_APPL\_INFO**

**Explanation:** The platform received a P-Connect-Indication that contained no application program s layer information. There was NO A-Associate-Indication contained in the PDU. Because this would not result in a usable connection, the connection will be rejected.

**Programmer response:** Establish the association to the peer (maybe it will accept our A-Associate) or adapt the peer to send an A-Associate on the P-Connect.

---

**838**      **ACF\_WRONG\_AE\_TITLE**

**Explanation:** The A-Associate-Indication provided a value for the called-AP-Title and qualifier that does not match the local values. The A-Associate could be rejected, but it will be accepted. We will merely respond with the local AE information in the responding AP-Title and responding AE-qualifier. The peer can abort the association if it sees fit.

**Programmer response:** None - the association was established.

---

**840**      **ACF\_NO\_AE\_QUALIFIER**

**Explanation:** This indicates (internally) that an A-Associate-Indication was received that contained only an AP-Title, and no AE-Qualifier. The association will be accepted.

**Programmer response:** No action is required unless this error code is externalized.

---

**900**      **MB\_ERR\_PROCFAIL\_NOT\_OPTIONAL**

**Explanation:** Although the parameter for an ROER-processingFailure is specified as OPTIONAL in the CMIP standard, the argument for an ROIV-m-Linked-Reply is not OPTIONAL. Because CMIP services may need to reformat an application's processingFailure CMIP error from an ROER to an ROIV-m-Linked-Reply, CMIP services requires the processingFailure argument to be specified.

**Programmer response:** Correct the application program to specify a processingFailure argument in all cases. The following is an example of a processingFailure argument that specifies the genericSpecificError: "(&OC, (distinguishedName &DN), (1.2.124.360501.9.24, NULL))"

---

**901**      **MB\_ERR\_COMPXLIM\_NOT\_OPTIONAL**

**Explanation:** Although the parameter for an ROER-complexityLimitation is specified as OPTIONAL in the CMIP standard, the argument for an ROIV-m-Linked-Reply is not OPTIONAL. Because CMIP services may need to reformat an application's complexityLimitation CMIP error from an ROER to an ROIV-m-Linked-Reply, CMIP services requires the complexityLimitation argument to be specified.

**Programmer response:** Correct the application program to specify a complexityLimitation argument in all cases. The following is a minimal example of a complexityLimitation argument which leaves out all the optional members: "()"

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**903**      **MB\_ERR\_INVALID\_TYPENAME**

**Explanation:** An ASN.1 type name was not recognized.

**Programmer response:** Correct the type name.

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---

**904 MB\_ERR\_NOT\_CONNECTED**

**Explanation:** A message was received from an application program that is no longer connected.

**Programmer response:** Call the MIBConnect function.

---

**914 MB\_ERR\_DELETE\_PROTOCOL\_ERROR**

**Explanation:** Various rules limit the responses which an agent is allowed to make in the first phase of a CMIP delete, when it send the MIB.DeleteResponse syntax to CMIP services. This error, returned to the agent application, indicates that the response was not allowed. The reason depends on whether the instance is a subtree manager or not and where the instance falls within the scope of the delete. This error is returned for six distinct conditions:

1. The instance is a subtree manager and is above the scope of the delete and has answered accepted (0).
2. The instance is a subtree manager and is above the scope of the delete and has answered rejected (1).
3. The instance is a subtree manager and is below the scope of the delete and has answered stmChildrenOnly (2).
4. The instance is not a subtree manager and has answered stmChildrenOnly (2).
5. The instance is below the scope of the delete and has answered noOneSelected (3).
6. The instance has not answered with 0, 1, 2, or 3.

**Programmer response:** Correct the application program 's delete-handling code. Note that if the object instance is not a subtree manager (the normal case), then conditions 1-3 are eliminated as possible causes. Also note that condition 4 does not specify where the instance is relative to the scope of the delete because non-subtree manager instances are never allowed to answer stmChildrenOnly. Condition 5 is an error because the filter for the delete is always stripped from the delete indication before it is delivered to the instances which are below the scope of the delete. Because these instances did not receive the filter, they cannot possibly have failed to pass it.

---

**918 MB\_ERR\_INVALID\_LINK\_ID**

**Explanation:** The value specified on the link identifier parameter does not refer to a valid connection.

---

**919 MB\_ERR\_INVALID\_STATE**

**Explanation:** CMIP services was attempting to write a message to a client application program but determined that the connection was not in a useable state. The message was not written, and the error was logged. The application program was not notified of the error nor was the sender of the request.

**Programmer response:** The application program should exit and reinitialize.

---

**920 MB\_ERR\_NOT\_REGISTERED**

**Explanation:** The application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine or the data space is out of storage. The registration will not be allowed.

---

**921 MB\_ERR\_CMIP\_ERR\_RESP\_ILLEGAL**

**Explanation:** An agent application program attempted to return a CMIP error and CMIP services flagged the response as illegal because the error code specified in the response is not allowed for indications of the type being responded to. For example, if an client agent application program returns a getListError for an m-Set indication or an invalidArgumentValue error for an m-Create. This error is also returned by CMIP services when an agent responds to a delete with the syntax MIB.DeleteResponse(1, X, ...) where the X is an error code that is not allowed by the CMIP standard in response to an m-Delete indication.

**Programmer response:** Correct the client agent application program to return an error code compliant with the CMIP standard (Rec. X.711 | ISO/IEC 9596-1 second edition).

---

**922 MB\_ERR\_CMIP\_ERR\_RESP\_STKCHK**

**Explanation:** An agent application program attempted to return a CMIP error and CMIP services flagged the response as illegal because the error code specified in the response was checked for by CMIP services when the indication was processed and was verified at that time not to have occurred. For example, all object classes are looked up and found in the metadata before the indication is delivered, so the NoSuchObjectClass error cannot occur

subsequently. If an application program attempts to return `NoSuchObjectClass`, CMIP services rejects the response with this error code. The other errors which fall into this category are `SyncNotSupported` and `InvalidScope`. CMIP services returns an ROER to all indications that specify a sych other than `bestEffort` and client agent application program s will never receive an indication that specifies atomic synchronization. Also all scopes are validated to be completely syntactically correct before the indication is delivered to the agent application. So these errors are not allowed by CMIP services. If an agent application program generates these errors, then the agent application program is in error.

**Programmer response:** A program ming error exists in the client agent application. Correct the application program to send the CMIP error that actually occurred.

#### 925 MB\_ERR\_LOST\_CONNECTION

**Explanation:** The application program has exited.

**Programmer response:** It should reconnect.

#### 929 MB\_ERR\_LOCAL\_ID\_ALREADY\_REGISTERED

**Explanation:** The local identifier is not unique.

**Programmer response:** Correct the client application program to pass a unique local identifier with each `MIBSendRegister` API function call.

#### 931 MB\_ERR\_SOURCE\_NOT\_IN\_SUBTREE

**Explanation:** Only instances registered with the `SUBTREE_MANAGER` or `EVENT_HANDLER` capabilities are permitted to use the source override feature on requests and responses. For the `EVENT_HANDLER` application program (there may be only one), any distinguished name may be specified as the source, with no restrictions. But for subtree manager application program s, there is a restriction placed on the distinguished names which may be specified. The restriction is that the distinguished name must be within the subtree managed by the subtree manager, i.e. the distinguished name specified as the source must have the distinguished name of the subtree as a prefix. This error is returned when a subtree manager specifies a source outside its managed subtree.

**Programmer response:** A programming error exists in the subtree manager application program. Correct the subtree manager application program.

#### 932 MB\_ERR\_MAX\_OUTSTANDING

**Explanation:** There are no remaining, unused invoke identifiers on this connection.

**Programmer response:** Increase the value of the max outstanding invoke identifiers parameter passed to the `MIBConnect` function.

#### 933 MB\_ERR\_CMIP\_ERR\_NOT\_STM

**Explanation:** A client agent application program returned a CMIP error as its response to an indication. In checking CMIP error responses, CMIP services takes several pieces of information into account. One of them is the operation-type for the indication (e.g. `m-Get`, `m-Action`, etc). Another is the client agent's capabilities, specifically whether the instance responding had the `SUBTREE_MANAGER` capability set when it was registered. This error is returned to the agent by CMIP services because CMIP services only allows the given CMIP error to be returned by subtree manager agents. This is because the given error is checked for by CMIP services before the indication is delivered to the client agent application. Except in the case of subtree managers, CMIP services has already verified that the error did not occur. Because the agent is not a subtree manager, the agent should not be allowed to return this error, because it could not have occurred. Had the agent been a subtree manager the error response would have been allowed, because in that case CMIP services could not have verified ahead of time that the error did not occur. It should not be inferred from this discussion that the solution is to make the client agent a subtree manager. Instead, it should be assumed that the client incorrectly detected the error condition signaled by the response, and that the client's response is in error.

**Programmer response:** Correct the client agent application program to return a valid CMIP response or an allowed CMIP error response.

---

**934 MB\_ERR\_NOT\_SUBTREE\_MGR**

**Explanation:** In a CMIP message, the information which determines the source of the message comes from three places. The CMIP string may specify the distinguished name of the instance sending the request or response. Or, the string may include the "&DN". macro. This is replaced by CMIP services with the distinguished name of the instance sending the message as identified by the local identifier supplied on the API call. Finally, a subtree manager instance is allowed to use the "&DN" macro and specify a source-override. This results in the distinguished name supplied on the override being substituted for the &DN rather than the DN of the subtree manager. This error indicates that the client application program specified a non-null value for the source parameter on a request or response (MIBSendResponse, MIBSendCmipRequest, MIBCmipRequest, MIBSendCmipResponse, or MIBCmipResponse) but the managed object instance sending the request or response is not a subtree manager.

**Programmer response:** Correct the client application. If the application program has been designed and coded to fulfill all the responsibilities of a subtree manager, then enable the SUBTREE MANAGER on the instance's MIBRegister call. Otherwise, do not specify the source parameter on the API function call.

---

**935 MB\_ERR\_DIDNT\_USE\_AMPER\_IID**

**Explanation:** An incorrect invoke identifier was used in a CMIP request.

**Programmer response:** Use the &IID MIB variable to include the new invoke identifier for this request.

---

**936 MB\_ERR\_CMIP\_ERR\_NOTASROIV**

**Explanation:** An agent application program attempted to return a response containing a CMIP error. The response is allowed given the operation value of the request, but CMIP services only supports sending the CMIP error as an ROER, not as an m-Linked-Reply. This error indicates that in order to deliver the message, the response would have had to be reformatted as an m-Linked-Reply. Because CMIP services supports sending all errors as linked replies that can legitimately be returned as linked replies, this error indicates that the error should not have been sent as a not-last response.

**Programmer response:** Correct the client agent application program to return the error as a final response.

---

**937 MB\_ERR\_INVALID\_MSG\_FORMAT**

**Explanation:** This error is returned when CMIP services cannot parse the module and type or the top-level sequence of a request or response. Incorrect values in the invoke identifier, operation-value, argument or argument-type labels can cause this error. Incorrect values in the module and type strings also cause this error.

**Programmer response:** Correct the string.

---

**938 MB\_ERR\_EMPTY\_ROIV\_INVALID**

**Explanation:** CMIP services was processing a client agent response and needed to reformat the response into an ROIVapdu for transmission as an m-LinkedReply. But the client agent application program did not provide an argument on the response, so the response cannot be formatted as an ROIV-m-LinkedReply. Because of the possibility of this failure, and the fact that agent application programs cannot predict whether the reformatting will be required, it is required that an argument be provided on all responses. This error is only checked when the argument is actually required, so it may appear to be an intermittent problem to the client agent, nevertheless, it is actually a consistent problem.

**Programmer response:** Determine which API function call was used to send the response and correct the client agent application program to provide an argument on the response in all cases.

---

**939 MB\_ERR\_INVALID\_RESP**

**Explanation:** There are several checks which CMIP services makes to validate an object instance's response. The object instance supplies an invokeId, a destination (in the form of an association handle), and a response string. This error can indicate a number of different failures which all have in common that the response was invalid because that instance was not allowed to respond to the specified request at the current time. The possible failures are:

- The invoke identifier and association handle did not specify a valid indication (that is, no instance is allowed to respond to the "request", because it does not exist).

- The invoke identifier and association handle specify a valid indication, but the object instance responding is not allowed to respond to that indication because it was not a recipient of the indication.
- The invoke identifier and association handle specify a valid indication, but the object instance responding is not allowed to respond to that indication because it has already responded to that indication with a "final" response.
- The invoke identifier and associate handle specify a valid delete indication to which the object instance is allowed to respond, but the instance responded "out of phase", either sending a phase-1 response during phase 2 or vice versa.
- When CMIP services discovers that a manager application program has terminated, CMIP services removes all indications from that manager from its log. Otherwise valid agent responses to the indication are rejected with this return code. This is the only case where the client agent application program is not at fault. One possible cause for this error (in cases 2 and 3) is that the client agent application program specified the wrong local identifier on the response.

**Programmer response:** Determine if the manager application program which issued the request terminated before the agent responded (see case 5 above). If so, then this error may be ignored. Otherwise correct the client agent application program to respond correctly.

