

z/OS
Version 2 Release 4

JES2 Email Delivery Services



Note

Before using this information and the product it supports, read the information in [“Notices” on page 33.](#)

This edition applies to Version 2 Release 4 of z/OS (5650-ZOS) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About the JES2 Email Delivery Services Content Solution

Purpose of this information

This information is a collection of all of the information that you need to understand and exploit JES2 Email Delivery Services (EDS). Some of the information in this content solution also exists elsewhere in the z/OS library.

Who should read this information

This information is intended for system programmers who are responsible for configuring JES2 EDS. This JES2 function accepts email messages from JES2 interfaces and delivers the messages to the intended recipients, the email addresses.

Related information

To find the complete z/OS® library, go to [IBM Knowledge Center \(www.ibm.com/support/knowledgecenter/SSLTBW/welcome\)](http://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

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Chapter 1. What is JES2 Email Delivery Services?

JES2 Email Delivery Services (EDS) is a JES2 function that accepts email messages from JES2 interfaces and delivers them to the intended recipients, the email addresses.

The interfaces JES2 provides for sending email messages are:

- The NOTIFY JCL statement specifies conditions and delivery method for job termination notification. One of the supported delivery methods is an email message. After job termination, if conditions specified by the WHEN keyword of a NOTIFY JCL statement are satisfied and notification method is email, JES2 sends job termination message by an email message. For more information, see JES2 message HASP165, in *z/OS JES2 Messages*. Also, for more information about the NOTIFY statement, see [NOTIFY statement](#).)
- The Notify user message service (SSI 75) allows an application to send a message to a user. One of the supported delivery methods for the message is email. For more information about SSI, see [Notify user message service call – SSI function code 75](#).

The stages that JES2 EDS processes email messages are:

1. The email messages are stored on JES2 SPOOL when email messages are accepted for delivery.
2. Then, email messages are read from JES2 SPOOL and are delivered to intended destination.

Separating email processing by using these stages allows JES2 to accept email messages even if the environment does not allow immediate delivery of the email. For example, TCP/IP services are not available or the email server is not accessible. In addition, this separation helps to protect accepted email messages from system failure.

Most of JES2 EDS processing is performed in a separate address space. The name of the address space has the format <subsystem>EDS, where <subsystem> is a subsystem name that is used by JES2. For example, if the subsystem name is JESA, then the address space name is JESAEDS.

The types of tasks that are running in the JES2 EDS address space are:

- Email spooler task accepts email messages and saves them on JES2 SPOOL.
- Email sender task reads email messages from JES2 SPOOL and sends them to intended recipient.

Another part of JES2 EDS is the EDS processor control element (PCE). EDS PCE runs in the JES2 main task in the JES2 address space and provides necessary services to the JES2 EDS tasks.

For information about the conditions you must meet before you can use JES2 Email Delivery Services, see [Chapter 2, “Requirements for JES2 Email Delivery Services,” on page 3](#).

Chapter 2. Requirements for JES2 Email Delivery Services

This topic describes the prerequisites for JES2 Email Delivery Services, as follows:

- [“System requirements for using JES2 EDS” on page 3](#)
- [“User requirements for using JES2 EDS” on page 3](#)

System requirements for using JES2 EDS

During operation, the following system functions must be active for JES2 EDS to deliver email:

- z/OS UNIX environment (OMVS)
- TCP/IP
- z/OSMF server

JES2 EDS accepts email messages and stores them in the JES2 SPOOL on any JES2 MAS member. No additional z/OS functions are required for that stage of email processing. However, for actual delivery of email messages, JES2 EDS relies on the services that are provided by z/OSMF.

Therefore, z/OSMF must be installed and configured before JES2 EDS can be used. The z/OSMF server does not have to be active on the same SYSPLEX member. All MAS members can access the same z/OSMF server active anywhere in the SYSPLEX, as long as communication to the z/OSMF server is possible.

This topic describes z/OSMF customization to the extent that it applies to JES2 EDS. If your installation has not yet configured z/OSMF, see [IBM z/OS Management Facility Configuration Guide](#) for instructions to install and configure the z/OSMF server.

Note: Only a z/OSMF server that is configured to participate in an AUTOSTART group can be used by JES2. Stand-alone z/OSMF servers do not advertise their presence to JES2. To configure and enable an z/OSMF AUTOSTART server, see the topic [Autostart concepts in z/OSMF](#) in [IBM z/OS Management Facility Configuration Guide](#).

User requirements for using JES2 EDS

To send an email message, JES2 EDS uses the email address that is specified on the NOTIFY= statement in the job. This value is used as-is, without validity checking. Therefore, the user must ensure that the email address is valid. The email address is case-sensitive.

Note: No specifications are needed in the user's profile for JES2 EDS to send an email message. Though an email address might be specified in the user's work attributes, JES2 EDS uses only the email address that is specified on the NOTIFY= statement in the job. In contrast, the email address that is specified in the user's profile is used for authentication, in cases when an email address (rather than a user ID), is specified on a JOB statement.

Chapter 3. Setting up JES2 Email Delivery Services

This topic describes a procedure for setting up JES2 Email Delivery Services (EDS).

About this procedure

After the z/OSMF server is successfully configured, as described in *IBM z/OS Management Facility Configuration Guide*, the following JES2-specific configuration steps must be performed to allow communication between JES2 and the z/OSMF server.

The example commands in this procedure are for illustrative purposes only. The examples are based on assumptions about default values that are used for JES2 and z/OSMF security configurations. Actual installations might have different naming conventions and security policies in place.

Procedure for setting up JES2 Email Delivery Services

1. Assign a user ID to the JES2 EDS address space. The user ID does not have to be the same as the JES2 subsystem user ID, but using the same one can help to simplify management. The user ID to use is specified either by creating a profile in the STARTED class that matches the JES2 EDS address space name, or by adding an entry in the started procedures table (ICHRIN03).
2. Create a key ring for the user identifier that is configured in step 1, if one does not already exist. The user identifier can have multiple key rings configured. JES2 EDS uses the key ring with the same name as EDS address space. For example, if the subsystem name is JES2, then the address space name is JES2EDS and the key ring name is JES2EDS. If the key ring with that name is not found, JES2 EDS uses the first key ring, in the order as returned by the RACF 'list key rings' function. For more information about key rings, see [z/OS Security Server RACF Command Language Reference](#).

For example:

```
RACDCERT ID(JES2USER) ADDRING(JES2EDS)
```

3. Create the client (personal) certificate for the user identifier that is configured in step 1. This certificate is used for SSL communication between JES2 and a z/OSMF server and also allows JES2 to sign on to a z/OSMF server. Add the client certificate to the key ring created in step 2. The key ring can have multiple client certificates configured. JES2 EDS uses the certificate that was added as DEFAULT. For more information about certificates, see [z/OS Security Server RACF System Programmer's Guide](#).

Use your own certificate authority (CA) certificate, or use a self-signed CA certificate.

