z/OS

IBM Ported Tools for z/OS: OpenSSH User's Guide

Version 1 Release 3

Note

Before using this information and the product it supports, read the information in “Notices” on page 529.

This edition applies to version 1, release 3, modification 0 of IBM Ported Tools for z/OS (product number 5655-M23) and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

Figures

Tables

About this document

This document presents the information you need to set up and use IBM Ported Tools for z/OS: OpenSSH.

Who should use this document?

This document is for system programmers who run a z/OS system with z/OS UNIX System Services (z/OS UNIX), and for their users who use IBM Ported Tools for z/OS: OpenSSH. On other open systems, some system programmer tasks might be done by an administrator.

This document assumes the readers are familiar with z/OS systems as well as with the information for it and its accompanying products.

z/OS information

This information explains how z/OS references information in other documents and on the web.

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 V2R2 Information Roadmap*.

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

IBM Ported Tools for z/OS home page

The IBM Ported Tools for z/OS home page is located at www-03.ibm.com/systems/z/os/zos/features/unix/ported/. It contains a brief description of the IBM Ported Tools for z/OS product, information on how to order it, and supporting documentation.

To order the IBM Ported Tools for z/OS: OpenSSH product, go to the IBM® ShopzSeries Web site at www14.software.ibm.com/webapp/ShopzSeries/ShopzSeries.jsp. Customers can report problems found with this product through their normal support structure.

Discussion list

A mailing list (discussion list) that is not sponsored by IBM might be helpful to users of OpenSSH. It is at http://www.openssh.org/list.html. It contains instructions on subscribing to the OpenSSH mailing list.

To search through past discussions, go to http://marc.theaimsgroup.com/.

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Include the following information:

- Your name and address
- Your email address
- Your phone or fax number
- The publication title and order number:
  IBM Ported Tools for z/OS: OpenSSH V1.3.0 User's Guide
  SA23-2246-03
- The topic and page number or URL of the specific information to which your comment relates
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Summary of changes

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

Changes made in IBM Ported Tools for z/OS: OpenSSH Version 1 Release 3

The information in this document was previously presented in *IBM Ported Tools for z/OS: OpenSSH User's Guide*, SA23-2246-02.

New information

- Support added for GSSAPI (Kerberos only) authentication and key exchange, including the addition of several GSSAPI options to **ssh_config** and **sshd_config**.
- A new zEnterprise Data Compression (zEDCCompression) option was added to **zos_ssh_config**, **zos_ssh_user_config**, and **zos_sshd_config**.
- A new ChannelConvert option was added to **zos_ssh_config**, **zos_ssh_user_config**, and **zos_sshd_config**.
- A new ProxyUseFdPass option was added to **ssh_config**.
- Support added to meet FIPS 140-2 specifications, including the addition of options to **zos_ssh_config**, **zos_ssh_user_config**, and **zos_sshd_config**.

IBM Ported Tools for z/OS: OpenSSH has been upgraded to these Open Source Software releases, resulting in changes to various commands, messages, and configuration files.

- OpenSSH 6.4p1

These sections are new for this release.

- “Certificates” on page 126 and “Key revocation lists” on page 126 in topic “ssh-keygen — Authentication key generation, management, and conversion” on page 118.
- “Client connection started (subtype 94)” on page 206 and “Server connection started (subtype 95)” on page 207 in topic Chapter 12, “SMF Type 119 records for OpenSSH,” on page 201.

Updated information

- The following commands were updated:
  - “scp — Secure copy (remote file copy program)” on page 85
  - “sftp — Secure file transfer program” on page 87
  - “sftp-server — SFTP server subsystem” on page 94
  - “ssh — OpenSSH client (remote login program)” on page 96
  - “ssh-add — Add RSA or DSA identities to the authentication agent” on page 112
  - “ssh-agent — Authentication agent” on page 115
  - “ssh-keygen — Authentication key generation, management, and conversion” on page 118

- “ssh-keyscan — Gather ssh public keys” on page 129
- “ssh-keysign — ssh helper program for host-based authentication” on page 131
- “sshd — OpenSSH daemon” on page 132

OpenSSH configuration files were updated, see Chapter 10, “OpenSSH files,” on page 147.

SMF records were updated, see Chapter 12, “SMF Type 119 records for OpenSSH,” on page 201.

Chapter 14, “OpenSSH messages,” on page 223 contains new and updated messages.

Deleted information

The command “ssh-rand-helper - Gather random numbers for OpenSSH” has been removed.