#### 941 MB\_ERR\_CANCELGET\_RESP\_INVALID

**Explanation:** CMIP services application program makes supporting the cancel get operation trivial for agents to implement by treating it as an unconfirmed request from the agent's viewpoint. Whenever CMIP services receives an m-CancelGet it takes care of cancelling the get and responding to the m-CancelGet and sending the operationCancelled ROER. Agents may either continue to respond to the get as if the cancel get had not been received (and CMIP services discards these responses) or agents may abort their get and send an operationCancelled error. Because of this design, agents are not allowed to respond to the m-CancelGet indication, and they receive this error if they do.

**Programmer response:** Correct the client agent application program to not respond to m-CancelGet indications.

#### 945 MB\_ERR\_CONNECT

**Explanation:** The MIBConnect was not successful. If the error condition indicated by the OPEN ACB error value parameter can be eliminated, another MIBConnect can be issued.

#### 952 HDR\_SYNTAX\_ERROR

**Explanation:** The module and type information that must accompany all messages is wrong. The value provided either does not contain both a module and type name, separated by a period.

**Programmer response:** Fix the type reference to be complete. A valid example is: CMIP-1.R0IVapdu.

#### 953 INVALID\_HDR\_DEST\_TYPE

**Explanation:** The type of the destination (the value for dest-type) contained in the string header is invalid. The only allowed types are:

- 0: none provided
- 1: association handle
- 2: Distinguished name of an instance
- 3: AE-title of a peer system

**Programmer response:** Fix the dest-type in the string header.

#### 954 INVALID\_HDR\_SRC\_TYPE

**Explanation:** The type of the source (the value for src-type) contained in the string header is invalid. The only allowed types are:

- 0: none provided
- 1: association handle
- 2: Distinguished name of the sending instance



Normally you should be doing one of two things. If this message is a response, the src-type MUST BE 1 - association handle. If this message is a request, the type should normally be 0. The only time any other value is used is when the request is coming from a specific instance and you need to provide its name for us to resolve an &DN MIB variable.

**Programmer response:** Fix the src-type in the string header.

955 UNRECOGNIZED\_HDR\_LABEL

**Explanation:** A label was encountered in the string header that was unrecognized or out of sequence.

**Programmer response:** If the message was sent using MIBSendRequest or MIBSendResponse, fix the string to align with the definition of the string header contained in ISTASN1. If the message was sent by CMIP services, or using MIBSendCmipRequest or MIBSendCmipResponse, call IBM Service.

956 KEY\_IS\_NULL

**Explanation:** While parsing the string an & was encountered. The valid MIB variables are &IID, &OC, &DN, and &GTM.

**Programmer response:** Fix the value to reference a valid MIB variable or avoid the use of a MIB variable or surround the value in quotation marks.

957 KEY\_NOT\_FOUND

**Explanation:** While parsing the string a MIB variable (a value which begins with the character '&') was encountered for which does not exist. The allowed values are &IID, &OC, &DN, and &GTM.

**Programmer response:** Fix the value to refer to a valid MIB variable or avoid the use of a MIB variable or surround the value in quotation marks.

958 MIB\_VAR\_NOT\_LOADED

**Explanation:** An invalid MIB variable was encountered.

**Programmer response:** Correct the use of the MIB variable to be one of those defined, or use a real value. If you want the value to be a string that begins with &, you must surround the value in quotes.

961 LABV\_END\_QUOTE\_NOT\_FOUND

**Explanation:** A string was found that began with a quote (single or double) for which there was no closing quote.

**Programmer response:** Fix the string value to conform to the rules for construction of string values.

962 LABV\_NULL\_VALUE

**Explanation:** CMIP services was provided with an input string that did not include a value. This is a warning that there was not a value in the string being processed.

**Programmer response:** This may be working correctly, assuming the input string intended did not include a value. This is unlikely because normally it is only necessary to parse strings that contain values. Change the string to be a valid value for an ASN.1 syntax.

963 LABV\_INVALID\_CHAR\_IN\_VALUE

**Explanation:** An invalid character was found in a value in the string being parsed.

**Programmer response:** Fix the string value to conform to the rules for construction of string values.

---

**964      LABV\_INVALID\_GROUP\_DELIMITER**

**Explanation:** The only characters that are allowed to follow a right parenthesis in a string are comma and right parenthesis. Something else was encountered.

**Programmer response:** Fix the string value to conform to the rules for construction of string values.

---

**965      LABV\_EMPTY\_STRING**

**Explanation:** CMIP services was handed a string with no contents. It did not return any labels or values.

**Programmer response:** None; you have reached the end of the string. Processing for the string should now terminate. This is working as designed.

---

**1000      MB\_WARN\_DATA\_SPACE\_FULL**

**Explanation:** If using a data space and the data space is out of storage, this warning is returned to remind the application program that no messages will be returned to this application program. This message will still be routed to CMIP services.

**Programmer response:** Remove messages from the data space.

---

**1001      MB\_WARN\_EXIT\_FAILURE**

**Explanation:** If using common storage area storage and the application program has indicated that it has had an unrecoverable error when returning to the read queue exit routine, this warning is returned to remind the application program that no messages will be returned to the application program. This message will still be routed to CMIP services.

**Programmer response:** The application program should disconnect and connect again.

---

**1002      MB\_DATA\_ON\_DATA\_SPACE**

**Explanation:** CMIP services has placed one or more messages in the data space.

**Programmer response:** Remove messages from the data space.

---

**1004      MB\_ERR\_INVALID\_ARGUMENT**

**Explanation:** The argument parameter was not provided.

**Programmer response:** Correct the argument.

---

**1005      MB\_ERR\_INVALID\_ARGUMENT\_TYPE**

**Explanation:** An incorrect argument type parameter was provided.

**Programmer response:** Correct the argument type.

---

**1006      MB\_ERR\_INVALID\_ASSOC\_HANDLE**

**Explanation:** An incorrect association handle parameter was provided.

**Programmer response:** Correct the association handle.

---

**1007      MB\_ERR\_INVALID\_SMAE\_NAME**

**Explanation:** The value specified for the SMAE name buffer parameter is not valid.

**Programmer response:** Correct the SMAE name.

---

---

**1008 MB\_ERR\_CMIP\_SERVICES\_INACTIVE**

**Explanation:** CMIP services is inactive.

If using common storage area storage, the read queue exit routine stops functioning.

If using data space storage, messages are not put on the data space.

**Programmer response:** Start CMIP services.

---

**1009 MB\_ERR\_INVALID\_DS\_VECTOR**

**Explanation:** The value specified for the data space vector length parameter is valid, but the data space vector parameter is not provided.

**Programmer response:** Correct the parameters.

---

**1010 MB\_ERR\_INVALID\_DEST\_TYPE**

**Explanation:** An incorrect destination type parameter was passed.

**Programmer response:** Correct the parameter.

---

**1011 MB\_ERR\_INVALID\_DIST\_NAME**

**Explanation:** An incorrect distinguished name was provided.

**Programmer response:** Correct the parameter.

---

**1012 MB\_ERR\_INVALID\_MAX\_INVOKE\_IDS**

**Explanation:** The value specified for the maximum outstanding requests parameter is not valid.

**Programmer response:** Correct the parameter.

---

**1013 MB\_ERR\_INVALID\_API\_LEVEL**

**Explanation:** An incorrect value for the API level parameter was passed.

**Programmer response:** Correct the parameter.

---

**1014 MB\_ERR\_INVALID\_APPL\_NAME**

**Explanation:** The value specified for the application name parameter is longer than 8 characters.

**Programmer response:** Correct the parameter.

---

**1015 MB\_ERR\_INVALID\_DS\_VECTOR\_SIZE**

**Explanation:** If the data space vector parameter is specified, the data space vector length must be at least the size of (ISTRIV10\_t), which is the length of the data space vector.

**Programmer response:** Correct the parameter.

---

**1016 MB\_ERR\_INVALID\_SMAE\_NAME\_SIZE**

**Explanation:** The buffer sent to the MIBConnect function is too small to accommodate the name of the SMAE. The actual amount of storage required is returned in the SMAE name length parameter.

**Programmer response:** Correct the parameter.

---

---

**1017 MB\_ERR\_INVALID\_INVOKE\_ID**

**Explanation:** The invoke identifier parameter was not provided.

**Programmer response:** Correct the parameter.

---

**1018 MB\_ERR\_MIBDISCONNECT**

**Explanation:** The MIBDisconnect function was not successful.

**Programmer response:** If the error condition indicated by the CLOSE ACB error value parameter can be eliminated, another MIBDisconnect can be issued.

---

**1019 MB\_ERR\_INVALID\_MSG**

**Explanation:** An incorrect message parameter was provided.

**Programmer response:** Correct the parameter.

---

**1020 MB\_ERR\_INVALID\_OBJECT\_CLASS**

**Explanation:** An incorrect object class parameter was provided.

**Programmer response:** Correct the parameter.

---

**1021 MB\_ERR\_INVALID\_READ\_QUEUE\_EXIT**

**Explanation:** The read queue exit routine was not provided.

**Programmer response:** Correct the parameter.

---

**1022 MB\_ERR\_INVALID\_SYSTEM\_NAME\_SIZE**

**Explanation:** The buffer sent to the MIBConnect function is too small to accommodate the name of the system object. The actual amount of storage required is returned in the system object name buffer size parameter.

**Programmer response:** Increase the buffer size.

---

**1023 MB\_ERR\_INVALID\_LOCAL\_ID\_SIZE**

**Explanation:** The value specified on the local identifier length parameter is outside the acceptable range of 1—8.

**Programmer response:** Increase the buffer size.

---

**1024 MB\_ERR\_TRANSMIT**

**Explanation:** An apparent error occurred. Either there is a logic error in VTAM, or the MIBDisconnect function has been issued, but it has not completed.

**Programmer response:** Do not use any other services once MIBDisconnect has been issued.

---

**1025 MB\_ERR\_VTAM\_INACTIVE**

**Explanation:** VTAM is inactive.

**Programmer response:** Start VTAM.

---

**1026 MB\_ERR\_INVALID\_USER\_DATA**

**Explanation:** The user data parameter was not provided.

**Programmer response:** Increase the buffer size.

---

---

**1027 MB\_ERR\_INVALID\_ERROR\_FLAG**

**Explanation:** The CLOSE ACB error value parameter does not point to a valid storage location.

**Programmer response:** Correct the parameter.

---

**1028 MB\_ERR\_INVALID\_RELEASE\_LEVEL**

**Explanation:** The value specified for the VTAM release level parameter is not valid.

**Programmer response:** Correct the parameter.

---

**1029 MB\_ERR\_INVALID\_PASSWORD**

**Explanation:** The value specified for the password parameter is not between 0 and 8 characters.

**Programmer response:** Correct the parameter.

---

**1030 MB\_ERR\_INVALID\_CAPABILITY\_FLAGS**

**Explanation:** The value specified for the capability flags parameter is not valid.

**Programmer response:** Correct the parameter.

---

**1031 MB\_ERR\_INVALID\_TPEND\_EXIT**

**Explanation:** The TPEND exit routine is not valid.

**Programmer response:** Correct the parameter.

---

**1032 MB\_ERR\_INVALID\_LAST\_IN\_CHAIN\_FLAG**

**Explanation:** An incorrect last in chain parameter was provided.

**Programmer response:** Correct the parameter.

---

**1033 MB\_ERR\_INVALID\_SUCCESS\_FLAG**

**Explanation:** An incorrect success parameter was provided.

**Programmer response:** Correct the parameter.

---

**1034 MB\_ERR\_INVALID\_SYSTEM\_NAME**

**Explanation:** The value specified for the system object name buffer parameter is not valid.

**Programmer response:** Correct the parameter.

---

**1035 MB\_ERR\_INVALID\_CONNECT\_OPTIONS**

**Explanation:** The value specified on the connection options parameter is not valid. Specify either NO\_CONNECT\_OPTIONS or SHORT\_NAMES as the value for the connection options parameter.

**Programmer response:** Correct the parameter.

---

**1036 MB\_ERR\_INVALID\_NAME\_TYPE**

**Explanation:** An incorrect name type parameter was provided.

**Programmer response:** Correct the parameter.

---

---

1037      **MB\_ERR\_INVALID\_NAME\_BINDING**

**Explanation:** An incorrect name binding parameter was provided.

**Programmer response:** Correct the parameter.

---

1038      **MB\_ERR\_INVALID\_ALLOMORPHS\_COUNT**

**Explanation:** An incorrect allomorphs count parameter was provided.

**Programmer response:** Correct the parameter.

---

1039      **MB\_ERR\_INVALID\_ALLOMORPHS\_ARRAY**

**Explanation:** An incorrect allomorphs array parameter was provided.

**Programmer response:** Correct the parameter.

---

1040      **MB\_ERR\_INVALID\_CREATE\_HANDLERS\_COUNT**

**Explanation:** An incorrect create handlers count parameter was provided.

**Programmer response:** Correct the parameter.

---

1041      **MB\_ERR\_INVALID\_CREATE\_HANDLERS\_ARRAY**

**Explanation:** An incorrect create handlers array parameter was provided.

**Programmer response:** Correct the parameter.

---

1042      **MB\_ERR\_INVALID\_LOCAL\_ID**

**Explanation:** An incorrect local identifier parameter was provided.

**Programmer response:** Correct the parameter.

---

1043      **MB\_ERR\_INVALID\_DEST**

**Explanation:** The value of the destination parameter is inconsistent with the value of the destination type parameter. This return code is returned if, for example, destination type is DS\_ASSOC\_HANDLE, but destination is NULL.