Example: Using a self signed certificate authority (CA) certificate for JES2 EDS use:

- a. Create self signed certificate authority (CA) certificate:

```
RACDCERT CERTAUTH GENCERT SUBJECTSDN(CN('JES2 Subsystem CA') O('JES2 CA Org')  
OU('JES2 CA Unit') L('Poughkeepsie') SP('New York') C('US')) WITHLABEL('JES2_CA')  
NOTAFTER(2027-05-31))
```

- b. Create client certificate for JES2 EDS use, signed with CA certificate created previously:

```
RACDCERT ID(JES2USER) GENCERT SUBJECTSDN(CN('JES2 Client') O('JES2 Client Org')  
OU('JES2 Client Unit') L('Poughkeepsie') SP('New York') C('US')) WITHLABEL('JES2_Client')  
SIGNWITH(CERTAUTH LABEL('JES2_CA'))
```

- c. Add JES2 client certificate to JES2 key ring:

```
RACDCERT ID(JES2USER) CONNECT(ID(JES2USER) LABEL('JES2_Client') RING(JES2EDS) DEFAULT))
```

To use an existing certificate authority (CA) certificate, modify the LABEL statement, as appropriate:

```
RACDCERT ID(JES2USER) CONNECT(ID(JES2USER) LABEL('CUSTOMER_Client') RING(JES2EDS)
DEFAULT))
```

4. Add the certificate authority (CERTAUTH) certificate that is used to sign a client certificate that is created in step 3 to the key ring that is associated with the user identifier that is configured for the z/OSMF server. (For the default z/OSMF configuration, it is IZUSVR.) This allows z/OSMF to authenticate JES2 during the HTTPS handshake process.

For example:

```
RACDCERT ID(IZUSVR) CONNECT(CERTAUTH LABEL('JES2_CA') RING(IZUKeyring.IZUDFLT))
```

To use an existing certificate authority (CA) certificate, modify the LABEL statement, as appropriate. For example:

```
RACDCERT ID(IZUSVR) CONNECT(CERTAUTH LABEL('CUSTOMER_CA') RING(IZUKeyring.IZUDFLT))
```

5. Add the certificate authority (CERTAUTH) certificate that is used to sign a z/OSMF server certificate, to the JES2 key ring created in step 2. This allows JES2 to authenticate z/OSMF server during the HTTPS handshake process.

For example:

```
RACDCERT ID(JES2USER) CONNECT(CERTAUTH LABEL('zOSMFCA') RING(JES2EDS))
```

6. Add the user identifier that is configured in step 1 to the z/OSMF configuration as a valid z/OSMF user. For information about granting this access, see *IBM z/OS Management Facility Configuration Guide*.
7. Authorize the user identifier that is configured in step 1 to use z/OSMF email (notification) services. The user identifier must have READ access to the following resource profiles in class ZMFAPLA:

- a. <SAF-prefix>.ZOSMF
- b. <SAF-prefix>.ZOSMF.NOTIFICATION.MODIFY

Where, <SAF-prefix> is the prefix that is used for z/OSMF security profiles. For the default z/OSMF installation, it is IZUDFLT.

For example:

```
PERMIT IZUDFLT.ZOSMF CLASS(ZMFAPLA) ID(JES2USER) ACCESS(READ)
PERMIT IZUDFLT.ZOSMF.NOTIFICATION.MODIFY CLASS(ZMFAPLA) ID(JES2USER) ACCESS(READ)
```

8. Add information about outgoing SMTP server to the z/OSMF configuration, if not already defined during z/OSMF installation and setup. To do so, a z/OSMF user with z/OSMF administration rights must enter SMTP server properties in the "Outgoing Email Configuration" tab of the Notification Settings task in the z/OSMF Settings category on the z/OSMF home page.

[Figure 1 on page 7](#) shows the Outgoing Email Configuration tab in z/OSMF.

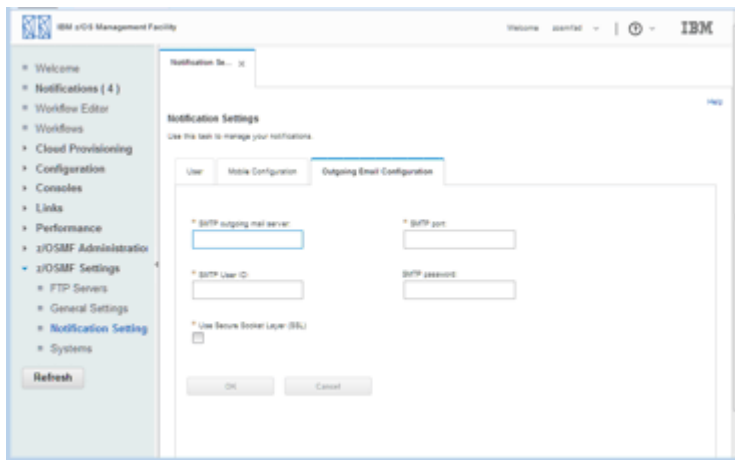


Figure 1. Outgoing Email Configuration tab in z/OSMF

The configuration steps that are described in the preceding steps must be performed only once.

- The JES2 Email Delivery Services (EDS) function in z/OS V2R3 requires a z/OSMF server to be active in an AUTOSTART group that JES2 can access. Specifically, the z/OSMF server must be started with `SERVER= ' AUTOSTART '` in the IZUSVR1 started procedure, and JES2 must be running on a system that is included in the AUTOSTART_GROUP specification. Otherwise, if this setup is not done, JES2 cannot send e-mail messages to users who submit jobs.

The z/OSMF server does not necessarily have to be on the same system on which the JES2 EDS is used. However, you do need to ensure that the system from which you are using JES2 EDS is part of an z/OSMF AUTOSTART_GROUP in which there is an active server in that group. If so, JES2 automatically detects the presence of the z/OSMF server; you do not need to identify the location of the z/OSMF server to JES2.

If your installation starts the z/OSMF server through another means, such by operator command or through automation, you must ensure that the z/OSMF server is active in an AUTOSTART group, as defined in your IZUPRMxx parmlib member.

- You can start the z/OSMF server manually on any system by using the **START** operator command with the name of the z/OSMF started procedure. By default, the procedure is IZUSVR1. For more information, see [IBM z/OS Management Facility Configuration Guide](#).

Retrying communications

If JES2 EDS fails to communicate with the z/OSMF server, JES2 is not able to send email messages. A communication failure is reported with a number of diagnostic messages that explain the specific problem, followed by the message HASP1523, Unable to connect to z/OSMF server.

In most cases, JES2 EDS is able to automatically detect changes in the state of the z/OSMF server and to retry communications without operator intervention. However, there are some configuration changes that JES2 EDS is unable to detect automatically. In these cases, you can use the JES2 operator command `$S EDS` to force JES2 EDS to retry communications.

Chapter 4. Using JES2 Email Delivery Services

This topic contains the following information about using JES2 Email Delivery Services (EDS):

- [Storing email messages in JES2](#)
- [Subject line of email messages](#)
- [Purging email messages](#)

Storing email messages in JES2

Email messages, accepted from JES2 email interfaces, are staged on the JES2 SPOOL in email message queues. JES2 uses the following JES2 resources to manage these queues:

- EDS message queue entries in the JES2 checkpoint (ESQs).
- \$EDSQnnnn system jobs. Each email message queue has an associated \$EDSQnnnn job.