The following messages were removed:

FOTS2227 FOTS2229 FOTS0162 FOTS1420 FOTS1152
FOTS0903 FOTS0989 FOTS1810 FOTS1811 FOTS1812
FOTS1813 FOTS1814 FOTS1815 FOTS1816 FOTS1817
FOTS1818 FOTS1819 FOTS2230 FOTS2234 FOTS2235
FOTS2236 FOTS2237 FOTS2238 FOTS2239 FOTS1390
FOTS1391 FOTS2350 FOTS2352 FOTS2353 FOTS2354
FOTS2355 FOTS2356 FOTS2045 FOTS3003 FOTS1123
FOTS1007 FOTS1820 FOTS1821 FOTS1822 FOTS1823
FOTS1824 FOTS1825 FOTS1826 FOTS1827 FOTS1829
FOTS1596 FOTS1597 FOTS1246 FOTS1288 FOTS2245
FOTS2246 FOTS1941 FOTS1944 FOTS1945 FOTS1946
FOTS1947 FOTS1948 FOTS0146 FOTS1361 FOTS1638
FOTS2051 FOTS2368 FOTS2054 FOTS0884 FOTS1755
FOTS1098 FOTS0960 FOTS0929 FOTS1830 FOTS1831
FOTS1838 FOTS1252 FOTS1296 FOTS1953 FOTS1954
FOTS2065FOTS0815 FOTS1764 FOTS1182 FOTS0931
FOTS0976 FOTS1840 FOTS1841 FOTS1842 FOTS1801
FOTS1843 FOTS1802 FOTS1803 FOTS1804 FOTS1805
FOTS1806 FOTS1807 FOTS1808 FOTS1809 FOTS1261
FOTS1262 FOTS1263 FOTS1264 FOTS1265 FOTS2220
FOTS2224

Changes made in IBM Ported Tools for z/OS: OpenSSH Version 1 Release 2, as updated April 2014

This document contains information that was previously presented in *IBM Ported Tools for z/OS: OpenSSH*, SA23-2246-01.

New information

- New information added to Chapter 9, “OpenSSH command descriptions,” on page 85.
- New message: FOTS0720

Changes made in IBM Ported Tools for z/OS: OpenSSH Version 1 Release 2, as updated February 2012

This document contains information that was previously presented in *IBM Ported Tools for z/OS: OpenSSH*, SA23-2246-00.

New information

- OpenSSH can be set up to use Integrated Cryptographic Service Facility (ICSF) to implement certain ciphers and MAC (message authentication code) algorithms. This extension enables OpenSSH to use hardware support when applicable. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.
- Information from APAR OA34819 was added; see the following topics:
  - "Managing OpenSSH user heap" on page 60
- Information from APAR OA33914 was added; see "sftp — Secure file transfer program" on page 87.
- A new term, Integrated Cryptographic Service Facility (ICSF), was added to the glossary.

Changes made in IBM Ported Tools for z/OS: OpenSSH Version 1 Release 2

The information in this document was previously presented in *IBM Ported Tools for z/OS User's Guide*, SA22-7985-06. The Xvfb section is now in *IBM Ported Tools for z/OS: Xvfb User's Guide*, SA23-2216-00.

New information

IBM Ported Tools for z/OS: OpenSSH has been upgraded to these Open Source Software releases, resulting in changes to various commands, messages, and configuration files.

- OpenSSH 5.0p1
- OpenSSL 1.0.1c
- zlib 1.2.3

These topics are new for this release.

- Chapter 6, "Security topics when using key rings for key management," on page 61. This chapter includes "Managing key rings and restricting access to them" on page 61
- Chapter 12, "SMF Type 119 records for OpenSSH," on page 201

The following sections are new for this release.

- "What you need to verify before using OpenSSH" on page 21
- "Steps for verifying the prerequisites for using OpenSSH" on page 21
- "Steps for setting up server authentication when keys are stored in key rings" on page 29
- "Limiting file system name space for sftp users" on page 45
- "Setting up OpenSSH to collect SMF records" on page 50
- "Steps for setting up user authentication when using key rings to store keys" on page 76
- zos_ssh_config

- zos_user_ssh_config
- zos_sshd_config

Two new graphics have been added.

- Figure 2 on page 36
- Figure 7 on page 82

New terms have been added to the glossary.

Updated information

- “Steps for creating or editing configuration files” on page 24
- “Steps for setting up server authentication when keys are stored in UNIX files” on page 27
- “Steps for setting up user authentication when using UNIX files to store keys” on page 75
- “Authentication” on page 135
- “User-generated files” on page 198
- Appendix C, “RFCs and Internet drafts,” on page 523

The OpenSSH files are now organized in Chapter 10, “OpenSSH files,” on page 147 as follows:

- “OpenSSH client configuration files” on page 147
- “OpenSSH daemon configuration files” on page 171
- “Other OpenSSH files” on page 195

Chapter 14, “OpenSSH messages,” on page 223 contains new and updated messages.

Information from the following APARs have been added:

- APAR OA34210
- APAR OA37278
- APAR OA39283
- APAR OA41089
- APAR OA41247
- APAR OA41704
- APAR OA42286
- APAR OA42873
- APAR OA43100
- APAR OA43934
- APAR OA44038
- APAR OA45001

The term *internationalization* has been replaced with *globalization*. The new term has been added to the glossary.

Deleted information

The chapter “What's new or changed in OpenSSH for 3.8.1p1?” has been deleted because the updates are now part of the OpenSSH 5.0p1 base.