**Programmer response:** Correct the parameter.

---

## CMER VIT entry error codes

These error codes can appear only in CMER VIT entries.

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151

**Explanation:** An invalid parameter was received.

**Programmer response:** No action is required. Other errors logged in CMER VIT entries or sent to an application program may indicate the cause of the problem.

---

153

**Explanation:** An error was encountered by notification services.

**Programmer response:** No action is required. Other errors logged in CMER VIT entries or sent to an application program may indicate the cause of the problem.

---

---

156

**Explanation:** A CMIP services dataset could not be opened.

**Programmer response:** Check the VTAM JCL to ensure that required DD cards are present and point to the correct datasets. Check the datasets to verify the presence of the required members. Then restart CMIP Services using the MODIFY VTAMOPTS,OSIMGMT=YES command.

---

157

**Explanation:** A CMIP services dataset contains incorrect data.

**Programmer response:** Reload the CMIP services datasets to ensure that the datasets are not corrupted. Then restart CMIP Services using the MODIFY VTAMOPTS,OSIMGMT=YES command.

---

158

**Explanation:** The directory definition file contained a syntax error.

**Programmer response:** Correct the directory definition file and restart CMIP services.

---

159

**Explanation:** The name attribute in the directory definition file was invalid.

**Programmer response:** Correct the directory definition file and restart CMIP services.

---

161

**Explanation:** The name attribute in the directory definition file was missing.

**Programmer response:** Correct the directory definition file and restart CMIP services.

---

162

**Explanation:** An attribute in the directory definition file was listed more than once in the same entry.

**Programmer response:** Correct the directory definition file and restart CMIP services.

---

166

**Explanation:** The class attribute in the directory definition file was invalid.

**Programmer response:** Correct the directory definition file and restart CMIP services.

---

167

**Explanation:** A generic error occurred. Other error codes should be traced or returned to the user in a MIB.ServiceError message.

**Programmer response:** No action is required. Other errors logged in CMER VIT entries or sent to an application program may indicate the cause of the problem.

---

168

**Explanation:** The class attribute in the directory definition file was missing.

**Programmer response:** Correct the directory definition file and restart CMIP services.

---

174

**Explanation:** A CMIP services dataset contains incorrect data.

**Programmer response:** Reload the CMIP services datasets to ensure that the datasets are not corrupted. Then restart CMIP Services using the MODIFY VTAMOPTS,OSIMGMT=YES command.

---

1051

**Explanation:** An EFD filter contained too many object classes to be recognized for topology agent processing. VTAM topology agent will not generate notifications for this EFD if the OSIEVENT start option is set to PATTERNS.

**Programmer response:** If the OSIEVENT start option is set to PATTERNS and the EFD which led to this warning is meant to collect information from VTAM topology agent, then the filter in the EFD must be rewritten to refer only to objects of a single class.

---

1052

**Explanation:** An EFD filter contained too many distinguished names to be recognized for topology agent processing. VTAM topology agent will not generate notifications for this EFD if the OSIEVENT start option is set to PATTERNS.

**Programmer response:** If the OSIEVENT start option is set to PATTERNS and the EFD which led to this warning is meant to collect information from VTAM topology agent, then the filter in the EFD must be rewritten to refer only to a single DN.

---

1053

**Explanation:** An EFD filter contained a resource name which was too long. VTAM topology agent will not generate notifications for this EFD if the OSIEVENT start option is set to patterns.

**Programmer response:** If the OSIEVENT start option is set to PATTERNS and the EFD which led to this warning is meant to collect information from VTAM topology agent, then the filter in the EFD must be rewritten to correct the object names.

---

1054

**Explanation:** An EFD destination was incorrect. The EFD will not be created.

**Programmer response:** The specified destination attribute is invalid and must be changed. The destination of an EFD should be an AE registered by the application program.

---

1055

**Explanation:** An EFD filter contained an object class which was not recognized for topology agent processing. VTAM topology agent will not generate notifications for this EFD if the OSIEVENT start option is set to PATTERNS.

**Programmer response:** If the OSIEVENT start option is set to PATTERNS and the EFD which led to this warning is meant to collect information from VTAM topology agent, then the filter in the EFD must be rewritten to specify a support object class.

---

1056

**Explanation:** An EFD filter was not recognized for topology agent processing. VTAM topology agent will not generate notifications for this EFD if the OSIEVENT start option is set to PATTERNS.

**Programmer response:** If the OSIEVENT start option is set to PATTERNS and the EFD which led to this warning is meant to collect information from VTAM topology agent, then the filter in the EFD must be rewritten to follow a recognizable pattern.

---



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1057

**Explanation:** An EFD filter was recognized as having nothing to do with VTAM topology. VTAM topology agent will not generate notifications for this EFD regardless of the setting of the OSIEVENT start option.

**Programmer response:** If the EFD which led to this warning is meant to collect information from VTAM topology agent, then the filter in the EFD must be rewritten, as it seems to have nothing to do with VTAM topology.



---

## Appendix D. VTAM CMIP services compliance with related standards and profiles

This section is designed to help you understand how VTAM CMIP services complies to the standards related to OSI systems management.

VTAM CMIP services implements functions that are defined in International Standards Organization (ISO) standards documents and industry profiles.

---

### ISO standards documents

This section indicates how VTAM CMIP services conforms to several ISO standards related to OSI systems management.

#### ISO 9596-1 CMIP—Common Management Information Protocol

VTAM CMIP services implements all functional units specified for CMIP Version 2 in this standard. Atomic synchronization is not supported.

#### (ISO 10164-5) OSI systems management part 5: event report function

VTAM CMIP services implements the event forwarding discriminator (EFD) described in this standard. All of the object management functions specified for the EFD are supported (GET, SET, CREATE, DELETE). VTAM CMIP services supports general discriminator constructs of any complexity. VTAM CMIP services does not support any of the conditional packages defined for the class or substring operations on SET valued attributes.

#### ISO 8650 ACSE—Association Control Service Element

VTAM CMIP services implements all required aspects of the protocol specified as ACSE Version 1 in this standard. VTAM CMIP services accepts all elements of protocol specified, but only a specific set of parameters are actually used.

#### ISO 8823 presentation layer

VTAM CMIP services implements all required aspects of the presentation layer protocol used for establishing and releasing connections. VTAM CMIP services also implements the encoding and decoding function specified. It supports a single transfer syntax, basic encoding rules (BER). Any other transfer syntaxes are rejected. If the partner does not support BER for an abstract syntax, an association cannot be established.

#### ISO 8825 BER—Basic Encoding Rules (BER)

VTAM CMIP services supports encoding and decoding of all of the ASN.1 types using the basic encoding rules. Some of the types are supported to a limited extent, specifically:

- Integers are encoded and decoded only up to the size supported by the machine in a native format. When any larger integers are received, they are left in the BER form, and passed to the user in the BER form.
- Only the default code page is supported for GraphicString.

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## ISO standards documents

This section indicates how VTAM CMIP services conforms to several industry profiles governing the implementation of ISO standards. These profiles are defined to allow interoperability between different implementations of the standards. Each covers a specific set of standards and specifies the set of mandatory and optional elements of those standards. Each profile specifies value ranges, message sizes, and so on, that ensure a common implementation base.

### DISP 11183-1, AOM 10

This profile governs the implementation of the ACSE, presentation layer, session layer for use with Remote Operation Service Element (ROSE) and Common Management Interface Service Element (CMISE).

VTAM CMIP services implements the relevant portions of this profile. All required elements of protocol are supported.

### DISP 11183-3, AOM 12

This profile governs the implementation of the CMISE.

VTAM CMIP services implements the relevant portions of this profile.

### AOM221—general event report management

This profile governs the implementation of the event forwarding discriminator object class, which VTAM CMIP services supports.

This profile specifies a minimum set of attributes that must be permitted to appear in discriminator constructs and the minimum levels of complexity that must be supported.

VTAM CMIP services complies; VTAM CMIP services allows any level of complexity and supports any set of events (GDMO NOTIFICATION templates and the associated attribute templates) with which it is loaded.

The profile also requires support for all matching rules that can be specified in the discriminator construct. VTAM CMIP services does not support the SET operations: subset, superset, and non-null-set-intersection.

The profile also requires support for two non-mandatory packages: weekly scheduling and backup destinations. VTAM CMIP services supports neither.

This profile does not require support for confirmed mode conditional, which VTAM CMIP services does not support.

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## Appendix E. VTAM topology agent object and attribute tables

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### VTAM-supported objects for snapshot operations

The set of objects VTAM supports for *snapshot* operations is presented in the following table.

Table 22. Supported object classes for snapshot

Object identifier	Object name
1.3.18.0.0.1811	<u>luCollection</u>
1.3.18.0.0.2291	<u>logicalUnitIndex</u>
1.3.18.0.0.2152	<u>snaLocalTopo</u>
1.3.18.0.0.2151	<u>snaNetwork</u>

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### Naming attributes for snapshot objects

Naming attributes for snapshot objects are presented in the following table.

Table 23. Naming attributes for snapshot objects

Attribute identifier	Attribute name	Object name
1.3.18.0.0.2216	<u>graphId</u>	<u>snaLocalTopo</u>
1.3.18.0.0.2216	<u>graphId</u>	<u>snaNetwork</u>
1.3.18.0.0.1815	<u>luCollectionId</u>	<u>luCollection</u>
1.3.18.0.0.1815	<u>logicalUnitIndexName</u>	<u>logicalUnitIndex</u>

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### VTAM-supported objects for snapshot responses

The set of objects VTAM supports for the *snapshot* operation responses includes all valid objects for a GET or *snapshot* request and the objects in the following table.

Table 24. Unique objects for snapshot response

Object identifier	Object name	Snapshot type
1.3.18.0.0.2278	<u>crossDomainResourceManager</u>	<u>snaNetwork</u>
1.3.18.0.0.1848	<u>virtualRoute</u>	<u>snaNetwork</u>
1.3.18.0.0.1849	<u>virtualRoutingNode</u>	<u>snaNetwork, snaLocalTopo</u>
1.3.18.0.0.1840	<u>subareaTransmissionGroup</u>	<u>snaLocalTopo</u>
1.3.18.0.0.1823	<u>appnTransmissionGroup</u>	<u>snaNetwork, snaLocalTopo</u>

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## VTAM-supported attributes for snapshot responses

The set of attributes VTAM supports for the *snapshot* operation responses includes all valid attributes for GET operations and the attributes in the following table.

Table 25. Unique attributes for snapshot response

Attribute identifier	Attribute name	Snapshot type
1.3.18.0.0.5246	<u>realSSCPname</u>	<u>snaNetwork</u>
1.3.18.0.0.1958	<u>cp-cpSessionSupport</u>	<u>snaNetwork, snaLocalTopo</u>
1.3.18.0.0.1941	<u>appnTGcapabilities</u>	<u>snaNetwork, snaLocalTopo</u>

---

## VTAM-supported objects for GET operation

The set of objects VTAM supports for the GET operation is presented in the following table.

Table 26. Supported object classes for GET

Object identifier	Object name
1.3.18.0.0.2281	<u>crossDomainResource</u>
1.3.18.0.0.2267	<u>definitionGroup</u>
1.3.18.0.0.1821	<u>appnEN</u>
1.3.18.0.0.1826	<u>interchangeNode</u>
1.3.18.0.0.1827	<u>lenNode</u>
1.3.18.0.0.2085	<u>logicalLink</u>
1.3.18.0.0.1829	<u>logicalUnit</u>
1.3.18.0.0.1803	<u>luGroup</u>
1.3.18.0.0.1833	<u>migrationDataHost</u>
1.3.18.0.0.1822	<u>appnNN</u>
1.3.18.0.0.2089	<u>port</u>
1.3.18.0.0.2288	<u>appnRegisteredLu</u>
1.3.18.0.0.1843	<u>t2-1Node</u>
1.3.18.0.0.1844	<u>t4Node</u>
1.3.18.0.0.1845	<u>t5Node</u>

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## VTAM-supported attributes for GET operation

The set of mandatory attributes supported for the GET operation for a given object is presented in the following tables. There is one table per supported object class for the GET operation.