EDS message queues and associated system jobs are created and managed by JES2, as needed. No operator intervention is required.

The amount of SPOOL space that is required to store email messages is highly dependent on the number of email messages that are processed. More SPOOL space might be required to support significant email processing in a constrained SPOOL environment.

Subject line of email messages

The subject line is optional for email messages that are sent by using the Notify user message service (SSI 75). If the subject line is omitted, JES2 provides a default subject line. The same default subject line is also used for email messages that are sent as a result of processing NOTIFY JCL statement.

If the default subject line is not satisfactory, a customized subject line can be configured by using the NFY_SUBJECT keyword of the JOBDEF JES2 command or initialization statement. This subject line setting is unique for each member in MAS. For more information, see [\\$D JOBDEF - Display characteristics assigned to jobs](#), [\\$T JOBDEF - Set job processing characteristics](#), or [Format description for JOBDEF](#).

Purging email messages

You might need to purge email messages if the delivery is no longer required or not possible. An EDS message queue and all email messages that are contained in the queue can be purged by using the JES2 command:

```
$PS($EDSQnnn)
```

Where, \$EDSQnnn is the name of the email queue.

The name of the current email queue is reported in the HAS1535 message if errors are detected when processing the queue. Also, the names of all currently existing email queues can be found by using a JES2 command:

```
$DS($EDSQ*)
```

If purging the entire email queue with all email messages on the queue is undesirable, another form of \$PS command allows you to purge only those email messages that experienced error on delivery attempt:

```
$PS($EDSQnnn),ONERROR
```

Chapter 5. Messages for JES2 Email Delivery Services

z/OS JES2 Messages contains the following information in support of JES2 Email Delivery Services (EDS).

JES2 Messages that were updated for JES2 EDS

\$HASP1500

Explanation

▶▶ Cannot create EDSCB. Email services not available. ◀◀

JES2 issues this message during initialization when it is not able to create EDSCB control block in CSA. Most likely reason is the shortage of free space in CSA.

System action

JES2 processing continues. JES2 rejects requests to send email messages by the Notify user message service (SSI 75) on this member. If another MAS member is available with Email Delivery Services function active, JES2 continues to process notifications requested by the NOTIFY JCL statement with email address as target of notification. If no such member is available, such notifications are no longer processed.

Operator response

None.

Programmer response

Increase available size of CSA and restart JES2.

Module

HASPIRMA

Routing Code: 1, 2,10

Descriptor Code: 4

\$HASP1501

Explanation

▶▶ Email spooler task failed to start.◀◀

JES2 issues this message during JES2 EDS address space initialization when an error is encountered when trying to start email spooler task.

System action

JES2 processing continues.

Operator response

None.

Programmer response

Collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1502

Explanation

▶▶ Email sender task failed to start.◀◀

JES2 issues this message during JES2 EDS address space initialization when an error is encountered trying to start email sender task.

System action

JES2 processing continues.

Operator response

None.

Programmer response

Collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1503

Explanation

➤➤ Email spooler task terminated unexpectedly.➤➤

JES2 issues this message when email spooler task in JES2 EDS address terminates unexpectedly.

System action

JES2 processing continues. JES2 attempts to restart the failed task.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1504

Explanation

➤➤ Email sender task terminated unexpectedly.➤➤

JES2 issues this message when email sender task in JES2 EDS address terminates unexpectedly.

System action

JES2 processing continues. JES2 attempts to restart the failed task.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1505

Explanation

➤➤ EDS PCE failed. Email services no longer available on this member. ➤➤

JES2 issues this message when EDS processor control element (PCE) fails.

System action

JES2 processing continues. JES2 rejects requests to send email messages by the Notify user message service (SSI 75) on this member. If another MAS member is available with Email Delivery Services function active, JES2 continues to process notifications requested by the NOTIFY JCL statement with email address as target of notification. If no such member is available, such notifications are no longer processed.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASPSERV

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1506

Explanation

➤➤ Email services address space failed. — Email services no longer available on this member. ➤➤

JES2 EDS processor control element (PCE) issues this message when all attempts to restart JES2 EDS address space fail.

System action

JES2 processing continues. JES2 rejects requests to send email messages by the Notify user message service (SSI 75) on this member. If another MAS member is available with Email Delivery Services function active, JES2 continues to process notifications requested by the NOTIFY JCL statement with email address as target of notification. If no such member is available, such notifications are no longer processed.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASPSERV

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1507

Explanation

▶▶ Cannot start Email services address space. Email — services not available on this member. ▶▶

JES2 EDS processor control element (PCE) issues this message when PCE cannot start JES2 EDS address space.

System action

JES2 processing continues. JES2 rejects requests to send email messages by the Notify user message service (SSI 75) on this member. If another MAS member is available with Email Delivery Services function active, JES2 continues to process notifications requested by the NOTIFY JCL statement with email address as target of notification. If no such member is available, such notifications are no longer processed.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASPSERV

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1508

Explanation

▶▶ Cannot add required structures to JES2 checkpoint. — Email services not available. ▶▶

JES2 issues this message during initialization if the JES2 Email Delivery Services function cannot be started in this MAS because of a JES2 configuration problem – insufficient checkpoint size.

System action

JES2 processing continues. JES2 email services are not available in this MAS. Email services include ability to send email messages by the Notify user message service (SSI 75) and ability to send job notifications that are requested by the NOTIFY JCL statement with email address as the target of notification.

Operator response

None.

Programmer response

Increase the size of the JES2 checkpoint to allow JES2 to create necessary checkpoint objects. The Email Delivery Service starts automatically.

Module

HASPIRDA

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1509

Explanation

▶▶ Structures required for Email services added to JES2 checkpoint. ▶▶

JES2 issues this informational message after earlier HASP1508 messages to indicate that error condition was resolved.

System action

JES2 processing continues.

Operator response

None.

Programmer response

None.

Module

HASPSERV

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1510

Explanation

▶▶ Corrupted email message queue was detected and removed from JES2 checkpoint RSN=xxxxxxxx,→▶

▶ Some messages could have been lost. ▶▶

JES2 issues this message when JES2 detects corrupted email message queue. Email message queue is deleted from the JES2 checkpoint. If email message queue contains any undelivered email messages, these messages are lost. Reason code (RSN) provides additional information to the IBM Service about the location and cause of the corruption.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASPSERV, HASPWARM

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1511

Explanation

▶▶ Email spooler task encountered problem. Some messages could have been lost. ▶▶

JES2 issues this message when email spooler task running in JES2 EDS address space abnormally terminates while processing messages. Some email messages might have been lost as a result of abnormal termination.

System action

Task is reinstated. JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1512

Explanation

▶▶ Email sender task encountered problem. Some messages could have been lost. ▶▶

JES2 issues this message when email sender task running in JES2 EDS address space abnormally terminates while processing messages. Some email messages might be lost as a result of abnormal termination.