Chapter 1. Introduction to IBM Ported Tools for z/OS: OpenSSH

The OpenSSH program product is one of the ported applications provided by IBM Ported Tools for z/OS. The current version, which is Version 1 Release 3, can be installed on z/OS 1.13 and later. Users of the previous release (Version 1 Release 2) must migrate to the new release as described in Chapter 4, "Migrating to Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH," on page 11 before using the information in this book.

In this document, *OpenSSH* refers to the z/OS implementation of OpenSSH. For the open source documentation, see http://www.openssh.org.

What is OpenSSH?

OpenSSH provides secure encryption for both remote login and file transfer. Some of the utilities that it includes are:

- **ssh**, a z/OS client program for logging into a z/OS shell. It can also be used to log into other platform's UNIX shells. It is an alternative to **rlogin**.
- **scp** for copying files between networks. It is an alternative to **rcp**.
- **sftp** for file transfers over an encrypted **ssh** transport. It is an interactive file transfer program similar to **ftp**.
- **sshd**, a daemon program for **ssh** that listens for connections from clients. The IBM Ported Tools for z/OS: OpenSSH implementation of **sshd** supports both SSH protocol versions 1 and 2 simultaneously.

  The default **sshd** configuration only runs protocol version 2.

Other basic utilities such as **ssh-add**, **ssh-agent**, **ssh-keysign**, **ssh-keyscan**, **ssh-keygen** and **sftp-server** are also included.

To ensure secure encrypted communications, OpenSSH uses ciphers such as AES, Blowfish and 3DES.

IBM Ported Tools for z/OS: OpenSSH provides the following z/OS extensions:

- System Authorization Facility (SAF) key ring. OpenSSH can be configured to allow OpenSSH keys to be stored in SAF key rings. See "Choosing between UNIX files and key rings" on page 61 for more information.
- Multilevel security. It is a security policy that allows the classification of data and users based on a system of hierarchical security levels combined with a system of non-hierarchical security categories. See "Running the sshd daemon in a multilevel-secure environment" on page 44.
- System Management Facility (SMF). OpenSSH can be configured to collect SMF Type 119 records for both the client and the server. See "Setting up OpenSSH to collect SMF records" on page 50 for more information.
- ICSF ciphers and MAC algorithms. OpenSSH can be set up to use Integrated Cryptographic Service Facility (ICSF) to implement certain ciphers and MAC (message authentication code) algorithms. This extension enables OpenSSH to use hardware support when applicable. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

- FIPS 140-2 mode. OpenSSH can be set up to direct all cryptographic operations to ICSF and System SSL interfaces running in FIPS mode. This extension enables OpenSSH to meet the FIPS 140-2 specifications. See "Setting up OpenSSH to run in FIPS mode" on page 58 for more information.

The Internet Engineering Task Force (http://www.ietf.org/) has a Secure Shell (SECSH) working group whose goal is to update and standardize the popular SSH protocol. For information about OpenSSH compliancy to SECSH RFCs and internet drafts, see Appendix C, "RFCs and Internet drafts," on page 523.

Chapter 2. What's new or changed in Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH

This topic documents changes that were introduced in Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH, which includes OpenSSH 6.4p1, OpenSSL 1.0.2h, and zlib 1.2.3. It includes these sections:

- “Summary of changes to commands”
- “New and changed configuration files”
- “Changed environment variables” on page 4
- “Summary of changes to SYS1.MACLIB” on page 5
- “Summary of changes to non-configuration files in /samples” on page 5

Summary of changes to commands

Table 1 lists commands that were changed in Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH.

Table 1. Summary of changes to commands in V1R3 of IBM Ported Tools for z/OS: OpenSSH

Command	Changes
ssh	The following options are changed: **-k, -K** Reference: • ssh

New and changed configuration files

Table 2 lists configuration files that were added or changed in Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH.

Table 2. Summary of changes to configuration files in V1R3 of IBM Ported Tools for z/OS: OpenSSH

Configuration file	Changes
ssh_config	These keywords have been added: GSSAPIClientIdentity GSSAPIKeyExchange GSSAPIRenewalForcesRekey GSSAPIServerIdentity GSSAPITrustDns ProxyUseFdpass These keywords have been changed: GSSAPIAuthentication GSSAPIDelegateCredentials PreferredAuthentications Reference: • ssh_config

Table 2. Summary of changes to configuration files in V1R3 of IBM Ported Tools for z/OS: OpenSSH (continued)

Configuration file	Changes
sshd_config	These keywords have been added: GSSAPICleanupCredentials GSSAPIKeyExchange GSSAPIStoreCredentialsOnRekey GSSAPIStrictAcceptorCheck These keywords have been changed: GSSAPIAuthentication GSSAPICleanupCredentials Reference: • sshd_config
zos_ssh_config	These keywords have been added: ChannelConvert FIPSMODE KexAlgorithmsSource zEDCCompression Reference: • zos_sshd_config
zos_sshd_config	These keywords have been added: ChannelConvert FIPSMODE KexAlgorithmsSource zEDCCompression Reference: • zos_sshd_config
zos_user_ssh_config	The following keywords have been added: ChannelConvert FIPSMODE KexAlgorithmsSource zEDCCompression Reference: • zos_user_ssh_config

Changed environment variables

Table 3 lists environment variables that are changed for Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH.