Table 27. CDRSC attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
2.9.3.2.7.33	<u>availabilityStatus</u>

Table 27. CDRSC attribute table (continued)

Attribute identifier	Attribute name
1.3.18.0.0.3591	<u>cdrscRealLUname</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
1.3.18.0.0.2284	<u>nlrResidentNodePointer (naming attribute)</u>
1.3.18.0.0.2276	<u>nonLocalResourceName</u>
1.3.18.0.0.2277	<u>nonLocalResourceType</u>
2.9.3.2.7.65	<u>objectClass</u>
2.9.3.2.7.35	<u>operationalState</u>
1.3.14.2.2.4.35	<u>opNetworkName</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.2.124.360501.1.302	<u>supportedResources</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>
0.0.13.3100.0.7.50	<u>userLabel</u>

Table 28. Definition group attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.3.18.0.0.2272	<u>definitionGroupName (naming attribute)</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
1.2.124.360501.1.302	<u>supportedResources</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 29. APPN end node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>

Table 29. APPN end node attribute table (continued)

Attribute identifier	Attribute name
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
1.3.18.0.0.1997	<u>nnServerPointer</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 30. Interchange node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.3.18.0.0.1940	<u>appnNodeCapabilities</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.2025	<u>dlurList</u>
1.3.18.0.0.1967	<u>erList</u>
1.3.18.0.0.1970	<u>extendedAppnNodeCapabilities</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.1972	<u>gatewaySSCP</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2013	<u>puName</u>
1.3.18.0.0.2019	<u>resourceSequenceNumber</u>



Table 30. Interchange node attribute table (continued)

Attribute identifier	Attribute name
1.3.18.0.0.2020	<u>routeAdditionResistance</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.3.18.0.0.2035	<u>subareaAddress</u>
1.3.18.0.0.2036	<u>subareaLimit</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 31. Low-entry networking node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 32. Logical link attribute table

Attribute identifier	Attribute name
1.3.18.0.0.2119	<u>adjacentLinkStationAddress</u>
1.3.18.0.0.2122	<u>adjacentNodeName</u>
1.3.18.0.0.2121	<u>adjacentNodeType</u>
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
2.9.3.2.7.33	<u>availabilityStatus</u>

Table 32. Logical link attribute table (continued)

Attribute identifier	Attribute name
2.9.3.5.7.1	<u>connectionID</u>
1.3.18.0.0.2125	<u>connectionType</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.7899	<u>dlurLocalLsAddress</u>
1.3.18.0.0.2309	<u>dlurName</u>
1.3.18.0.0.2235	<u>endpointForArc</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.2131	<u>lineType</u>
1.3.18.0.0.2133	<u>linkName (naming attribute)</u>
1.3.18.0.0.2134	<u>linkStationRole</u>
1.3.18.0.0.2137	<u>maxBTUsize</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
1.3.18.0.0.2236	<u>partnerConnection</u>
1.3.18.0.0.2142	<u>portId</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2045	<u>transmissionGroupNumber</u>
2.9.3.5.7.14	<u>underlyingConnectionNames</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 33. Logical unit attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.1984	<u>luName (naming attribute)</u>
1.3.18.0.0.1819	<u>luSecondName</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
2.9.3.2.7.35	<u>operationalState</u>

Table 33. Logical unit attribute table (continued)

Attribute identifier	Attribute name
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2018	<u>residentNodePointer</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.7900	<u>tn3270ClientDnsName</u>
1.3.18.0.0.7901	<u>tn3270ClientIpAddress</u>
1.3.18.0.0.7902	<u>tn3270ClientportNumber</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>
0.0.13.3100.0.7.50	<u>userLabel</u>

Table 34. LU group attribute table

Attribute identifier	Attribute name
2.9.3.2.7.50	<u>allomorphs</u>
1.3.18.0.0.1808	<u>luGroupMembers</u>
1.3.18.0.0.1807	<u>luGroupName (naming attribute)</u>
1.3.18.0.0.1809	<u>luGroupSize</u>
2.9.3.2.7.63	<u>nameBinding</u>
2.9.3.2.7.65	<u>objectClass</u>
2.9.3.2.7.66	<u>packages</u>

Table 35. Migration data host node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.1967	<u>erList</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.1972	<u>gatewaySSCP</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
1.3.18.0.0.1997	<u>nnServerPointer</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2013	<u>puName</u>

Table 35. Migration data host node attribute table (continued)

Attribute identifier	Attribute name
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.3.18.0.0.2035	<u>subareaAddress</u>
1.3.18.0.0.2036	<u>subareaLimit</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 36. APPN network node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.3.18.0.0.1940	<u>appnNodeCapabilities</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.2025	<u>dlurList</u>
1.3.18.0.0.1970	<u>extendedAppnNodeCapabilities</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2019	<u>resourceSequenceNumber</u>
1.3.18.0.0.2020	<u>routeAdditionResistance</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 37. Port attribute table

Attribute identifier	Attribute name
1.3.18.0.0.2115	<u>abmSupported</u>
1.3.18.0.0.2117	<u>adapterAddresses</u>

Table 37. Port attribute table (continued)

Attribute identifier	Attribute name
1.3.18.0.0.2118	<u>adapterNumbers</u>
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
2.9.3.5.7.1	<u>connectionID</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.2127	<u>dlcName</u>
1.3.18.0.0.2235	<u>endpointForArc</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.2129	<u>limitedResource</u>
1.3.18.0.0.2130	<u>limitedResourceTimeout</u>
1.3.18.0.0.2131	<u>lineType</u>
1.3.18.0.0.2134	<u>linkStationRole</u>
1.3.18.0.0.2137	<u>maxBTUsize</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
1.3.18.0.0.2236	<u>partnerConnection</u>
1.3.18.0.0.2142	<u>portId (naming attribute)</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2146	<u>receiveWindowSize</u>
1.3.18.0.0.2244	<u>relatedAdapter</u>
1.3.18.0.0.2148	<u>sendWindowSize</u>
1.2.124.360501.1.302	<u>supportedResources</u>
2.9.3.5.7.14	<u>underlyingConnectionNames</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 38. APPN registered LU attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>

Table 38. APPN registered LU attribute table (continued)

Attribute identifier	Attribute name
1.3.18.0.0.2284	<u>nlrResidentNodePointer</u>
1.3.18.0.0.2276	<u>nonLocalResourceName (naming attribute)</u>
1.3.18.0.0.2277	<u>nonLocalResourceType</u>
2.9.3.2.7.65	<u>objectClass</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2273	<u>registeredBy</u>
1.2.124.360501.1.302	<u>supportedResources</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 39. Type 2.1 node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.2.124.360501.1.240	<u>functionID</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 40. Type 4 node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>

Table 40. Type 4 node attribute table (continued)

Attribute identifier	Attribute name
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.1967	<u>erList</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.1971	<u>gatewayNode</u>
1.3.18.0.0.1978	<u>interconnectedNetids</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.18.0.0.2035	<u>subareaAddress</u>
1.3.18.0.0.2036	<u>subareaLimit</u>
1.2.124.360501.1.302	<u>supportedResources</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>

Table 41. Type 5 node attribute table

Attribute identifier	Attribute name
2.9.3.2.7.31	<u>administrativeState</u>
2.9.3.2.7.50	<u>allomorphs</u>
1.2.124.360501.1.209	<u>attachedCircuitList</u>
2.9.3.2.7.33	<u>availabilityStatus</u>
1.3.18.0.0.2194	<u>dependencies</u>
1.3.18.0.0.1967	<u>erList</u>
1.2.124.360501.1.240	<u>functionID</u>
1.3.18.0.0.1972	<u>gatewaySSCP</u>
2.9.3.2.7.63	<u>nameBinding</u>
1.3.18.0.0.2080	<u>nativeStatus</u>
2.9.3.2.7.65	<u>objectClass</u>
1.3.14.2.2.4.33	<u>opEquipmentList</u>
2.9.3.2.7.35	<u>operationalState</u>
2.9.3.2.7.66	<u>packages</u>
2.9.3.2.7.36	<u>proceduralStatus</u>
1.3.18.0.0.2013	<u>puName</u>
1.3.18.0.0.2032	<u>snaNodeName (naming attribute)</u>
1.3.14.2.2.4.53	<u>softwareList</u>
1.3.18.0.0.2035	<u>subareaAddress</u>

Table 41. Type 5 node attribute table (continued)

<b>Attribute identifier</b>	<b>Attribute name</b>
1.3.18.0.0.2036	<u>subareaLimit</u>
1.2.124.360501.1.302	<u>supportedResources</u>
1.3.18.0.0.2296	<u>sysplexInfo</u>
2.9.3.2.7.38	<u>unknownStatus</u>
2.9.3.2.7.39	<u>usageState</u>



---

## Appendix F. VTAM topology agent attributes definition

For each attribute, the following table explains:

- ASN.1 syntax used for that attribute
- The information that attribute describes about the resource; for example, its DLC address
- What VTAM resource that attribute is referring to
- Which CMIP operations can report that attribute
- Which OSI classes that attribute applies to

---

### abmSupported

#### Syntax

BOOLEAN

**TRUE** Supports asynchronous balance mode

**FALSE**

Does not support asynchronous balance mode

#### Meaning

Whether asynchronous balanced mode is supported

#### Source

XID3. This value is only TRUE when the XID format 3 received from a type 2.1 node indicates asynchronous balanced mode.

#### Operations

GET

#### Attribute of

port

---

### adapterAddresses

#### Syntax

SET OF OCTET STRING

#### Meaning

Local DLC address; for example, local MAC/SAP address.

#### Source

Dependent on resource type:

##### **NTRI physical line**

The local MAC/SAP address returned as 14 characters; for example, 11223344556601. The first 12 characters are the MAC address and the last two are the SAP address. This is the value coded on the LOCADD operand of the LINE definition statement in an NCP major node.

**Note:** The local MAC/SAP address does not apply to NTRI logical lines.

##### **LAN or ATM LAN emulation switched line**

The local MAC/SAP address for the XCA adapter associated with

the line. This information is available only when the line and PU are active and the X'57' DLC address vector has been received.

**LAN or ATM LAN emulation leased line**

The local MAC/SAP address for the XCA adapter associated with the line. This information is available only when the line and PU are active and the X'57' DLC address vector has been received.

**ATM native SVC (switched line) or PVC (nonswitched line)**

The local ATM address for the IBM S/390® Open Systems Adapter associated with the SVC or PVC. The local ATM address is returned as a variable length character string. The following is an example of an ATM address:

XXXXYYYYZZ...ZZ

where:

**XXXX** Represents the address type and plan and can be:

**X'0101'**

Indicates public E164 address, which means the address is in a public ATM network.

**X'0002'**

Indicates International Organization for Standardization (ISO) network service access point (NSAP), which means the address is in a private ATM network.

**YYYY** Represents the length of the address. The address can be up to 20 bytes in hexadecimal format.

**ZZ...ZZ**

Represents the actual ATM address. The address can be up to 20 bytes in length.

**XCF line**

The XCF token of the agent VTAM returned as 16 characters.

**Operations**

GET, SNAPSHOT(snaLocalTopo)

**Attribute of**

port

---

## adapterNumbers

**Syntax**

SET OF INTEGER (0..65535)

**Meaning**

Address or addresses used to access the port

**Source**

Dependent on resource type:

**Channel lines**

This is the *decimal* representation of the channel unit address coded on the ADDRESS operand of the LINE definition statement.

**Multipath channel**

This is the *decimal* representation of each read and write channel

unit address coded on the READ and WRITE operands of the LINE definition statement in the MPC group.

**APPN host-to-host channel**

This is the *decimal* representation of each read and write channel unit address coded on the READ and WRITE operands of the transport resource list entry (TRLE) associated with the PU.

**NCP SDLC lines**

This is the *decimal* representation of the line address coded on ADDRESS operand of the LINE definition statement.

**XCA lines**

The *decimal* channel unit address of the channel that connects VTAM to the 3172 Interconnect Controller.

**Operations**

GET, SNAPSHOT(snaLocalTopo-appnOnly)

**Attribute of**

port

---

## adjacentLinkStationAddress

**Syntax**

CHOICE { IsAddr OCTET STRING, noLSaddr NULL }

**Meaning**

DLC address for the remote PU.

**For SDLC**

SDLC polling address

**For token ring and frame relay**

Remote MAC/SAP address

**For ATM native SVCs**

Destination ATM address

**For ATM native PVCs**

Null string

**For XCF**

XCF token of the adjacent VTAM

**Source**

Dependent on resource type:

**For SDLC non-switched PUs**

The SDLC polling address of the PU. This is specified on the ADDR operand of the PU statement.

**For NTRI logical switched PUs**

The MAC/SAP address of the remote PU in the form 11223344556601. The first 12 characters are the MAC address and the last two are the SAP address. This information is available only when the line and PU are active and the X'57' DLC address vector has been received.

**For NTRI logical subarea PUs**

The MAC/SAP address of the remote link station. The MAC address is coded on the LOCADD operand of the LINE. The SAP address for NCP NTRI is X'04'.

**LAN or ATM LAN emulation peripheral connections (switched)**

The MAC/SAP address of the remote PU. This information is available only when the line and PU are active and the X'57' DLC address vector has been received.

**LAN or ATM LAN emulation subarea connections (leased)**

The MAC/SAP address of the remote link station. This MAC address is defined on the MACADDR operand of the PU definition statement. The SAP address is defined on the SAPADDR operand of the PU definition statement.

**ATM native connections (TGs over SVCs)**

The destination ATM address for the remote node associated with the SVC. The destination ATM address The remote ATM address is returned as a variable length character string. The following is an example of an ATM address:

XXXXYYYYZZ...ZZ

where:

**XXXX** Represents the address type and plan and can be:

**X'0101'**

Indicates public E164 address, which means the address is in a public ATM network.