System action

Task is reinstated. JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1513

Explanation

▶▶ I/O error when writing to email queue. Some messages could have been lost. ▶▶

Email spooler task running in JES2 EDS address space issues this message when it detects an I/O error when saving email messages on JES2 SPOOL. Some email messages might be lost as a result of this I/O error.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1514**Explanation**

►► I/O error when reading from email queue. Some messages could have been lost. ◄◄

Email sender task running in JES2 EDS address space issues this message when it detects I/O error when reading email messages from JES2 SPOOL. Some email messages might be lost as a result of this I/O error.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1515**Explanation**

►► I/O error when adding messages to email queue. Some messages could have been lost. ◄◄

Email spooler task running in JES2 EDS address space issues this message when it detects I/O error when looking for an end of the existing email message queue on JES2 SPOOL to add more messages to it. This message might be a result of a prior system failure that abruptly interrupted email spooler task. This message might be an indication that some email messages have been lost.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1516**Explanation**

►► Email queue error encountered. Some messages could have been lost. ◄◄

Email sender task running in JES2 EDS address space issues this message when it detects corrupted email message queue on JES2 SPOOL. The corruption might be a result of a prior I/O error or an abrupt system failure. This message might be an indication that some email messages are lost.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1517**Explanation**

►► Corrupted email message queue was detected. Some messages could have been lost. ◄◄

This message is issued by JES2 initialization code during all member warm start with spool validation

(see SPOOL=VALIDATE JES2 start option), if an email message queue on SPOOL is found to be corrupted or unreadable. The corruption might be a result of a prior I/O error or an abrupt system failure. This message might be an indication that some email messages are lost.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1518

Explanation

►► Waiting for Email Delivery Services address space. ◄◄

This message is issued once every 30 seconds by JES2 termination code when it takes too long for JES2 EDS address space to respond to a stop request.

System action

JES2 processing continues.

Operator response

None.

Programmer response

If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASPSERV

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1519

Explanation

►► UNICODE character conversion service not available. ◄◄

This message is issued by the JES2 email sender task in the JES2 EDS address space if it is unable to initialize UNICODE character conversion service during its initialization.

System action

JES2 processing continues. This error prevents the email sender task from starting. JES2 email delivery services are not available on this member of MAS. JES2 rejects requests to send email messages by the Notify user message service (SSI 75) on this member. If another MAS member is available with Email Delivery Services function active, JES2 continues to process notifications requested by the NOTIFY JCL statement with email address as target of notification. If no such member is available, such notifications are no longer processed.

Operator response

None.

Programmer response

Investigate the reason for UNICODE character conversion service unavailability and restart JES2. If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1520

Explanation

►► Unable to extract key ring information. ◄◄

This message is issued by JES2 email sender task in JES2 EDS address space if it is unable to retrieve key ring information from a security product database (for example, RACF) for use in communication with the z/OSMF server using the HTTPS protocol. Most likely reason is that the required key ring information is not configured.

System action

JES2 processing continues. This error might cause communication errors when trying to connect to the z/

OSMF server, which also might cause diagnostic messages.

Operator response

None.

Programmer response

Make sure that the key ring is properly configured. For more information, see [JES2 Email Delivery Services](#). Use the JES2 \$S EDS operator command to cause JES2 email sender task to retry communications or restart JES2.

If the error is not caused by configuration error, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1521

Explanation

►► Unable to initialize HTTP toolkit.◄◄

This message is issued by JES2 email sender task in JES2 EDS address space if it is unable to initialize HTTP toolkit.

System action

JES2 processing continues. This error makes it impossible for JES2 email sender task to communicate to z/OSMF server.

Operator response

None.

Programmer response

Collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1522

Explanation

►► Unable to locate z/OSMF server. ◄◄

JES2 issues this message when JES2 cannot find the z/OSMF server that it can use to send outgoing email messages.

System action

JES2 processing continues. JES2 waits for the z/OSMF server to become available.

Operator response

Make sure that the z/OSMF server is started.

Programmer response

Make sure that the z/OSMF server is properly configured.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1523

Explanation

►► Unable to connect to z/OSMF server. ◄◄

This message is issued by the JES2 email sender task in the JES2 EDS address space if it is unable to communicate to the z/OSMF server. This message is typically preceded by one or more JES2 messages that describe a specific situation encountered by the JES2 email sender task. \$HASP1523 is not reissued periodically.

System action

JES2 processing continues.

Operator response

Inspect preceding diagnostic messages. If necessary, start or restart is required for z/OS functions, such as OMVS, TCP/IP, z/OSMF, and so on. If necessary, update the z/OSMF configuration. In most cases, JES2 email processing restarts automatically. In some cases, for example, if configuration change was required, manual intervention is required. Use the JES2 \$S EDS command to instruct JES2 email processing to try communication again with the z/OSMF server.

Programmer response

If this is a persisting problem and cannot be resolved by updating the configuration or activating the required z/OS functions, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 2, 7

\$HASP1524

Explanation

➤ Error building z/OSMF server request. ➤

This message is issued by the JES2 email sender task when it fails to set the HTTP request body.

System action

JES2 processing continues. This error makes it impossible for the JES2 email sender task to communicate to the z/OSMF server.

Operator response

None.

Programmer response

Collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1525

Explanation

➤ Error sending z/OSMF server request. ➤

This message is issued by the JES2 email sender task when the HTTP request to the z/OSMF server fails. This message is typically preceded by another JES2 message that describes a specific error.

System action

JES2 processing continues. This error makes it impossible for the JES2 email sender task to communicate to the z/OSMF server.

Operator response

Inspect preceding diagnostic messages. If necessary, start or restart the required z/OS functions, for example, z/OSMF.

Programmer response

Inspect preceding diagnostic messages. If this is a persisting problem and cannot be resolved by updating the configuration or activating the required z/OS functions, collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1526

Explanation

➤ OMVS environment is not available. ➤

This message is issued by the JES2 email sender task when it detects that the OMVS environment is not available. OMVS is a required z/OS function for JES2 email delivery services.

System action

JES2 processing continues.

Operator response

Start or restart OMVS.

Programmer response

None.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1527

Explanation

▶▶ nnnn message ◀◀

This diagnostic message is issued by the JES2 email sender task when it experiences errors when communicating to the z/OSMF server.

In the message text:

nnnn

The HTTP return code from the z/OSMF server.

message

The text of the error message that is returned by the z/OSMF server.

System action

JES2 processing continues.

Operator response

None.

Programmer response

Inspect the HTTP return code and diagnostic message. If the problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDES

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1528

Explanation

▶▶ message ◀◀

This message is issued by the JES2 email sender task when processing an email message that is saved on JES2 SPOOL, if extended EDS diagnostic was requested (\$TDEBUG,EDS=YES).

In the message text:

message

The beginning of an email message currently being processed by the email sender task.

System action

JES2 processing continues.

Operator response

None.

Programmer response

None.

Module

HASCEDES

Routing Code: 11

\$HASP1529

Explanation

▶▶ nnn mmmm message ◀◀

This diagnostic message is issued by the JES2 email sender task when it experiences errors when communicating to the z/OSMF server.

In the message text:

nnn mmmm message

The error codes and text of a diagnostic message that is provided by the communication APIs that are used by the JES2 email sender task (HTTP toolkit).