Table 3. List of changed environment variables in V1R3 of IBM Ported Tools for z/OS: OpenSSH

Environment variable	Changes
ZOS_SSH_PRNG_CMDS_TIMEOUT	This environment variable is no longer being used. Reference: None

Summary of changes to SYS1.MACLIB

Table 4 lists members of SYS1.MACLIB that were added in Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH.

Table 4. Summary of changes to SYS1.MACLIB in V1R3 of IBM Ported Tools for z/OS: OpenSSH

Sample	Changes
FOTSMF77	New authentication method types were added to the Common Security section. Reference: • Chapter 12, "SMF Type 119 records for OpenSSH," on page 201

Summary of changes to non-configuration files in /samples

Table 5 lists files in the `/samples` directory that were added in Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH.

Table 5. Summary of changes to /samples in V1R3 of IBM Ported Tools for z/OS: OpenSSH

Sample	Changes
ssh_smf.h	This file contains C mapping macros for OpenSSH SMF Type 119 records and has been updated. New authentication method types were added to the Common Security section. Reference: • Chapter 12, "SMF Type 119 records for OpenSSH," on page 201

Chapter 3. How does IBM Ported Tools for z/OS: OpenSSH differ from the open source version?

This topic describes how IBM Ported Tools for z/OS: OpenSSH differs from the open source version.

What IBM Ported Tools for z/OS: OpenSSH supports

sftp can treat files as binary or text. By default, **sftp** assumes that files are binary. Files transferred between EBCDIC and ASCII platforms are not converted. For file transfers between z/OS and ASCII UNIX platforms, you might need to convert your files (treat them as text). The **sftp** ascii subcommand can be used to transfer files in ASCII between the local host and a remote UNIX host. This subcommand assumes that the file data on the network should be encoded in ISO/IEC 8859-1. The **sftp** binary subcommand can be used to disable this conversion and return to performing binary file transfers.

scp treats files as text. By default, **scp** performs ASCII/EBCDIC conversion on files. For more information about how **scp** performs conversion, see Chapter 7, “Globalization on z/OS systems,” on page 63.

ssh, sftp and scp are restricted from using passwords when running in a 3270 environment. The OpenSSH client (**ssh**) cannot use passwords when being run from OMVS (which is a 3270 session). **sftp** and **scp** invoke **ssh** as part of their processing, so they have the same restriction.

IBM Ported Tools for z/OS: OpenSSH has different default settings. IBM Ported Tools for z/OS: OpenSSH has different default settings than the open source level of OpenSSH. If you share OpenSSH configuration files among platforms, then you should be aware of these differences. The differences are:

- The daemon configuration (**sshd_config**) file has both the AllowTcpForwarding keyword and the Compression keyword set to "no".
- The default **ssh_config** file has been changed to specify default Ciphers and MACs algorithms to prefer ICSF hardware accelerated algorithms and AES over 3DES, and SHA over MD5.
- The daemon configuration (**sshd_config**) file has the Protocol keyword set to 2 as the default setting, which specifies that only protocol version 2 connections are allowed.
- The client configuration (**ssh_config**) file has the Protocol keyword set to 2, which specifies that only protocol version 2 connections are allowed.
- The default locations of z/OS executables might differ than on other platforms, so the Subsystem specification of **sftp** might contain a different path on z/OS. On z/OS it is set to:

  ```
  Subsystem     sftp    /usr/lib/ssh/sftp-server
  ```

Provides support unique to z/OS. IBM Ported Tools for z/OS: OpenSSH provides the following z/OS extensions:

- System Authorization Facility (SAF) key ring. OpenSSH can be configured to allow OpenSSH keys to be stored in SAF key rings. See “Choosing between UNIX files and key rings” on page 61 for more information.

- Multilevel security. It is a security policy that allows the classification of data and users based on a system of hierarchical security levels combined with a system of non-hierarchical security categories. See "Running the sshd daemon in a multilevel-secure environment" on page 44.
- System Management Facility (SMF). OpenSSH can be configured to collect SMF Type 119 records for both the client and the server. See "Setting up OpenSSH to collect SMF records" on page 50 for more information.
- ICSF ciphers and MAC algorithms. OpenSSH can be set up to use Integrated Cryptographic Service Facility (ICSF) to implement certain ciphers and MAC (message authentication code) algorithms. This extension enables OpenSSH to use hardware support when applicable. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.
- FIPS 140-2 mode. OpenSSH can be set up to direct all cryptographic operations to ICSF and System SSL interfaces running in FIPS mode. This extension enables OpenSSH to meet FIPS 140-2 specifications. See "Setting up OpenSSH to run in FIPS mode" on page 58 for more information.