**X'0002'**

Indicates International Organization for Standardization (ISO) network service access point (NSAP), which means the address is in a private ATM network.

**YYYY** Represents the length of the address. The address can be up to 20 bytes in hexadecimal format.

**ZZ...ZZ**

Represents the actual ATM address. The address can be up to 20 bytes in length.

**ATM native connections (TGs over PVCs)**

The destination ATM address for the remote node associated with the PVC is unknown.

**XCF connections**

The XCF token of the adjacent VTAM returned as 16 characters. This information is available only when the XCF connection is active.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

logicalLink

---

**adjacentNodeName**

**Syntax**

GraphicString (SIZE(0..17))

**Meaning**

Network qualified name of node connected to this logicalLink.

**Source**

Generally, this information is available only when the line and PU are active. This represents the name of the adjacent node and depends on the type of connection (subarea or APPN) and the code level of the contacted node. These nodes are capable of providing the X'0EF1', X'0EF4', and X'0EF7' control vectors during CONTACT processing.

**Subarea connection to VTAM V4R3 or later**

The SSCP name of the VTAM contacted by this link station.

**Subarea connection to NCP V7R1 or later**

The PU name of the NCP contacted by this link station. This might be the same as the NCP load module name.

**Subarea connection to backlevel subarea node (NCP earlier than V7R1 or VTAM earlier than V4R3)**

The name is represented as a character string with the decimal subarea number of the contacted node. For example, 00000123 would be the name for a backlevel subarea node with subarea number 123.

**APPN connections**

The CP name of the contacted APPN node.

**LEN connections**

The CP name of the contacted LEN node or the predefined CP name or the name of the VTAM host CP supporting the LEN connection.

**Operations**

GET

**Attribute of**

logicalLink

**adjacentNodeType****Syntax**

```
ENUMERATED { unknown,
             len,
             nn,
             en,
             t1,
             t20,
             t4,
             t5,
             t21 }
```

**Meaning**

Type of attached PU or node.

**Source**

The node type is provided as it is currently known according to definitions at VTAM topology agent host. This attribute is related to the PUTYPE and XID operand of the PU definition statement. The value provided may change after the node is contacted and VTAM determines the actual node type of the contacted node.

PUTYPE	XID	AdjacentNodeType
1	N/A	t1
2	NO	t20
2	YES	t21 (if not yet contacted)
2	YES	len (contacted len node)
2	YES	en (contacted APPN end node)
2	YES	nn (contacted APPN network node)
4	N/A	t4 (contacted PU type 4)
4	N/A	t5 (contacted PU type 5)
5	N/A	t5 (contacted PU type 5)

**Note:** logicalLinks represent either a subarea or APPN connection to an adjacent node. Therefore, the adjacent node type is never be a composite of subarea and APPN (for example, an interchange node). The manager application program must infer the actual node type of composite nodes or consult an agent application program at the node in question.

#### Operations

GET, SNAPSHOT(snaLocalTopo)

#### Attribute of

logicalLink

---

## administrativeState

#### Syntax

Two types: ENUMERATED { locked,

unlocked,  
shuttingDown }

OCTET: X'00'= locked

X'00'= locked  
X'01'= unlocked  
X'02'= shuttingDown  
X'FF'= unchanged

ENUMERATED is used for GET operations. OCTET is used for SNAPSHOT operations.

#### Meaning

OSI administrative state.

#### Source

Value is always "unlocked".

#### Operations

GET, SNAPSHOT(all types)

#### Attribute of

all objects

---

## allomorphs

### Syntax

SET OF ObjectClass (OIs)

### Meaning

Classes for which this class can emulate. Constant value; depends on object class.

### Source

Depends on the object class

### Object class

**allomorphs**

### t5Node

(lenNode, t2-1Node)

### appnNN

(lenNode, t2-1Node)

### appnEN

(lenNode, t2-1Node)

### interchangeNode

(lenNode, t2-1Node, t5Node, appnNN)

### migrationDataHost

(lenNode, t2-1Node, t5Node, appnEN)

### others ()

### Operations

GET

### Attribute of

all objects

---

## appnNodeCapabilities

### Syntax

OCTET STRING (SIZE(2))

### Meaning

SNA control vector 45, subfield 80:

### Bit      Meaning

1... .... Gateway function supported

.1. .... Directory server function supported

..1. .... Intermediate routing function supported

...1 .... Chain function supported

.... 00..  
Reserved

.... ..00  
SNA node type 5

.... ..11  
SNA node type 2.1

1... .... Release 1 border node

- .1. .... Interchange node
- ..1. .... Release 2 border node
- ...0 0...
- No HPR support
- ...0 1...
- HPR base support
- ...1 0...
- HPR base and tower support
- ...1 1...
- Reserved
- .... .000
- Reserved

**Source**

This information is provided only for the node running the VTAM topology agent and only when the node is capable of being an APPN network node.

**Operations**

GET, SNAPSHOT(snaNetwork, snaLocalTopo)

**Attribute of**

interchangeNode  
appnNN

## appnTGcapabilities

**Syntax**

OCTET STRING (SIZE(1))

**Meaning**

TG capabilities of an APPN transmission group from SNA control vector 46, subfield 80, flags byte

**Bit      Meaning**

- 1... .... tgPartnerIsAConnectionNetwork
- .1. .... Peripheral TG
- ..1. .... tgPartnerType is type 2
- ..0. .... tgPartnerType is type 2.1
- ...0 0...
- tgType is boundary function or APPN TG
- ...0 1...
- tgType is interchange TG
- ...1 0...
- tgType is virtual route TG
- ...1 1...
- Reserved
- .... .1. intersubnetworkLink for Release 1 border nodes
- .... .0. intersubnetworkLink for Release 2 border nodes



.... ..1. Reserved

.... ..1 Reserved

**Source**

CV 46, subfield 80 for active APPN TGs. This attribute does not apply to LEN connections.

**Operations**

SNAPSHOT(snaNetwork,snaLocalTopo)

**Attribute of**

appnTransmissionGroup

---

## attachedCircuitList

**Syntax**

SET OF ObjectInstance

**Meaning**

VTAM always builds the empty set, ().

**Source**

Not supported

**Operations**

GET

**Attribute of**

appnEN  
interchangeNode  
lenNode  
logicalUnit  
migrationDataHost  
appnNN  
t2-1Node  
t4Node  
t5Node

---

## availabilityStatus

**Syntax**

SET OF INTEGER { inTest (0),

failed (1),  
powerOff (2),  
offLine (3),  
offDuty (4),  
dependency (5),  
degraded (6),  
notInstalled (7),  
logFull (8) }

OCTET: X'00'= no Status

X'01'= notInstalled  
X'02'= degraded  
X'04'= dependency  
X'08'= offDuty

X'10'= offLine  
X'20'= powerOff  
X'40'= failed  
X'80'= inTest  
X'FF'= no change

INTEGER is used for GET and NOTIFICATION operations.

OCTET is used for SNAPSHOT operations.

**Meaning**

OSI availability status: The following values can be returned by VTAM: offline, failed, inTest, dependency, degraded, and no information NULL.

**Source**

Determined from VTAM resource definition table entry (RDTE) finite state machine (FSM) state or SNA control vector 45, subfield 80 depending on resource type.

**Operations**

GET, SNAPSHOT(all types), NOTIFICATIONS

**Attribute of**

all objects except luGroup

---

## cdrscRealLUname

**Syntax**

SNACsAD-819(SIZE(0..17))

**Meaning**

Represents the network-qualified real LU name (instead of an alias name) for a cross-domain resource.

**Source**

Valid for a cross-domain resource that has been verified by session establishment with the actual resource represented by the CDRSC. The real name may vary from the CDRSC name because of alias name translation.

**Operations**

GET, SNAPSHOT (luCollection, luIndex)

**Attribute of**

crossDomainResource

---

## connectionID

**Syntax**

GraphicString

**Meaning**

Address or addresses used to access the port

**Source**

The information provided is similar to that provided for adapterNumbers. However, this attribute provides the data in character format that might contain hexadecimal characters.

- For a port object, the value is described by the following:

**Channel lines**

This is the *hex* representation of the channel unit address coded on the ADDRESS operand of the LINE definition statement.

**Multipath channel**

This is the *hex* representation of each read and write channel unit address coded on the READ and WRITE operands of the LINE definition statement in the MPC group. Each address each separated by a comma.

**APPN host-to-host channel**

This is the *hex* representation of each read and write channel unit address coded on the READ and WRITE operands of the transport resource list entry (TRLE) associated with the PU. Each address is separated by a comma.

**NCP SDLC lines**

This is the *decimal* representation of the line address coded on ADDRESS operand of the LINE definition statement.

**LAN or ATM LAN emulation lines**

The *hex* channel unit address of the channel that connects VTAM to the IBM 3172 Nways Interconnect Controller or the IBM S/390 Open Systems Adapter. This attribute appends the slot number to the channel address separated by a period; for example, 590.001. The slot number is coded on the ADAPTNO operand of the PORT statement in the external communications adapter (XCA) major node.

**ATM native SVCs (switched lines) and PVCs (nonswitched lines)**

The name of the TRLE definition statement in the TRL major node that defines the IBM S/390 Open Systems Adapter.

**XCA Lines for Enterprise Extender**

This is the local host virtual IP address (VIPA). The IP address can be either an IPv4 address in dotted-decimal form or an IPv6 address in the colon-hexadecimal form.

- For a logicalLink object, the value is described by the following:

**ATM native SVCs (switched lines) and PVCs (nonswitched lines)**

The virtual path connection identifier/virtual channel identifier (VPCI/VCI) received on the CM\_CONNECT indication.

**Switched PUs for Enterprise Extender lines**

This is the remote host virtual IP address (VIPA). The IP address can be either an IPv4 address in dotted-decimal form or an IPv6 address in the colon-hexadecimal form.

**Operations**

GET, SNAPSHOT(snaLocalTopo-appnPlusSubarea)

**Attribute of**

logicalLink  
port

---

**connectionType**
**Syntax**

ENUMERATED { unknown,

host,  
peer,  
host-and-peer }

**Meaning**

Type of connection to node:

**peer** T2.1 nodes not requesting ACTPU

**host-and-peer**  
T2.1 nodes requesting ACTPU

**host** FID4 connections

**unknown**  
Inactive FID2 connections

**Source**

For type 2.1 node, the XID format 3 indicates ACTPU requirements. FID4 connections are determined by system definition.

**Operations**

GET

**Attribute of**

logicalLink

---

## cp-cpSessionSupport

**Syntax**

BOOLEAN

**TRUE** APPN TG is capable of CP-CP sessions.

**FALSE**  
APPN TG is not capable of CP-CP sessions.

**Meaning**

Whether TG is capable of supporting CP-CP sessions. This does NOT indicate whether CP-CP sessions exist; it indicates only that the capability exists.

**Source**

Determined from TG control vector X'47'.

**Operations**

SNAPSHOT(snaNetwork), SNAPSHOT(snaLocalTopo)

**Attribute of**

appnTransmissionGroup

---

## definitionGroupName

**Syntax**

GraphicString

**Meaning**

Major node type and major node name.

**Source**

Major node type and name are determined from system definition. The type and name are concatenated and separated by a period; for example, NCP.NCP3AB7.

The following major node types are supported.

**Prefix Description**

**NCP** NCP major node

**APPL** Application major node

**LCLNONSNA**

Local non-SNA major node

**SWITCHED**

Switched major node

**LOCALSNA**

Local SNA major node

**CDRM**

CDRM major node

**CDRSC**

CDRSC major node

**CA** Channel Attached major node

**MODEL**

Model major node

**LAN** ICA LAN major node

**PACKET**

Packet major node

**XCA** XCA major node

**LUGROUP**

LUGROUP major node

**ADJCP**

Adjacent CP major node

**TCP** TCP/IP major node

**TRL** Transport resource list major node

**Operations**

GET, SNAPSHOT(snaLocalTopo)

**Attribute of**

definitionGroup

---

## dependencies

**Syntax**

CHOICE { unknown -0- IMPLICIT NULL,

noDependents -1- IMPLICIT NULL,  
dependents Dependents }

Dependents ::= CHOICE { item ObjectInstance,

and IMPLICIT SET OF Dependents,  
or IMPLICIT SET OF Dependents}

**Meaning**

Higher level object upon which the object of interest is dependent. This usually includes the definitionGroup object that has information about the VTAM major node and type.

**Object type****Dependent on**

**port** definition group, logicalLink, VTAM, NCP

NTRI logical lines that are represented as port objects report the physical unit as a dependency, when known.

**logicalLink**

definition group, port

Switched logicalLinks report a port dependency only when the PU is connected.

**Note:** VTAMTOPO line filtering does not affect port dependency.

**t4Node**

definition group, VTAM

**logical unit**

definition group, logicalLink, VTAM, dependent LU requester

Dependent logical units have a dependency on the owning PU. The owning PU is represented as a logicalLink. The logicalLink is not included for logicalUnits owned by the VTAM host, such as application programs.