System action

JES2 processing continues.

Operator response

None.

Programmer response

Inspect the embedded error codes and diagnostic message. If the problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASCEDES

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1530

Explanation

▶▶ TCP/IP is not available. ◀◀

This message is issued by the JES2 email sender task when it detects that TCP/IP is not available. TCP/IP is a required z/OS function for JES2 email delivery services.

System action

JES2 processing continues.

Operator response

Start or restart TCP/IP.

Programmer response

None.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1531

Explanation

➤ Email spooler task encountered problem.➤

JES2 issues this message when the email spooler task running in JES2 EDS address space abnormally terminates while it does not process any messages.

System action

The task is reinstated. JES2 processing continues.

Operator response

None.

Programmer response

Collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1532

Explanation

➤ Email sender task encountered problem.➤

JES2 issues this message when email sender task running in JES2 EDS address space abnormally terminates while it does not process any messages.

System action

The task is reinstated. JES2 processing continues.

Operator response

None.

Programmer response

Collect diagnostic information and contact your IBM service representative.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1534

Explanation

➤ z/OSMF server URI URIstring ➤

JES2 issues this informational message to report the URI of the z/OSMF server that JES2 tries to use to send outgoing email messages.

In the message text:

URIstring

The URI of the z/OSMF server.

System action

JES2 processing continues.

Operator response

None.

Programmer response

None.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1535

Explanation

➤ Current message is in email queue — *queue-name* — at *offset* — *offset* — in EMQT — *mqtr* — .➤

JES2 issues this informational message to report the location of the current email message that JES2 attempts to send.

In the message text:

queue-name

The name of the email queue. The format is \$EDSQnnn.

offset

The offset of the message in the above EMQT.

mqtr

The location on the SPOOL in the format of MQTR of the Email Queue Table (EMQT) that contains the current email message.

System action

JES2 processing continues.

Operator response

None.

Programmer response

None.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP1536

Explanation

►► Current message purged on error. ◄◄

JES2 issues this informational message to indicate that the current email message is purged as the result of an error communicating to the z/OSMF server. JES2 might purge undeliverable email messages if instructed by the JES2 command:

```
$PS($EDSQnnn),ONERROR
```

System action

JES2 processing continues.

Operator response

None.

Programmer response

None.

Module

HASCEDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 4

\$HASP9180

Explanation

►► EMAIL SERVICES NOT AVAILABLE ◄◄

JES2 issues this message in response to a \$JDJES or \$JDSTATUS JES2 monitor command. This message indicates that the JES2 Email Delivery Services function cannot be started in this MAS because of a JES2 configuration problem, which is an insufficient checkpoint size.

System action

JES2 processing continues. JES2 email services are not available in this MAS. Email services include the ability to send email messages by using the Notify user message service (SSI 75) and the ability to send job notifications that are requested by the NOTIFY JCL statement with email address as the target of notification.

Operator response

None.

System programmer response

Increase the size of the JES2 checkpoint to allow JES2 to create necessary checkpoint objects. The Email Delivery Service starts automatically.

Module

HASJCMDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 5

\$HASP9181

Explanation

►► EMAIL SERVICES NOT AVAILABLE ON THIS MEMBER ◄◄

JES2 issues this message in response to a \$JDJES or \$JDSTATUS JES2 monitor command. This message indicates that the JES2 Email Delivery Services address space has failed on this member of JES2 MAS.

System action

JES2 processing continues. JES2 rejects requests to send email messages by using the Notify user message service (SSI 75) on this MAS member. If another MAS member is available with the Email Delivery Services function active, JES2 continues to process notifications requested by using the NOTIFY JCL statement with email address as target of notification. If no such member is available, such notifications are no longer processed.

Operator response

None.

System programmer response

Restart this JES2 member. If problem persists, collect diagnostic information and contact your IBM service representative.

Module

HASJCMDS

Routing Code: 1, 2, 10, 42

Descriptor Code: 5

Appendix A. Autostart concepts in z/OSMF

z/OSMF is started when you IPL your z/OS system. This behavior, which is referred to as *z/OSMF autostart*, means that z/OSMF is available for use as soon as the system is up.

To make the best use of the z/OSMF autostart capability, you must plan how to deploy one or more z/OSMF servers in your environment. Generally, having one z/OSMF server active in a sysplex or monoplex is sufficient, but you might choose to have more, based on your workload requirements. The goal is to ensure that at least one z/OSMF server is always active in your environment.

For a monoplex, little or no planning is needed. The z/OSMF server is started when you IPL the system.

For a sysplex, more planning is required. You can choose to have one z/OSMF server autostart on a particular system and be used by the other systems in the sysplex. Or, you can select a subset of systems, or several subsets, and associate each subset with a specific z/OSMF server within an autostart group.

If you do not want to use the autostart capability, some planning is needed to either remove it or to disable autostart, even in a monoplex. For more information, see [“Scenario 4: The z/OSMF server is not autostarted on any system”](#) on page 26.

The set of systems that is served by an autostarted server is known as the *autostart group*. z/OSMF includes one autostart group by default. To have more z/OSMF servers autostarted in a sysplex, you must associate each server—and the systems it serves—with a unique autostart group name.

In your planning, you must decide:

- What the autostart groups will be in your sysplex
- Which systems will autostart a z/OSMF server
- Which systems will share the use of the autostarted server; these systems must be defined to the same autostart group.

Only one z/OSMF server can be active per autostart group in the sysplex. An autostarted z/OSMF server holds an enqueue on the z/OSMF data directory file system, and handles the z/OSMF requests from other systems that are connected to the same autostart group. Based on your planning, you can enable the desired number of z/OSMF autostart groups for your sysplex.

To create one or more autostart groups in z/OSMF, use the following statements in parmlib member IZUPRMxx in combination:

AUTOSTART(LOCAL|CONNECT)

Specifies the capability for autostarting the z/OSMF server on this system.

- AUTOSTART(LOCAL) indicates that the system is capable of autostarting a z/OSMF server.
- AUTOSTART(CONNECT) indicates that the system cannot autostart a z/OSMF server. The system will, instead, use the z/OSMF server on another system in the same autostart group.

By default, AUTOSTART is set to LOCAL.

AUTOSTART_GROUP(IZUDFLT|'nnnnnnn')

Assigns a name to the autostart group. z/OSMF includes one AUTOSTART_GROUP name by default (called IZUDFLT). To associate a group of systems with a different autostart group, ensure that each system specifies the same value for AUTOSTART_GROUP.

By default, AUTOSTART_GROUP is set to IZUDFLT.

If one autostart group is sufficient for your sysplex, it is recommended that you allow each system to use the IZUDFLT autostart group.

The following scenarios are valid in a multi-system environment:

- [“Scenario 1: One z/OSMF server is autostarted for the entire sysplex”](#) on page 24
- [“Scenario 2: Multiple z/OSMF servers and autostart groups per sysplex”](#) on page 24

- “Scenario 3: Some systems belong to an autostart group, and other systems do not” on page 25
- “Scenario 4: The z/OSMF server is not autostarted on any system” on page 26.