What IBM Ported Tools for z/OS: OpenSSH does not support

IBM Ported Tools for z/OS: OpenSSH does not support the following functionality:

- AFS token passing
- Kerberos (except through the use of GSS-API)
- Pluggable Authentication Module (PAM)
- Print last log
- Smart cards
- "Keyboard-interactive" user authentication
- TCP wrappers
- Tunnel device forwarding

User-defined subsystems treat data as binary. Subsystems are a feature of SSH protocol version 2 which facilitate the use of **ssh** as a secure transport for other applications such as **sftp**. However, you can define your own subsystem using the Subsystem keyword of **sshd_config**. The subsystem is then invoked as a remote command. For example:

```
Subsystem  backups   /home/billyjc/backups.sh
```

By default, the network data for a subsystem is treated as binary. Any output generated by a subsystem will not be displayed correctly between z/OS systems unless steps are taken to convert the data. The included **sftp** subsystem must be treated as binary, but connections for user-defined subsystems that are not binary may use the **ChannelConvert** option. The **ChannelConvert** option may be used in a Host or Match block to convert data for selected connections. See the description for **ChannelConvert** in "zos_ssh_config — z/OS-specific system-wide OpenSSH client configuration file" on page 164 and "zos_sshd_config — z/OS-specific OpenSSH daemon configuration file" on page 190.

Note: **ChannelConvert** should be added with caution to **zos_ssh_config** or **zos_sshd_config** so that it does not cause connections to fail, since they are or are not converting data as required.

IBM Ported Tools for z/OS: OpenSSH does not support multibyte locales. IBM Ported Tools for z/OS: OpenSSH does not support running in multibyte locales. It currently only supports single-byte locales that are compatible with ASCII coded character set ISO/IEC 8859-1. For more information, see Chapter 7, "Globalization on z/OS systems," on page 63.

Chapter 4. Migrating to Version 1 Release 3 of IBM Ported Tools for z/OS: OpenSSH

This information assumes that you are migrating from Version 1 Release 2 of IBM Ported Tools for z/OS: OpenSSH and that it has been upgraded to OpenSSH 5.0p1 with all the available PTFs applied.

If you are migrating from an unsupported version, you must first migrate to IBM Ported Tools for z/OS: OpenSSH Version 1 Release 2 that has been upgraded to OpenSSH 5.0p1 before migrating to IBM Ported Tools for z/OS: OpenSSH Version 1 Release 3.

Considerations when migrating from IBM Ported Tools for z/OS: OpenSSH Version 1 Release 2

This section describes coexistence and compatibility considerations when migrating from IBM Ported Tools for z/OS: OpenSSH Version 1 Release 2.

Coexistence considerations

In a sysplex environment, some systems might share the same configuration. They might also share the `ssh_known_hosts` or `authorized_keys` files. However, those systems might have different versions of **ssh** or **sshd**. In that situation, the previous version of the command might exit with an error message because it does not support the new features. For a list of the configuration keywords that were introduced in IBM Ported Tools for z/OS: OpenSSH Version 1 Release 3, see Table 2 on page 3. For a list of the `ssh_known_hosts` or `authorized_keys` files options that were introduced, see “Summary of changes to commands” on page 3.

Tips: When sharing files, consider these tips:

- To avoid sharing the same configuration file, the user can specify the local configuration file using '`-F config_file`' for **ssh** and '`-f config_file`' for **sshd** on the command line.
- To avoid sharing the same `ssh_known_hosts` file, the user can specify the local file using the **ssh_config** GlobalKnownHostsFile or UserKnownHostsFile keywords.
- To avoid sharing the same `authorized_keys` file, the user can specify the local file using the **sshd_config** AuthorizedKeysFile keyword.

Compatibility considerations

When a newer version of the SSH client is trying to connect to a previous version of the **sshd** daemon, connection might not be established due to incompatibility of the new configuration options. For a list of the configuration keywords that were introduced in IBM Ported Tools for z/OS: OpenSSH Version 1 Release 3, see Table 2 on page 3.

Migration actions for IBM Ported Tools for z/OS: OpenSSH Version 1 Release 3

Migration to IBM Ported Tools for z/OS: OpenSSH Version 1 Release 3 might require certain actions, which are listed as follows:

- “Changes to the random number support that might require a migration action”
- “Changes to the sftp command that might require a migration action” on page 13
- “Changes to the ssh command that might require a migration action” on page 13
- “Changes to the ssh_config file that might require a migration action” on page 14
- “Changes to the sshd command that might require a migration action” on page 16
- “Changes to the sshd_config file that might require a migration action” on page 17
- “Changes to the ssh-keygen command that might require a migration action” on page 18
- “Changes to the ssh-keyscan command that might require a migration action” on page 19
- “Changes to the ssh-rand-helper command that might require a migration action” on page 19
- “Changes to /samples/ssh_smf.h and FOTSMF77 in SYS1.MACLIB that might require a migration action” on page 20

Setting up the XPLINK environment for use by IBM Ported Tools for z/OS: OpenSSH

Description: Beginning in Version 1 Release 2, IBM Ported Tools for z/OS: OpenSSH is an XPLINK application. XPLINK (Extra Performance Linkage) is a type of call linkage that can improve performance in an environment of frequent calls between small functions.