Dependent LUs that use the dependent LU requester and dependent LU server function are dependent on the dependent LU requester node, which is represented as a snaNode.

**cdrsc** definition group, snaNode

CDRSCs have a dependency on the owning CDRM, when known. The owning CDRM is represented as an snaNode.

**Source**

The major node type and name and the higher level resource name are determined from system definitions.

**Operations**

GET, SNAPSHOT(snaLocalTopo, snaNetwork, luCollection)

**Attribute of**

all objects except luGroup

**dlcName****Syntax**

GraphicString (SIZE(1..8))

**Meaning**

A character constant describing the data link control name, as shown in the following list. VTAM might not support each DLC listed.

**Constant****Description**

**IBMTRNET**  
 Token Ring  
**FDDI** Fiber  
**SDLC** SDLC  
**CSMA**  
 CSMA  
**FRRELAY**  
 Frame Relay  
**SMDS**  
 SMDS  
**CHANNEL**  
 Channel  
**ETHERAND**  
 Ethernet  
**TOKENBUS**  
 Token Bus  
**ISDNBASC**  
 ISDN basic  
**ISDNPRI**  
 ISDN primary  
**ISDNBB**  
 ISDN broadband  
**ATM** Asynchronous Transfer Mode  
**XCF** Cross-system Coupling Facility

**Source**

Determined from system definition.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

port

## dlurList

**Syntax**

SET OF ObjectInstance

**Meaning**

The list of dependent LU requester (DLUR) nodes served by this dependent LU server (DLUS) node. VTAM always returns empty set.

**Source**

Not supported.

**Operations**

GET

**Attribute of**

appnNN  
 interchangeNode

---

## dlurLocalLsAddress

**Syntax**

CHOICE { noLSaddr NULL, lsAddr OCTET STRING }

**Meaning**

The local DLUR DLC address.

**Source**

The MAC/SAP address of the DLUR LAN adapter used for the connection to the PU reporting this attribute. This value is in the form 11223344556601 where the first 12 characters are the MAC address and the last two are the SAP address. This information is available when the PU is active and the 'x'57' DLC address vector has been received.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

logicalLink

When a DLUR supports downstream PUs, an instance with this behavior reports the local addressing information (for example, a LAN MAC and SAP at the DLUR's end) for the logical link between the DLUR and the downstream PU.

---

## dlurName

**Syntax**

CHOICE { noInfo NULL, object ObjectInstance }

**Meaning**

The network-qualified name of the dependent LU requester (DLUR) node associated with this logicalLink.

**Source**

This attribute value is determined when a switched PU connects to a dependent LU requester.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

logicalLink

---

## endpointForArc

**Syntax**

CHOICE { noinfo NULL, object ObjectInstance }

**Meaning**

VTAM always returns noinfo NULL.

**Source**

Not supported.

**Operations**

GET

**Attribute of**



logicalLink  
port

---

## erList

**Syntax**  
SET OF ObjectInstance

**Meaning**  
VTAM always returns empty set.

**Source**  
Not supported.

**Operations**  
GET

**Attribute of**

interchangeNode  
migrationDataHost  
t4Node  
t5Node

---

## extendedAppnNodeCapabilities

**Syntax**  
OCTET STRING (SIZE(2))

**Meaning**  
SNA control vector 45, subfield 81:

Bit	Meaning
1... ....	Node is central director server
.000 0000	Reserved
0000 0000	Reserved

**Source**  
The VTAM topology data base.

**Operations**  
GET, SNAPSHOT (snaNetwork, snaLocalTopo)

**Attribute of**

interchangeNode  
appnNN

---

## functionID

**Syntax**  
CHOICE { number INTEGER, string GraphicString }

**Meaning**  
Value of the low-order relative distinguished name in the distinguished name of the object. This is the common name of the object.

**Source**  
The value is determined from the GET request.

**Operations**  
GET

**Attribute of**  
all objects except luGroup

---

## gatewayNode

**Syntax**  
BOOLEAN

**TRUE** The type 4 node is capable of acting as a gateway node.

**FALSE**  
The type 4 node is not capable of acting as a gateway node.

**Meaning**  
Whether type 4 node is capable of acting as a gateway node.

**Source**  
This capability is indicated on the ACTPU response.

**Operations**  
GET, SNAPSHOT (snaLocalTopo)

**Attribute of**  
t4Node

---

## gatewaySSCP

**Syntax**  
BOOLEAN

**TRUE** The node running the VTAM topology agent is capable of acting as a gateway node

**FALSE**  
The node running the VTAM topology agent is not capable of acting as a gateway node

**Meaning**  
Whether the node running the VTAM topology agent is capable of acting as a gateway node

**Source**  
Start option definition for GWSSCP start option.

**Operations**  
GET, SNAPSHOT(snaLocalTopo)

**Attribute of**  
  
interchangeNode  
migrationDataHost  
t5Node

---

## interconnectedNetids

### Syntax

SET OF SEQUENCE { native BOOLEAN,  
  
netid ObjectInstance,  
netIdRole ENUMERATED { static (0),  
  
dynamic (1) },  
  
subareaAddress subareaAddress,  
subareaLimit SubareaLimit }

### Meaning

The network identifiers supported by a gateway NCP.

### Source

These network identifiers are either defined on the NETWORK operand of the NCP major node or they are discovered by using the NOTIFY RUs from the NCP.

### Operations

GET, SNAPSHOT(snaLocalTopo)

### Attribute of

t4Node

---

## limitedResource

### Syntax

BOOLEAN  
  
TRUE The port is a limited resource.  
  
FALSE  
The port is not a limited resource.

### Meaning

Whether the port is a limited resource.

### Source

System definition for line represented by port object. Limited resource status is indicated by the LIMRES keyword.

### Operations

GET

### Attribute of

port

---

## limitedResourceTimeout

### Syntax

CHOICE { integer INTEGER, uninitialized NULL }

### Meaning

This attribute is always returned as uninitialized NULL.

### Source

Not supported.

**Operations**  
GET

**Attribute of**  
port

---

## lineType

**Syntax**  
ENUMERATED { switched, nonswitched }

**Meaning**  
Depends on whether the line is switched.

**switched**  
The line or physical unit is a switched resource.

**nonswitched**  
The line or physical unit is not a switched resource.

**For ATM native connections:** are nonswitched.

**Source**  
System definition for the PU.

**Operations**  
GET, SNAPSHOT (snaLocalTopo)

**Attribute of**  
  
logicalLink  
port

---

## linkName

**Syntax**  
GraphicString (SIZE(1..17))

**Meaning**  
The name of the physical unit represented by the logicalLink object.

**Source**  
System definition for the PU or link station.

**Operations**  
GET

**Attribute of**  
logicalLink

---

## linkStationRole

**Syntax**  
ENUMERATED { secondary,  
  
primary,  
negotiable,  
unknown }

**Meaning**  
Indicates the role of the link station represented by the logicalLink object.

**Source**

This is determined by system definition and XIDs where applicable.

**Operations**

GET

**Attribute of**

logicalLink  
port

---

## luGroupMembers

**Syntax**

SET OF Fully-QualifiedNAUname  
SNACsAD-819(SIZE(1..17))

**Meaning**

Network-qualified names of the resources that make up an luGroup object.

**Source**

Depends on the underlying implementation of the luGroup.

**USERVAR**

The name specified on the VALUE= keyword when defining a USERVAR.

**Generic resource**

The names of real application programs associated with the generic resource definition. Application programs are added to or deleted from the luGroup with the SETLOGON macroinstruction of the VTAM application programming interface (API).

**Operations**

GET, SNAPSHOT (luCollection)

**Attribute of**

luGroup

---

## luGroupName

**Syntax**

SNACsAD-819(SIZE(1..8))

**Meaning**

The naming attribute of the luGroup object.

**Source**

This is the name provided on a GET request for an luGroup object.

**Operations**

GET

**Attribute of**

luGroup

---

## luGroupSize

**Syntax**

NonnegativeNumber

**Meaning**

Number of members in the luGroup object.

**Source**

For a USERVAR, this is always 1. For a generic resource, this is the number of application programs associated with the generic resource. This corresponds to the number of member names provided in the luGroupMembers attribute.

**Operations**

GET

**Attribute of**

luGroup

---

## luSecondName

**Syntax**

GraphicString

**Meaning**

For logicalUnit objects that are VTAM application programs, this attribute provides the ACB name of the application. For logicalUnit objects that are not application programs, this attribute value is the null string.

**Source**

The ACBNAME is coded on the APPL application definition in an application program major node. The ACBNAME may be the same as the application name.

**Operations**

GET

**Attribute of**

logicalUnit

---

## maxBTUsize

**Syntax**

CHOICE { maxBTUsize INTEGER (1..32767), noMaxBTUsize NULL }

**Meaning**

VTAM always builds (noMaxBTUsize NULL).

**Source**

This attribute value is not supported.

**Operations**

GET

**Attribute of**

logicalLink  
port

---

## nameBinding

**Syntax**

OBJECT IDENTIFIER

**Meaning**

The name binding object from which VTAM derives the naming attribute of the object class.

**Source**

Constant for each object class

**Operations**

GET

**Attribute of**

all objects

**nativeStatus****Syntax**

```
INTEGER { active (0),
        activeWithSession (1),
        inactive (2),
        neverActive (3),
        pendingActive (4),
        pendingInactive (5),
        connectable (6),
        routable (7),
        operative (8),
        congested (9),
        released (10),
        reset (11),
        inoperative (12) }
```

OCTET: X'02'= inactive

X'03'= neverActive

X'04'= pendingActive

X'05'= pendingInactive

X'06'= connectable

X'07'= routable

X'09'= congested

X'0A'= released

X'0B'= reset

X'0C'= inoperative

X'FF'= no change

INTEGER is used for GET and NOTIFICATION operations.

OCTET is used for snapshot operations.

**Meaning**

The VTAM status of the resource. All of the states except the “congested” status correspond with existing VTAM resource states. The “congested” status indicates that an NCP type 4 node is in slowdown.

**Source**

The finite state machine and modifiers in the RDTE for the resource.

**Note:** This value usually corresponds with the resource status displayed on VTAM message IST486I. However, the VTAM display is usually more

specific because VTAM defines many more intermediate resource states than are provided by the VTAM topology agent.

**Operations**

GET, SNAPSHOT (all types), NOTIFICATIONS

**Attribute of**

all objects except luGroup

---

## **nlrResidentNodePointer**

**Syntax**

GraphicString

**Meaning**

Name of the CP or SSCP that owns the real resource represented by this CDRSC or appnRegisteredLu object.

**Source**

Depends on Object type

**CDRSC**

This is the owning CP or SSCP. This may be predefined or learned as a result of session establishment. When this information is unknown, the null string is returned.

**appnRegisteredLu**

This is the CP name for this resource.

**Operations**

GET, SNAPSHOT (luCollection)

**Attribute of**

CDRSC  
appnRegisteredLu

---

## **nnServerPointer**

**Syntax**

CHOICE { noObject NULL, Object ObjectInstance }

**Meaning**

This is the object instance that represents the network node server for the node running the VTAM topology agent when the node is an APPN end node or migration data host. The null form is provided when the network node server is not known.

**Source**

The network node server is determined at the time CP-CP sessions are established. Potential network node servers might be defined in a network node server list major node, but this attribute is available only when a server has actually been selected.

**Operations**

GET

**Attribute of**

appnEN  
migrationDataHost



---

## nonLocalResourceName

**Syntax**

GraphicString

**Meaning**

The name specified on the GET operation for the registeredLU object or the CDRSC object.

**Source**

The input name is returned in this attribute.

**Operations**

GET

**Attribute of**

CDRSC  
appnRegisteredLu

---

## nonLocalResourceType

**Syntax**

GraphicString

**Meaning**

The object type of the object found with the nonLocalResourceName attribute. The values are:

- CDRSC
- appnRegisteredLu.

**Source**

The resulting type depends on the type of the resource found as a result of a GET operation. If both exists, CDRSC is returned.

**Operations**

GET

**Attribute of**

CDRSC  
appnRegisteredLu

---

## objectClass

**Syntax**

OBJECT IDENTIFIER

**Meaning**

The object class of the object containing this attribute

**Source**

From VTAM resource information

**Operations**

GET

**Attribute of**

all objects

---

## opEquipmentList

### Syntax

SET OF ObjectInstance

### Meaning

For the node running the VTAM topology agent, a distinguished name in the form:

```
distinguishedName  
"1.3.18.0.2.4.8=ORGREG;  
2.5.4.10=IBM;  
1.3.18.0.2.4.7=<CPU Model>;  
1.3.14.2.2.4.50=<CPU Serial Number>"
```

<CPU Model> is a character string that contains the actual CPU model for the agent host. <CPU Serial Number> is a character string that contains the serial number for the agent host.

For non-host objects, the null set is returned.

### Source

Determined from system storage.

### Operations

GET, SNAPSHOT (snaLocalTopo)

### Attribute of

appnEN  
interchangeNode  
lenNode  
logicalLink  
migrationDataHost  
appnNN  
port  
t2-1Node  
t4Node  
t5Node

---

## opNetworkName

### Syntax

GraphicString

### Meaning

The network name of the network where the LU represented by the CDRSC object resides, when available.