Scenario 1: One z/OSMF server is autostarted for the entire sysplex

In this scenario, the z/OSMF server is autostarted on one system in the sysplex. All systems are associated with the default autostart group, which is named IZUDFLT.

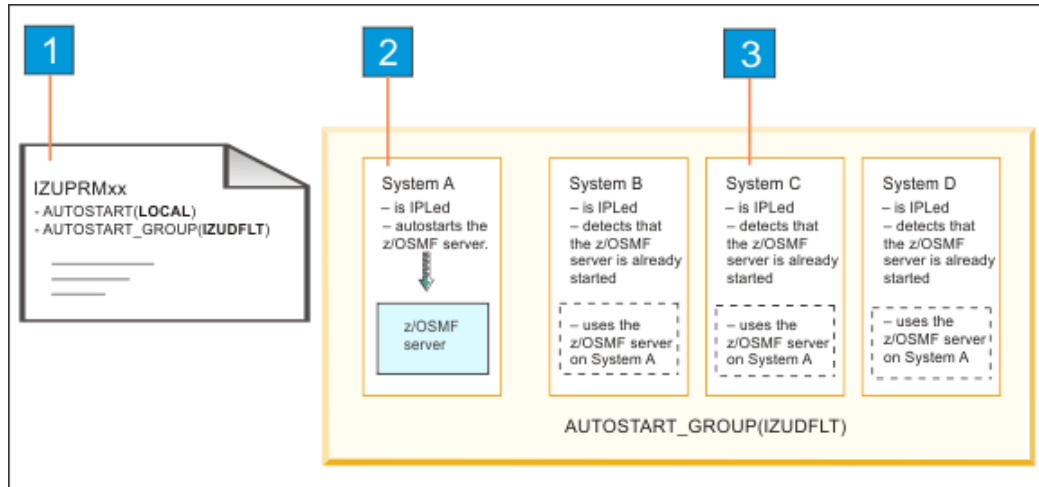


Figure 2. Scenario 1: One z/OSMF server is autostarted for the entire sysplex

In Figure 2 on page 24:

1. Each system uses the following default values for autostart:

```
AUTOSTART(LOCAL)
AUTOSTART_GROUP(IZUDFLT)
```

With these values set for all systems, the first one to complete IPL is the system on which the z/OSMF server is started.

2. System A is the first system to complete IPL in the sysplex. Its attempt to autostart the z/OSMF server is successful.
3. System B, C, and D complete IPL. These systems detect that an autostarted server is active on System A, so they do not attempt a server. Instead, they use the server on System A.

In a sysplex of z/OS V2R3 systems, this scenario is enabled by default. If it is sufficient for your requirements, you can use the z/OSMF defaults. If you care *which* system in the sysplex autostarts the z/OSMF server, keep the default values for that system and change the AUTOSTART value to CONNECT for all other systems in the same autostart group.

Scenario 2: Multiple z/OSMF servers and autostart groups per sysplex

In this scenario, more than one z/OSMF server is to be autostarted in a sysplex. Suppose, for example, that you have a sysplex of four systems: A, B, C, and D. You plan to have System A autostart a server and share it with System B. Similarly, System C will autostart a server and share it with System D.

In this scenario, each server and the systems it serves are associated with an autostart group, as follows:

- System A and System B are associated with the autostart group IZUDFLT
- System C and System D are associated with the autostart group ALTERNATE.

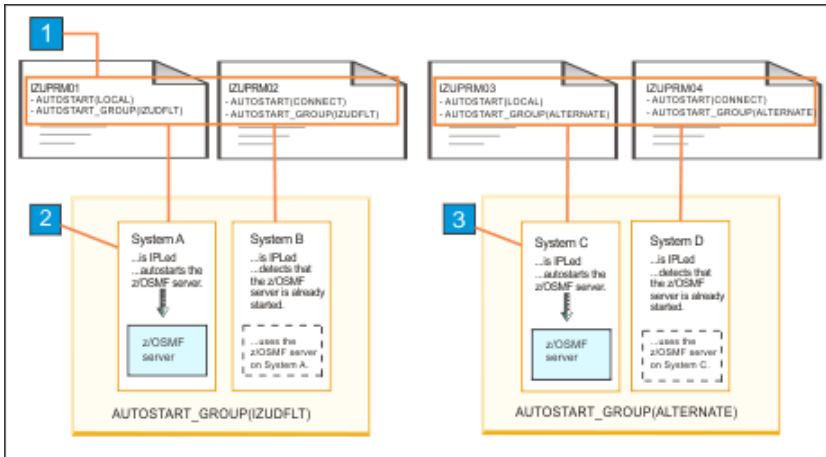


Figure 3. Scenario 2: Multiple z/OSMF servers and autostart groups per sysplex.

In Figure 3 on page 25:

1. Each system uses a different IZUPRMxx member with different settings for AUTOSTART and AUTOSTART_GROUP.
2. System A autostarts a z/OSMF server. System B uses the autostarted server on System A.
3. System C autostarts a z/OSMF server. System D uses the autostarted server on System C.

Scenario 3: Some systems belong to an autostart group, and other systems do not

In this scenario, some systems belong to an autostart group, and other systems do not. Suppose, for example, that you have a sysplex of four systems: System A, B, C, and D. In this sysplex, you plan to have System A autostart the z/OSMF server and share it with System B. System C and System D will not use an autostarted z/OSMF server. The z/OSMF server can be started on these systems manually, by using the **START** operator command with the name of the z/OSMF started procedure (IZUSVR1).

In this scenario:

- System A and System B are defined to autostart group IZUDFLT
- System C and System D are not defined to an autostart group.

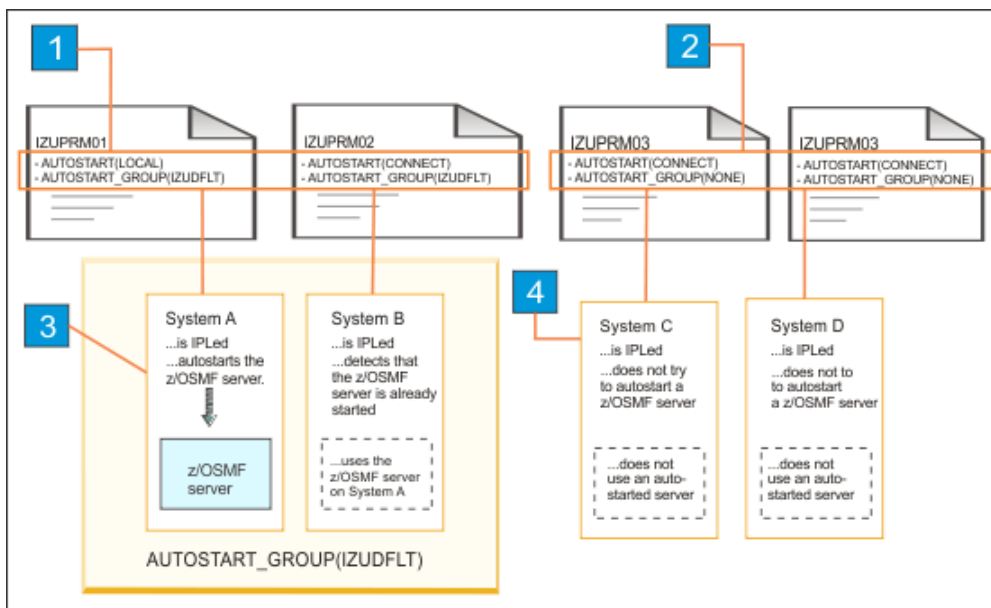


Figure 4. Scenario 3: One z/OSMF server is autostarted for a subset of systems in a sysplex.