Is the migration action required? Yes, to ensure optimal performance.

Steps to take: To set up the XPLINK environment (that is, to initialize the resources necessary to run an XPLINK application), take the following steps:

- Put the Language Environment® run-time library SCEERUN2 in the LNKLST member of SYS1.PARMLIB.
- Refer to the provided CEE.SCEESAMP(EDCWLPA) data set member to put the Language Environment XPLINK runtime modules in the dynamic LPA.
- Mark the run-time library SCEERUN2 as program controlled.

Reference information: The following list provides reference information that might be helpful.

- For more information about XPLINK, see *z/OS Language Environment Programming Guide*.
- For more information about placing SCEERUN2 in LNKLST, see *z/OS Language Environment Customization*.
- For more information about LNKLST, see *z/OS MVS Initialization and Tuning Reference*.

Changes to the random number support that might require a migration action

Table 6 on page 13 lists the changes to the random number support that might require a migration action and the accompanying actions.

Table 6. Changes to the random number support that might require a migration action

What changed	Migration action needed?
Random number support Previously, this support did not require ICSF. Now, random number support requires ICSF.	Yes. If ICSF is not available and configured to provide this support, OpenSSH client and server initialization will fail. For more information, see "Using hardware support to generate random numbers" on page 49. **Action:** If there is no cryptography card, ICSF HCR77A0 or later is required. The ICSF PTF for APAR OA45548 must be installed in order to use new ICSF Ciphers and MAC algorithms. For more information, see "Using hardware support to generate random numbers" on page 49 and "Setting up OpenSSH to use ICSF cryptographic operations" on page 52.

Changes to the sftp command that might require a migration action

Table 7 lists the changes to the **sftp** command that might require a migration action and the accompanying actions.

Table 7. Changes to the sftp command that might require a migration action

What changed	Migration action needed?
The **-P** option Previously, this option was used to specify the sftp_server_path. Now, this option is used to specify the port to connect to on the remote host.	Yes, if you specify the sftp_server_path. If you specify **-P** sftp_server_path, the following message is returned: `FOTS1401 filename line line number: Bad number number` **Action:** Use the **-D** option to specify the sftp_server_path.
Previously, the **`ln`** and **`symlink`** subcommands created a symbolic link from *oldpath* to *newpath* on the remote host. Now, the **-s** flag is specified the created link with is a symbolic link, otherwise it is a hard link.	Yes, if you create a symbolic link. **Action:** Run the sftp **`ln`** subcommand with the **-s** flag to create a symbolic link or create a hard link without the flag.

Changes to the ssh command that might require a migration action

Table 8 lists the changes to the **ssh** command that might require a migration action and the accompanying actions.

Table 8. Changes to the ssh command that might require a migration action

What changed	Migration action needed?
The **-c** option Previously, the default cipher list did not contain arcfour128-gcm@openssh.com and arcfour256-gcm@openssh.com. Now the default cipher list contains arcfour128-gcm@openssh.com and arcfour256-gcm@openssh.com. Most customers will not be affected by the changed default. The complete list of ciphers used by **`ssh`** can be found in "ssh_config — OpenSSH client configuration files" on page 147(see Ciphers).	Yes, if you wish to use the updated list to allow the new ciphers or the updated order of the preferred ciphers. **Action:** Specify the updated default list.

Table 8. Changes to the ssh command that might require a migration action (continued)

What changed	Migration action needed?
The **-I** option Previously, the argument was the device that `ssh` should use to communicate with a smart card used for storing the user's private RSA key. Now, the argument is the PKCS#11 shared library `ssh` should use to communicate with a PKCS#11 token providing the user's private RSA key.	No, because the option (**-I** *smartcard_device*) is not supported on z/OS systems.
The **-m** option Previously, the default MACs list did not contain hmac-md5-etm@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, hmac-sha1-96-etm@openssh.com, hmac-md5-96-etm@openssh.com, umac-128@openssh.com, hmac-sha2-256 and hmac-sha2-512. Now the default cipher list contain hmac-md5-etm@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, hmac-sha1-96-etm@openssh.com, hmac-md5-96-etm@openssh.com, umac-128@openssh.com, hmac-sha2-256 and hmac-sha2-512. The complete list of MACs can be found in “ssh_config — OpenSSH client configuration files” on page 147 (see MACs).	Yes, if you wish to use the updated list to allow the new MACs or the updated order of the preferred MACs. **Action:** Specify the updated default list.
The **-R** options Previously, the port argument "0" was not supported. Now, if the port argument is “0”, the listen port will be dynamically allocated on the server and reported to the client at run time.	No, setting the port argument to 0 was considered to be illegal in the previous version.

Changes to the ssh_config file that might require a migration action

Table 9 on page 15 lists the changes to the **ssh_config** file that might require a migration action and the accompanying actions.