### Source

For predefined alias CDRSCs that are not in session, this information is unknown and the null string is provided. Otherwise, this is the predefined or learned NETID of the resource represented by this CDRSC object.

### Operations

GET

### Attribute of

CDRSC

---

## operationalState

### Syntax

ENUMERATED { disabled, enabled } OCTET: X'00'= disabled

X'01'= enabled

X'FF'= no change

ENUMERATED is used for GET and NOTIFICATION operations.

OCTET is used for snapshot operations.

### Meaning

The OSI operational state.

### Source

Determined from VTAM resource definition table entry (RDTE) finite state machine (FSM) state or SNA control vector 45, subfield 80 depending on resource type.

### Operations

GET, SNAPSHOT (all types), NOTIFICATIONS

### Attribute of

all objects except luGroup

---

## packages

### Syntax

SET OF OBJECT IDENTIFIER

### Meaning

The packages of attributes supported by VTAM for an object class.

### Source

Constant set of attributes for each class

### Operations

GET

### Attribute of

all objects

---

## partnerConnection

### Syntax

CHOICE { noinfo NULL,object ObjectInstance }

### Meaning

This is the object instance that represents the logicalLink on other end of a subarea or APPN TG connection, when available.

### Source

This is the name of the partner link station provided by the X'0EF7' control vector on XID. This information is available from APPN nodes and uplevel subarea nodes. Uplevel subarea nodes are VTAM V4R3 or NCP V7R1 or later. LogicalLinks must be active to obtain this information.

### Operations

GET

### Attribute of

logicalLink  
port

---

## portId

### Syntax

GraphicString

### Meaning

Name of the port object. When reported as an attribute of logicalLink, this identifies the SNA line associated with the physical unit. When reported as an attribute of port, it names the port object.

### Source

The port object represents a SNA LINE or DAN. SNA lines are defined during system definition or are dynamically created when channel attached NCPs are activated. Dynamically created lines have names of the form 0321-L where the first 4 characters are the printable hex representation of the channel unit address coded on the CUADDR operand of the PCCU statement in the NCP major node.

DANs represent connections to SNA controllers and are not explicitly defined. The name for the DAN is constructed from the channel unit address on the CUADDR operand of the PU statement in the local SNA major node. For example, CUADDR=16, would result in a portid of 000016-L.

### Operations

GET, SNAPSHOT (snaLocalTopo)

### Attribute of

logicalLink  
port

---

## proceduralStatus

### Syntax

SET OF INTEGER { initializationRequired (0)

notInitialized (1)  
initializing (2)  
reporting (3)  
terminating (4) }

OCTET: X'00'= no status

X'08'= terminating  
X'10'= reporting  
X'20'= initializing  
X'40'= not initialized

INTEGER is used for GET and NOTIFICATION operations.

OCTET is used for snapshot operations.

### Meaning

OSI state procedural status.

**Source**

Determined from VTAM resource definition table entry (RDTE) finite state machine (FSM) state or SNA control vector 45, subfield 80 depending on resource type.

**Operations**

GET, SNAPSHOT (all types), NOTIFICATIONS

**Attribute of**

all objects except luGroup and definitionGroup

**puName**

SNAcS-A-819 (SIZE(1..8))

**Meaning**

This is the name of the VTAM Agent host's subarea PU.

**Source**

The VTAM host subarea PU name is defined on the HOSTPU start option or is defaulted to ISTPUS.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

interchangeNode  
migrationDataHost  
t5Node

**receiveWindowSize****Syntax**

CHOICE { integer INTEGER, uninitialized NULL }

**Meaning**

VTAM always returns uninitialized NULL.

**Source**

Not supported

**Operations**

GET

**Attribute of**

port

**realSSCPname****Syntax**

SNAcS-AD-819 (SIZE(0..17))

**Meaning**

The real name of a cross domain resource manager as known at its SSCP. This information is not known until a CDRM-CDRM session has been established to the CDRM.

**Source**

This information is determined from SSCP Name control vector X'18' when available.

**Operations**

SNAPSHOT (snaNetwork-appnPlusSubarea)

**Attribute of**

crossDomainResourceManager

---

**registeredBy****Syntax**

ObjectInstance

**Meaning**

Provides the name of the node which registered the logical unit represented by this nonlocal resource.

**Source**

Name of the end node that registered the LU. This attribute is only known at Directory Server and Network Node Server agent hosts that have the resource registered.

**Operations**

GET

**Attribute of**

appnRegisteredLu

---

**relatedAdapter****Syntax**

CHOICE { noinfo NULL, object ObjectInstance }

**Meaning**

A logicalLink instance that is providing the physical connection for a logical line represented by a port object.

**Source**

The physical resource is applicable to NTRI logical lines and is determined at connection time. The physical PU is determined by the Related Resource Network Name subfield of the X'57' control vector provided by NCP.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

port

---

**residentNodePointer****Syntax**

ObjectInstance

**Meaning**

Name of a managed object representing the SNA node upon which this logicalUnit resides.

**Source**

For Dependent LUs, this represents the PU under which the LU is defined. For application programs and local non-SNA terminals, this represents the VTAM host.

**Operations**

GET, SNAPSHOT (luCollection)

**Attribute of**

logicalUnit

---

**resourceSequenceNumber****Syntax**

INTEGER (0..2\*\*32-1)

**Meaning**

For a GET on the VTAM agent host object, this attribute provides the current resource sequence number for the node. For SNAPSHOT(snaNetwork) this attribute provides the current resource sequence number for an appnTransmissionGroup object.

**Source**

VTAM resource data

**Operations**

GET, SNAPSHOT (snaNetwork)

**Attribute of**

interchangeNode  
appnNN  
appnTransmissionGroup

---

**routeAdditionResistance****Syntax**

INTEGER (0..255)

**Meaning**

VTAM always provides the value 0.

**Source**

Not supported.

**Operations**

GET

**Attribute of**

interchangeNode  
appnNN

---

**sendWindowSize****Syntax**

CHOICE { integer INTEGER, uninitialized NULL }

**Meaning**

VTAM always provides uninitialized NULL.

**Source**

Not supported.

**Operations**

GET

Attribute of  
port

---

## snaNodeName

### Syntax

SNACsAD-819 (SIZE(1..17))

### Meaning

The name of an SNA node.

### Source

For the VTAM host objects, this is the CP or SSCP name. For t4Node objects, this is the NCP PU name. For t2-1Node or lenNode, this is the CP name.

**Note:** GET support for all node types except t4Node is limited to the VTAM agent host.

### Operations

GET

### Attribute of

appnEN  
interchangeNode  
lenNode  
migrationDataHost  
appnNN  
t2-1Node  
t4Node  
t5Node

---

## softwareList

### Syntax

SET OF ObjectInstance

### Meaning

Provides the version and release of the VTAM running at the agent host.

distinguishedName  
"1.3.18.0.2.4.8=ORGREG;  
2.5.4.10=IBM;  
0.0.13.3100.0=(pString  
ACF/VTAM.<version>.<release>.  
<dot rel>)"

### Source

VTAM storage.

### Operations

GET, SNAPSHOT (snaLocalTopo)

### Attribute of

appnEN  
interchangeNode  
lenNode  
migrationDataHost



appnNN  
t2-1Node  
t5Node

---

## subareaAddress

### Syntax

INTEGER (1..65535)

### Meaning

The subarea address associated with the subarea object instance.

### Source

For the agent host object types, this is the value of the HOSTSA start option.

For t4Node objects that represent NCPs, this is the value of the SUBAREA operand of the PCCU statement in an NCP major node.

### Operations

GET, SNAPSHOT (snaLocalTopo)

### Attribute of

interchangeNode  
migrationDataHost  
t4Node  
t5Node

---

## subareaLimit

### Syntax

INTEGER (255..65535)

### Meaning

The subarea limit associated with the subarea object instance.

### Source

For the agent host object types, this is the value of the MXSUBNUM start option.

For t4Node objects that represent NCPs, this is the value of the SALIMIT operand of the NETWORK statement in an NCP major node. VTAM obtains this value at ACTPU response time, not from the NCP definition.

### Operations

GET, SNAPSHOT (snaLocalTopo)

### Attribute of

interchangeNode  
migrationDataHost  
t4Node  
t5Node

---

## supportedResources

### Syntax

CHOICE { noResources NoResources, resources SET OF ObjectInstance }

NoResources ::= ENUMERATED { infoUnavailable,  
none }

**Meaning**

When provided for the VTAM agent host object, this attribute contains a set of definitionGroup objects that represent all the major nodes defined at this host. For all other object types, (noResources none) is returned.

**Source**

This information is obtained from the system definitions at the agent host.

**Operations**

GET

**Attribute of**

all objects except luGroup

---

## sysplexInfo

**Syntax**

GraphicString

**Meaning**

Name of the z/OS sysplex, if known.

**Source**

This name is obtained from the MVS CVT when available.

**Operations**

GET, SNAPSHOT (snaLocalTopo)

**Attribute of**

appnEN  
interchangeNode  
lenNode  
migrationDataHost  
appnNN  
t2-1Node  
t5Node

---

## tn3270ClientDnsName

**Syntax**

CHOICE { noDnsName NULL, fullName GraphicString, truncatedName  
GraphicString }

**Meaning**

The TN3270 client DNS name.

**Source**

The client DNS name associated with TN3270 LU.

**Operations**

GET, SNAPSHOT (luCollection), NOTIFICATIONS

**Attribute of**

logicalUnit

This attribute returns either a GraphicString representation of a Domain Name Service (DNS) name for the TN3270 client associated with this LU, or a NULL value indicating that there is no client DNS name associated with this LU. If a name is returned, there is an indication whether it is a full name or a truncated name.

---

## tn3270ClientIpAddress

### Syntax

CHOICE { noIpAddress NULL, ipv4 GraphicString(SIZE(7..15)), ipv6 GraphicString(SIZE(2..56))}

### Meaning

The TN3270 client IP address.

### Source

The IP address associated with TN3270 LU.

### Operations

GET, SNAPSHOT (luCollection), NOTIFICATIONS

### Attribute of

logicalUnit

This attribute returns either a NULL value, indicating that there is no client IP address associated with this LU, or an IPv4 address in the dotteddecimal form (for example, a.b.c.d), or an IPv6 address in the colonhexadecimal form (for example, a:b:c:d:e:f:g:h) or if the IPv6 zone ID is supported, displays could be in the form a:b:c:d:e:f:g:h%zoneid.

---

## tn3270ClientPortNumber

### Syntax

CHOICE { noIpPort NULL, portNumber PrintableString(SIZE(1..5))}

### Meaning

The TN3270 client IP port number.

### Source

The IP port number associated with TN3270 LU.

### Operations

GET, SNAPSHOT (luCollection), NOTIFICATIONS

### Attribute of

logicalUnit

This attribute returns either a PrintableString representation of an IP port number between 1 and 65535 (decimal) inclusive, or a NULL value indicating that there is no client IP port number associated with this LU.

---

## transmissionGroupNumber

### Syntax

CHOICE { integer INTEGER, uninitialized NULL }

### Meaning

This attribute provides the TG number associated with the connection provided by this logicalLink. If the TG number is unknown, (uninitialized NULL) is provided.

**Source**

The TG number may be predefined with the TGN operand of the PU statement in system definition or may be dynamically assigned if not predefined. Not all PUs represented as logicalLinks will have TG numbers (for example, PU T1). PUs or link stations with the TG defined as ANY, where the TG number has not been negotiated, will return uninitialized NULL.

**Operations**

GET

**Attribute of**

logicalLink

---

**underlyingConnectionNames****Syntax**

SET OF ObjectInstance

**Meaning**

For a port object, this is always the null set.

For a logicalLink object, this represents the port that the logicalLink is subordinate to. If unknown, the null set is provided.

**Source**

For non-switched PUs, this is always the port object representing the LINE that the physical unit is defined under. For switched PUs, this attribute will not be known if the PU is not dialed.

**Operations**

GET

**Attribute of**

logicalLink  
port

---

**userLabel****Syntax**

GraphicString

**Meaning**

For logicalUnit objects that represent VTAM applications, this attribute contains the name of the application ACB. For CDRSC objects, this attribute contains the name of the CDRSC LUALIAS name if coded. For all other logicalUnit and CDRSC objects this attribute is the null string.

**Source**

VTAM applications define the ACB name on the ACBNAME operand of the APPL statement in a VTAM application program major node. The CDRSC LUALIAS name is coded on the LUALIAS operand of the CDRSC statement for a predefined CDRSC.

**Operations**

GET, SNAPSHOT (luCollection)

**Attribute of**

CDRSC  
logicalUnit

---

## unknownStatus

### Syntax

BOOLEAN

**TRUE** Unknown status

**FALSE**

Status is known

OCTET: X'00'= FALSE

X'01'= TRUE

X'FF'= no change

BOOLEAN is used for GET and NOTIFICATION operations.

OCTET is used for snapshot operations.

### Meaning

OSI state unknown status.

### Source

Determined from VTAM resource definition table entry (RDTE) finite state machine (FSM) state or SNA control vector 45, subfield 80 depending on resource type.