In Figure 4 on page 26:

1. Systems A and B specify AUTOSTART_GROUP(IZUDFLT).
2. Systems C and D specify a non-functioning autostart group name, NONE.
3. System A autostarts a z/OSMF server. System B uses the autostarted server on System A.
4. Systems C and D do not use an autostarted z/OSMF.

Scenario 4: The z/OSMF server is not autostarted on any system

In this scenario, no z/OSMF servers are started automatically during system IPL. That is, the autostart capability is disabled. Perhaps, you prefer to start the server manually, with the **START** operator command, as done in previous releases.

To disable the autostarting of z/OSMF servers in a sysplex, do the following for each system in the sysplex:

- To prevent a z/OS system from autostarting the z/OSMF server, ensure that the system uses a IZUPRMxx member that specifies AUTOSTART(CONNECT). This setting causes the system to connect to the autostart group that is specified on the AUTOSTART_GROUP statement, rather than autostarting its own server.
- To prevent a z/OS system from connecting to an autostart group, specify the name of a group on the AUTOSTART_GROUP parameter that is not used by any autostart server in the sysplex. For example, AUTOSTART_GROUP('NONE').
- Similarly, for each system for which you want to disable z/OSMF autostart, ensure that the AUTOSTART(CONNECT) and AUTOSTART_GROUP('NONE') settings are in effect.
- In your IZU= specifications, verify that the IZU= parameter identifies the suffixes of the IZUPRMxx members that contain the desired settings.

These actions must be taken if you want to disable the autostarting of z/OSMF servers. Otherwise, the default behavior for each system is to attempt to start the z/OSMF server automatically during IPL.

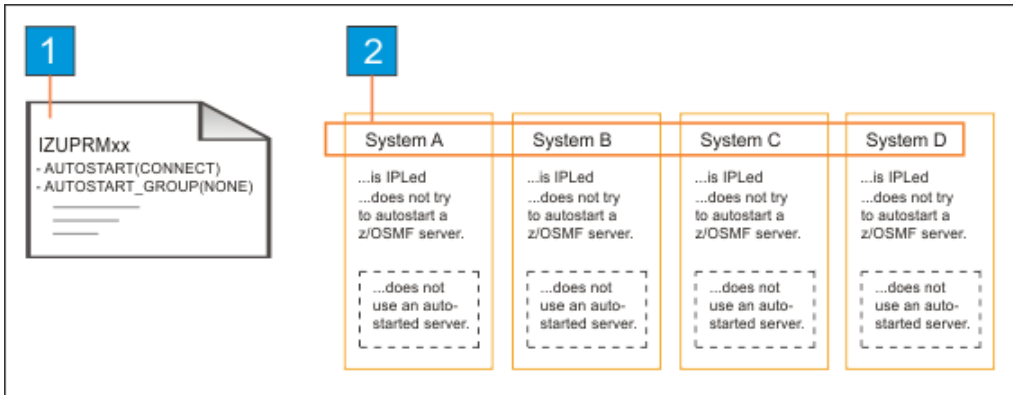


Figure 5. Scenario 4: No z/OSMF servers are started automatically.

In Figure 5 on page 27:

1. Each system uses the following values for autostart:

```
AUTOSTART(CONNECT)
AUTOSTART_GROUP(NONE)
```

With these values set for all systems, no system attempts to autostart an z/OSMF server.

2. Systems A, B, C, and D complete the IPL process. No z/OSMF servers are autostarted in the sysplex.
- The JES2 Email Delivery Services (EDS) function in z/OS V2R3 requires a z/OSMF server to be active in an AUTOSTART group that JES2 can access. Specifically, the z/OSMF server must be started with SERVER= 'AUTOSTART' in the IZUSVR1 started procedure, and JES2 must be running on a system that is included in the AUTOSTART_GROUP specification. Otherwise, if this setup is not done, JES2 cannot send e-mail messages to users who submit jobs.

The z/OSMF server does not necessarily have to be on the same system on which the JES2 EDS is used. However, you do need to ensure that the system from which you are using JES2 EDS is part of an z/OSMF AUTOSTART_GROUP in which there is an active server in that group. If so, JES2 automatically detects the presence of the z/OSMF server; you do not need to identify the location of the z/OSMF server to JES2.

For information about configuring JES2 EDS, see the topic [JES2 Email Delivery Services in z/OS JES2 Initialization and Tuning Guide](#).

- You can start the z/OSMF server manually on any system by using the **START** operator command with the name of the z/OSMF started procedure. By default, the procedure is IZUSVR1. For more information, see [IBM z/OS Management Facility Configuration Guide](#).
- Changing an AUTOSTART_GROUP name requires an IPL. You cannot change this option with a stop and restart of the z/OSMF server.
- The z/OSMF autostart capability does not automatically restart a terminated server. If an autostarted server fails, you can resume z/OSMF operations by manually starting the server.
- Authorized programs can use the event notification facility (ENF) to determine whether the z/OSMF server is up or down. For more information, see [IBM z/OS Management Facility Configuration Guide](#).

Steps to enable or disable the autostart capability

The autostart capability requires that common event adapter (CEA) be configured on your system. For information, see [Ensure that common event adapter \(CEA\) is configured and active](#).

Plan your use of the autostart capability, based on the preceding scenarios.

- If you want to use the autostart capability, refer to “Scenario 1: One z/OSMF server is autostarted for the entire sysplex” on page 24, “Scenario 2: Multiple z/OSMF servers and autostart groups per sysplex” on page 24, and “Scenario 3: Some systems belong to an autostart group, and other systems do not” on page 25 to plan your z/OSMF environment. Then, do the following:

1. Customize your parmlib IZUPRMxx to fit the scenario that you select. Add the IZUPRMxx member to your system's parmlib concatenation.
 2. Specify the suffix IZU=xx for IZUPRM in your IEASYSxx parmlib member.
 3. Review the job IZUATSEC in SYS1.SAMPLIB and run it to set up security for the AUTOSTART function.
 4. If your installation uses an external security manager other than RACF, ask your security administrator to create equivalent commands for your environment.
- If you do not want to use the autostart capability, refer to Scenario 4 to plan your z/OSMF environment. Then, do the following:
 1. Customize your IZUPRMxx parmlib member to fit Scenario 4. Add the IZUPRMxx member to your system's parmlib concatenation.
 2. Specify the suffix IZU=xx for IZUPRM in your IEASYSxx parmlib member.
 3. Do not run job IZUATSEC.