Table 9. Changes to the ssh_config file that might require a migration action

What changed	Migration action needed?
The **Ciphers** keyword Previously, the default cipher list did not contain arcfour128-gcm@openssh.com and arcfour256-gcm@openssh.com. Now the default cipher list contains arcfour128-gcm@openssh.com and arcfour256-gcm@openssh.com. Most customers will not be affected by the changed default. The complete list of ciphers can be found in "ssh_config — OpenSSH client configuration files" on page 147 (see Ciphers).	Yes, if you wish to use the updated list to allow the new ciphers or the updated order of the preferred ciphers. **Action:** Specify the updated default list.
The **ControlPath** keyword Previously, %l in the path was substituted by the local host name. Now, %l in the path is substituted by the local host name (including any domain name).	Yes, if you want to use substitute character to substitute the local host name without any domain name. **Action:** Use the %L in the path to substitute the first component of the local host name.
The **GlobalKnownHostsFile** keyword Previously, the default global known hosts file list did not contain `/etc/ssh/ssh_known_hosts2`. Now, the default global known hosts file list contains `/etc/ssh/ssh_known_hosts2`. The complete list of **GlobalKnownHostsFile** can be found in "ssh_config — OpenSSH client configuration files" on page 147 (see GlobalKnownHostsFile).	Yes, if you wish to use the new global known hosts file or the new order of the preferred global known hosts file. **Action:** Specify the updated default list.
The **HostKeyAlgorithms** keyword Previously, the default host key algorithms list did not contain ecdsa-sha2-nistp256-cert-v01@openssh.com, ecdsa-sha2-nistp384-cert-v01@openssh.com, ecdsa-sha2-nistp521-cert-v01@openssh.com, ssh-rsa-cert-v01@openssh.com , ssh-dss-cert-v01@openssh.com, ssh-rsa-cert-v00@openssh.com,ssh-dss-cert-v00@openssh.com, ecdsa-sha2- nistp256,ecdsa-sha2-nistp384, ecdsa-sha2-nistp521. Now the default cipher list contains ecdsa-sha2-nistp256-cert-v01@openssh.com, ecdsa-sha2-nistp384-cert-v01@openssh.com, ecdsa-sha2-nistp521-cert-v01@openssh.com, ssh-rsa-cert-v01@openssh.com , ssh-dss-cert-v01@openssh.com, ssh-rsa-cert-v00@openssh.com, ssh-dss-cert-v00@openssh.com, ecdsa-sha2- nistp256, ecdsa-sha2-nistp384, ecdsa-sha2-nistp521. The complete list of host key algorithms can be found in "ssh_config — OpenSSH client configuration files" on page 147(see HostKeyAlgorithms).	Yes, if you wish to use the new host key algorithms or the new order of the preferred host key algorithms. **Action:** Specify the updated default list.
The **IdentityFile** keyword Previously, the default identity file list did not contain `~/.ssh/id_ecdsa`. Now, the default identity file list contains `~/.ssh/id_ecdsa`. The complete list of identity file can be found in (see IdentityFile).	Yes, if you wish to use the new identity file or the new order of the preferred identity file. **Action:** Specify the updated default list.

Table 9. Changes to the ssh_config file that might require a migration action (continued)

What changed	Migration action needed?
The **MACs** keyword Previously, the default MACs list did not contain hmac-md5-etm@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, hmac-sha1-96-etm@openssh.com, hmac-md5-96-etm@openssh.com, umac-128@openssh.com, hmac-sha2-256 and hmac-sha2-512. Now the default cipher list contain hmac-md5-etm@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, hmac-sha1-96-etm@openssh.com, hmac-md5-96-etm@openssh.com, umac-128@openssh.com, hmac-sha2-256 and hmac-sha2-512. The complete list of MACs can be found in "ssh_config — OpenSSH client configuration files" on page 147 (see MACs).	Yes, if you wish to use the updated list to allow the new MACs or the updated order of the preferred MACs. **Action:** Specify the updated default list.
The **RemoteForward** keyword Previously, the port argument "0" was not supported. Now, if the port argument is "0", the listen port will be dynamically allocated on the server and reported to the client at run time.	No, set the port argument to 0 was considered to be illegal in the previous version.
The **RhostsAuthentication** keyword Previously, this option was supported for protocol version 1. Now this option is no longer supported for protocol version 1 on z/OS UNIX.	Yes, if you use **RhostsAuthentication** for protocol version 1 in your application. When setting this, you will receive the following message: `filename line line_number: Deprecated option keyword`. **Action:** Update your application.
The **UserKnownHostsFile** keyword Previously, the default user known hosts file list did not contain `~/.ssh/known_hosts2`. Now, the default user known hosts file list contains `~/.ssh/known_hosts2`. The complete list of **UserKnownHostsFile** can be found in "ssh_config — OpenSSH client configuration files" on page 147(see UserKnownHostsFile).	Yes, if you wish to use the new user known hosts file or the new order of the preferred user known hosts file. **Action:** Specify the previous default list.

Changes to the sshd command that might require a migration action

Table 10 on page 17 lists the changes to the **sshd** command that might require a migration action and the accompanying actions.