### Operations

GET, SNAPSHOT (all types), NOTIFICATIONS

### Attribute of

all objects except luGroup

---

## usageState

### Syntax

ENUMERATED { idle,

active,

busy }

OCTET: X'00'= idle

X'01'= active

X'02'= busy

X'FF'= no change

### Meaning

OSI state usage state

### Source

Determined from VTAM resource definition table entry (RDTE) finite state machine (FSM) state or SNA control vector 45, subfield 80 depending on resource type.

### Operations

GET

### Attribute of

appnNN  
port  
appnRegisteredLu  
t2-1Node  
t4Node  
t5Node

## Appendix G. VTAMTOPO filtering option reporting

Table 42 summarizes the results of using the VTAMTOPO filtering option for reporting a switched PU under an NCP.

The following is the legend for the table:

**notIGNR/INCL**

Neither IGNORE or INCLUDE specified.

**r** VTAMTOPO= not specified, REPORT inherited from node above.

**R** VTAMTOPO=REPORT specified (or NOLLINES at containing GROUP).

**nr** VTAMTOPO= not specified, NOREPORT inherited from node above.

**NR** VTAMTOPO=NOREPORT specified (or NOSWPUS at containing GROUP).

**NotRep**

Switched PU is not reported.

**IGNR** VTAMTOPO=IGNORE specified at designated major node.

**INCL** VTAMTOPO=INCLUDE specified at the designated major node.

**any** Value of VTAMTOPO= does not matter, inclusion not specified.

**R-NCP**

Switched PU is reported under the NCP under which the Switched PU is connected.

**R-SSCP**

Switched PU is reported under the SSCP directly (not under any NCP), as it is when it is not connected.

**Note:**

1. Values shown are assumed to be set in the applicable major node, individual PUX or SW PU before the connection is established. A MODIFY VTAMTOPO to set these values after the connection is established may not show the expected result before the connection is taken down and reestablished.
2. This table can also be used for the Switched PUs that are connected under an XCA. In the results column, all R-NCP will be R-SSCP, because the XCA is not represented by a PU type, and does not appear as a discrete node in SNA local topology.
3. The PUX is a place holder for a future connected switched PU under the switched line. It takes its VTAMTOPO value either explicitly from the line GROUP value, or implicitly from the NCP or the XCA major node value. If its VTAMTOPO value is explicitly set, it cannot be modified.

Table 42. Connected switched PU report

NCP	VTAMTOPO value on			SPWU result
	PUX	SWND	SWPU	
notIGNR/INCL	r/R	R	r	R-NCP
notIGNR/INCL	r/R	INCL	r	R-NCP
notIGNR/INCL	r/R	R	R	R-NCP
notIGNR/INCL	r/R	INCL	R	R-NCP

Table 42. Connected switched PU report (continued)

	VTAMTOPO value on			SPWU result
	NCP	PUX	SWND	
notIGNR/INCL	r/R	R	NR	NotRep
notIGNR/INCL	r/R	INCL	NR	R-NCP
notIGNR/INCL	r/R	NR	nr	R-NCP
notIGNR/INCL	r/R	IGNR	nr	R-NCP
notIGNR/INCL	r/R	NR	NR	NotRep
notIGNR/INCL	r/R	IGNR	NR	NotRep
notIGNR/INCL	r/R	NR	R	R-NCP
notIGNR/INCL	r/R	IGNR	R	R-NCP
notIGNR/INCL	nr/NR	R	r	R-SSCP
notIGNR/INCL	nr/NR	INCL	r	R-SSCP
notIGNR/INCL	nr/NR	R	R	R-NCP
notIGNR/INCL	nr/NR	INCL	R	R-SSCP
notIGNR/INCL	nr/NR	R	NR	NotRep
notIGNR/INCL	nr/NR	INCL	NR	R-SSCP
notIGNR/INCL	nr/NR	NR	nr	NotRep
notIGNR/INCL	nr/NR	IGNR	nr	NotRep
notIGNR/INCL	nr/NR	NR	NR	NotRep
notIGNR/INCL	nr/NR	IGNR	NR	NotRep
notIGNR/INCL	nr/NR	NR	R	R-NCP
notIGNR/INCL	nr/NR	IGNR	R	NotRep
INCL	any	R	r	R-NCP
INCL	any	INCL	r	R-NCP
INCL	any	R	R	R-NCP
INCL	any	INCL	R	R-NCP
INCL	any	R	NR	NotRep
INCL	any	INCL	NR	R-NCP
INCL	any	NR	nr	R-NCP
INCL	any	IGNR	nr	R-NCP
INCL	any	NR	NR	NotRep
INCL	any	IGNR	NR	NotRep
INCL	any	NR	R	R-NCP
INCL	any	IGNR	R	R-NCP
IGNR	any	R	r	R-SSCP
IGNR	any	INCL	r	R-SSCP
IGNR	any	R	R	R-SSCP
IGNR	any	INCL	R	R-SSCP
IGNR	any	R	NR	NotRep
IGNR	any	INCL	NR	R-SSCP
IGNR	any	NR	nr	NotRep



Table 42. Connected switched PU report (continued)

VTAMTOPO value on				SPWU result
NCP	PUX	SWND	SWPU	
IGNR	any	IGNR	nr	NotRep
IGNR	any	NotRep	NotRep	NotRep
IGNR	any	IGNR	NR	NotRep
IGNR	any	NR	R	R-SSCP
IGNR	any	IGNR	R	NotRep



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## Appendix H. 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.

You can request RFCs through electronic mail, from the automated Network Information Center (NIC) mail server, by sending a message to `service@nic.ddn.mil` with a subject line of RFC *nnnn* for text versions or a subject line of RFC *nnnn*.PS for PostScript versions. To request a copy of the RFC index, send a message with a subject line of RFC INDEX.

For more information, contact `nic@nic.ddn.mil` or at:

Government Systems, Inc.  
Attn: Network Information Center  
14200 Park Meadow Drive  
Suite 200  
Chantilly, VA 22021

Hard copies of all RFCs are available from the NIC, either individually or by subscription. Online copies are available at the following Web address:  
<http://www.rfc-editor.org/rfc.html>.

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:

**RFC Title and Author**

**RFC 652**

*Telnet output carriage-return disposition option* D. Crocker

**RFC 653**

*Telnet output horizontal tabstops option* D. Crocker

**RFC 654**

*Telnet output horizontal tab disposition option* D. Crocker

**RFC 655**

*Telnet output formfeed disposition option* D. Crocker

**RFC 657**

*Telnet output vertical tab disposition option* D. Crocker

**RFC 658**

*Telnet output linefeed disposition* D. Crocker

**RFC 698**

*Telnet extended ASCII option* T. Mock

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*Remote Controlled Transmission and Echoing Telnet option* J. Postel, D. Crocker
- RFC 727**  
*Telnet logout option* M.R. Crispin
- RFC 732**  
*Telnet Data Entry Terminal option* J.D. Day
- RFC 733**  
*Standard for the format of ARPA network text messages* D. Crocker, J. Vittal, K.T. Pogran, D.A. Henderson
- RFC 734**  
*SUPDUP Protocol* M.R. Crispin
- RFC 735**  
*Revised Telnet byte macro option* D. Crocker, R.H. Gumpertz
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*Telnet SUPDUP option* M.R. Crispin
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*Telnet SUPDUP—Output option* B. Greenberg
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*File Transfer Protocol specification* J. Postel
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*User Datagram Protocol* J. Postel
- RFC 779**  
*Telnet send-location option* E. Killian
- RFC 783**  
*TFTP Protocol (revision 2)* K.R. Sollins
- RFC 791**  
*Internet Protocol* J. Postel
- RFC 792**  
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*Assigned numbers* J. Postel
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*Telnet Option Specification* J. Postel, J. Reynolds
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*Telnet Binary Transmission* J. Postel, J. Reynolds
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*Telnet Suppress Go Ahead Option* J. Postel, J. Reynolds
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*Telnet Status Option* J. Postel, J. Reynolds
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*Telnet Timing Mark Option* J. Postel, J. Reynolds
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*Discard Protocol* J. Postel
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*Quote of the Day Protocol* J. Postel
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*Telnet terminal type option* M. Solomon, E. Wimmers
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*Telnet end of record option* J. Postel
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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

z/OS information is accessible using screen readers with the BookServer or Library Server versions of z/OS books in the Internet library at [www.ibm.com/systems/z/os/zos/bkserv/](http://www.ibm.com/systems/z/os/zos/bkserv/).



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## Programming interface information

This publication documents intended Programming Interfaces that allow the customer to write programs to obtain the services of z/OS Communications Server.

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## Bibliography

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z/OS Communications Server documentation is available in the following forms:

- Online at the z/OS Internet Library web page at [www.ibm.com/systems/z/os/zos/bkserv/](http://www.ibm.com/systems/z/os/zos/bkserv/)
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### **z/OS Communications Server library updates**

An index to z/OS Communications Server book updates is at <http://www.ibm.com/support/docview.wss?uid=swg21178966>. Updates to documents are also available on RETAIN<sup>®</sup> and in information APARs (info APARs). Go to <http://www.ibm.com/software/network/commserver/zos/support> to view information APARs. In addition, Info APARs for z/OS documents are in *z/OS and z/OS.e DOC APAR and PTF ++HOLD Documentation*, which can be found at [http://publibz.boulder.ibm.com/cgi-bin/bookmgr\\_OS390/Shelves/ZDOCAPAR](http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/Shelves/ZDOCAPAR).

### **z/OS Communications Server information**

z/OS Communications Server product information is grouped by task in the following tables.

#### **Planning**

Title	Number	Description
z/OS Communications Server: New Function Summary	GC27-3664	This document is intended to help you plan for new IP or SNA function, 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.
z/OS Communications Server: IPv6 Network and Application Design Guide	SC27-3663	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.

#### **Resource definition, configuration, and tuning**

Title	Number	Description
z/OS Communications Server: IP Configuration Guide	SC27-3650	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.

Title	Number	Description
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: <ul style="list-style-type: none"> <li>• TCP/IP configuration data sets</li> <li>• Configuration statements</li> <li>• Translation tables</li> <li>• Protocol number and port assignments</li> </ul>
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.

## Operation

Title	Number	Description
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 and receive 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

Title	Number	Description
z/OS Communications Server: SNA Customization	SC27-3666	This document enables you to customize SNA, and includes the following information: <ul style="list-style-type: none"> <li>• Communication network management (CNM) routing table</li> <li>• Logon-interpret routine requirements</li> <li>• Logon manager installation-wide exit routine for the CLU search exit</li> <li>• TSO/SNA installation-wide exit routines</li> <li>• SNA installation-wide exit routines</li> </ul>

## Writing application programs

Title	Number	Description
z/OS Communications Server: IP Sockets Application Programming Interface Guide and Reference	SC27-3660	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.
z/OS Communications Server: IP CICS Sockets Guide	SC27-3649	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.
z/OS Communications Server: IP IMS Sockets Guide	SC27-3653	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.
z/OS Communications Server: IP Programmer's Guide and Reference	SC27-3659	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.
z/OS Communications Server: SNA Programming	SC27-3674	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.
z/OS Communications Server: SNA Programmer's LU 6.2 Guide	SC27-3669	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.)
z/OS Communications Server: SNA Programmer's LU 6.2 Reference	SC27-3670	This document provides reference material for the SNA LU 6.2 programming interface for host application programs.
z/OS Communications Server: CSM Guide	SC27-3647	This document describes how applications use the communications storage manager.

Title	Number	Description
z/OS Communications Server: CMIP Services and Topology Agent Guide	SC27-3646	This document describes the Common Management Information Protocol (CMIP) programming interface for application programmers to use in coding CMIP application programs. The document provides guide and reference information about CMIP services and the SNA topology agent.

## Diagnosis

Title	Number	Description
z/OS Communications Server: IP Diagnosis Guide	GC27-3652	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.
z/OS Communications Server: ACF/TAP Trace Analysis Handbook	GC27-3645	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.
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	GC27-3667 GC27-3668	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.
z/OS Communications Server: SNA Data Areas Volume 1 and z/OS Communications Server: SNA Data Areas Volume 2	GC31-6852 GC31-6853	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.

## Messages and codes

Title	Number	Description
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: <ul style="list-style-type: none"> <li>• Command and RU types in SNA messages</li> <li>• Node and ID types in SNA messages</li> <li>• Supplemental message-related information</li> </ul>
z/OS Communications Server: IP Messages Volume 1 (EZA)	SC27-3654	This volume contains TCP/IP messages beginning with EZA.
z/OS Communications Server: IP Messages Volume 2 (EZB, EZD)	SC27-3655	This volume contains TCP/IP messages beginning with EZB or EZD.
z/OS Communications Server: IP Messages Volume 3 (EZY)	SC27-3656	This volume contains TCP/IP messages beginning with EZY.
z/OS Communications Server: IP Messages Volume 4 (EZZ, SNM)	SC27-3657	This volume contains TCP/IP messages beginning with EZZ and SNM.
z/OS Communications Server: IP and SNA Codes	SC27-3648	This document describes codes and other information that appear in z/OS Communications Server messages.

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