Appendix B. Accessibility

Accessible publications for this product are offered through [IBM Knowledge Center \(www.ibm.com/support/knowledgecenter/SSLTBW/welcome\)](http://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

If you experience difficulty with the accessibility of any z/OS information, send a detailed message to the [Contact z/OS web page \(www.ibm.com/systems/z/os/zos/webqs.html\)](http://www.ibm.com/systems/z/os/zos/webqs.html) or use the following mailing address.

IBM Corporation
Attention: MHVRCFS Reader Comments
Department H6MA, Building 707
2455 South Road
Poughkeepsie, NY 12601-5400
United States

Accessibility features

Accessibility features help users who have physical disabilities such as restricted mobility or limited vision use software products successfully. The accessibility features in z/OS can help users do the following tasks:

- Run assistive technology such as screen readers and screen magnifier software.
- Operate specific or equivalent features by using the keyboard.
- Customize display attributes such as color, contrast, and font size.

Consult assistive technologies

Assistive technology products such as screen readers function with the user interfaces found in z/OS. Consult the product information for the specific assistive technology product that is used to access z/OS interfaces.

Keyboard navigation of the user interface

You can access z/OS user interfaces with TSO/E or ISPF. The following information describes how to use TSO/E and ISPF, including the use of keyboard shortcuts and function keys (PF keys). Each guide includes the default settings for the PF keys.

- [*z/OS TSO/E Primer*](#)
- [*z/OS TSO/E User's Guide*](#)
- [*z/OS ISPF User's Guide Vol I*](#)

Dotted decimal syntax diagrams

Syntax diagrams are provided in dotted decimal format for users who access IBM Knowledge Center with a screen reader. In dotted decimal format, each syntax element is written on a separate line. If two or more syntax elements are always present together (or always absent together), they can appear on the same line because they are considered a single compound syntax element.

Each line starts with a dotted decimal number; for example, 3 or 3.1 or 3.1.1. To hear these numbers correctly, make sure that the screen reader is set to read out punctuation. All the syntax elements that have the same dotted decimal number (for example, all the syntax elements that have the number 3.1) are mutually exclusive alternatives. If you hear the lines 3.1 USERID and 3.1 SYSTEMID, your syntax can include either USERID or SYSTEMID, but not both.

The dotted decimal numbering level denotes the level of nesting. For example, if a syntax element with dotted decimal number 3 is followed by a series of syntax elements with dotted decimal number 3.1, all the syntax elements numbered 3.1 are subordinate to the syntax element numbered 3.

Certain words and symbols are used next to the dotted decimal numbers to add information about the syntax elements. Occasionally, these words and symbols might occur at the beginning of the element itself. For ease of identification, if the word or symbol is a part of the syntax element, it is preceded by the backslash (\) character. The * symbol is placed next to a dotted decimal number to indicate that the syntax element repeats. For example, syntax element *FILE with dotted decimal number 3 is given the format 3 * FILE. Format 3* FILE indicates that syntax element FILE repeats. Format 3* * FILE indicates that syntax element * FILE repeats.

Characters such as commas, which are used to separate a string of syntax elements, are shown in the syntax just before the items they separate. These characters can appear on the same line as each item, or on a separate line with the same dotted decimal number as the relevant items. The line can also show another symbol to provide information about the syntax elements. For example, the lines 5.1*, 5.1 LASTRUN, and 5.1 DELETE mean that if you use more than one of the LASTRUN and DELETE syntax elements, the elements must be separated by a comma. If no separator is given, assume that you use a blank to separate each syntax element.

If a syntax element is preceded by the % symbol, it indicates a reference that is defined elsewhere. The string that follows the % symbol is the name of a syntax fragment rather than a literal. For example, the line 2.1 %OP1 means that you must refer to separate syntax fragment OP1.

The following symbols are used next to the dotted decimal numbers.

? indicates an optional syntax element

The question mark (?) symbol indicates an optional syntax element. A dotted decimal number followed by the question mark symbol (?) indicates that all the syntax elements with a corresponding dotted decimal number, and any subordinate syntax elements, are optional. If there is only one syntax element with a dotted decimal number, the ? symbol is displayed on the same line as the syntax element, (for example 5? NOTIFY). If there is more than one syntax element with a dotted decimal number, the ? symbol is displayed on a line by itself, followed by the syntax elements that are optional. For example, if you hear the lines 5 ?, 5 NOTIFY, and 5 UPDATE, you know that the syntax elements NOTIFY and UPDATE are optional. That is, you can choose one or none of them. The ? symbol is equivalent to a bypass line in a railroad diagram.

! indicates a default syntax element

The exclamation mark (!) symbol indicates a default syntax element. A dotted decimal number followed by the ! symbol and a syntax element indicate that the syntax element is the default option for all syntax elements that share the same dotted decimal number. Only one of the syntax elements that share the dotted decimal number can specify the ! symbol. For example, if you hear the lines 2? FILE, 2.1! (KEEP), and 2.1 (DELETE), you know that (KEEP) is the default option for the FILE keyword. In the example, if you include the FILE keyword, but do not specify an option, the default option KEEP is applied. A default option also applies to the next higher dotted decimal number. In this example, if the FILE keyword is omitted, the default FILE(KEEP) is used. However, if you hear the lines 2? FILE, 2.1, 2.1.1! (KEEP), and 2.1.1 (DELETE), the default option KEEP applies only to the next higher dotted decimal number, 2.1 (which does not have an associated keyword), and does not apply to 2? FILE. Nothing is used if the keyword FILE is omitted.

*** indicates an optional syntax element that is repeatable**

The asterisk or glyph (*) symbol indicates a syntax element that can be repeated zero or more times. A dotted decimal number followed by the * symbol indicates that this syntax element can be used zero or more times; that is, it is optional and can be repeated. For example, if you hear the line 5.1* data area, you know that you can include one data area, more than one data area, or no data area. If you

hear the lines 3* , 3 HOST, 3 STATE, you know that you can include HOST, STATE, both together, or nothing.

Notes:

1. If a dotted decimal number has an asterisk (*) next to it and there is only one item with that dotted decimal number, you can repeat that same item more than once.
2. If a dotted decimal number has an asterisk next to it and several items have that dotted decimal number, you can use more than one item from the list, but you cannot use the items more than once each. In the previous example, you can write HOST STATE, but you cannot write HOST HOST.
3. The * symbol is equivalent to a loopback line in a railroad syntax diagram.

+ indicates a syntax element that must be included

The plus (+) symbol indicates a syntax element that must be included at least once. A dotted decimal number followed by the + symbol indicates that the syntax element must be included one or more times. That is, it must be included at least once and can be repeated. For example, if you hear the line 6.1+ data area, you must include at least one data area. If you hear the lines 2+, 2 HOST, and 2 STATE, you know that you must include HOST, STATE, or both. Similar to the * symbol, the + symbol can repeat a particular item if it is the only item with that dotted decimal number. The + symbol, like the * symbol, is equivalent to a loopback line in a railroad syntax diagram.

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- For information about software support lifecycle, see: [IBM Lifecycle Support for z/OS \(www.ibm.com/software/support/systemsz/lifecycle\)](http://www.ibm.com/software/support/systemsz/lifecycle)
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