Table 10. Changes to the sshd command that might require a migration action

What changed	Migration action needed?
The **-b** option Previously, the default number of bits in the ephemeral protocol version 1 server key was 768. Now, the default number of bits in the ephemeral protocol version 1 server key is 1024.	Yes, if you use the ephemeral protocol version 1 server key which is 768 bits. **Action:** Start the **sshd** daemon with specifying **-b** 768.

Changes to the sshd_config file that might require a migration action

d lists the changes to the **sshd_config** file that might require a migration action and the accompanying actions.

Table 11. Changes to the sshd_config file that might require a migration action

What changed	Migration action needed?
The **AuthorizedKeysFile** keyword Previously, the default value was `.ssh/authorized_keys`, but `.ssh/authorized_keys2` was also searched.	Yes, if you don't use the defaults and have specified **AuthorizedKeysFile** and want to continue to search `.ssh/authorized_keys2`. **Action:** If you specify **AuthorizedKeysFile** and would like to search `.ssh/authorized_keys2`, you must specify it.
The **Ciphers** keyword Previously, the default cipher list did not contain aes128-gcm@openssh.comand and aes256-gcm@openssh.com. Now the default cipher list contains aes128-gcm@openssh.com and aes256-gcm@openssh.com. The complete list of ciphers used by **sshd** can be found in “sshd_config — OpenSSH daemon configuration file” on page 171(see Ciphers).	Yes, if you wish to use the updated list to allow the new ciphers or the updated order of the preferred ciphers. **Action:** Specify the updated default list.
The **HostKey** keyword Previously, the default host key was `/etc/ssh/ssh_host_rsa_key` and `/etc/ssh/ssh_host_dsa_key` for protocol version 2. Now, the default host key for protocol version 2 is `/etc/ssh/ssh_host_rsa_key`, `/etc/ssh/ssh_host_dsa_key` and `/etc/ssh/ssh_host_ecdsa_key`.	Yes, if you wish to use host key `/etc/ssh/ssh_host_ecdsa_key` for protocol version 2. **Action:** Specify the updated default list.

Table 11. Changes to the sshd_config file that might require a migration action (continued)

What changed	Migration action needed?
The **MACs** keyword Previously, the default MAC algorithms list did not contain hmac-md5-etm@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, hmac-sha1-96-etm@openssh.com, hmac-md5-96-etm@openssh.com, umac-128@openssh.com, hmac-sha2-256 and hmac-sha2-512. Now, the default cipher list contains hmac-md5-etm@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, hmac-sha1-96-etm@openssh.com, hmac-md5-96-etm@openssh.com, umac-128@openssh.com, hmac-sha2-256 and hmac-sha2-512. The complete list of MAC algorithms used by `sshd` can be found in "sshd_config — OpenSSH daemon configuration file" on page 171 (see MACs)	Yes, if you wish to use the updated list to allow the new MACs or the updated order of the preferred MACs. **Action:** Specify the updated default list.
The **RhostsAuthentication** keyword Previously, this option was supported for protocol version 1. Now, this option is no longer supported for protocol version 1 on z/OS Unix.	Yes, if you use **RhostsAuthentication** for protocol version 1 in your application. When setting it, the following message is returned: `FOTS2374 filename line line_number: Deprecated option keyword" is returned`. **Action:** Update your application.
The **ServerKeyBits** keyword Previously, the default number of bits in the ephemeral protocol version 1 server key was 768. Now, the default number of bits in the ephemeral protocol version 1 server key is 1024.	Yes, if you use the ephemeral protocol version 1 server key which is 768 bits. **Action:** Start the `sshd` daemon with specifying **-b** 768, if you want to use the old default.

Changes to the ssh-keygen command that might require a migration action

Table 12 lists the changes to the **ssh-keygen** command that might require a migration action and the accompanying actions.

Table 12. Changes to the ssh-keygen command that might require a migration action

What changed	Migration action needed?
-d option Previously, **-d** option as alias of **-t dsa**was supported. Now, it is not supported.	Yes, if you use `ssh-keygen` command with **-d** option. Specifying the **-d** option will return the following error message: `unknown option -- d`. **Action:** Replace **-d** by **-t dsa**.
-b option (used in conjunction with **-G**) Previously, the minimum value on the `ssh-keygen -b` option used with **-G** options was 768. Now the minimum value is 512.	No. Because minimum value 512 is less than 768.

Table 12. Changes to the ssh-keygen command that might require a migration action (continued)

What changed	Migration action needed?
-b option (for RSA) Previously, the maximum RSA key size on the **ssh-keygen -b** option was 32768. Now the maximum size is 16384.	Yes, if you are using **ssh-keygen** to generate RSA keys with a size that is between 16384 and 32768 bits. If you specify an RSA key size larger than 16384, the following error message will be returned: `key bits exceeds maximum 16384`. **Action:** Use **ssh-keygen** to generate new RSA keys based on the new size requirement.

Changes to the ssh-keyscan command that might require a migration action

Table 13 lists the changes to the **ssh-keyscan** command that might require a migration action and the accompanying actions.

Table 13. Changes to the ssh-keyscan command that might require a migration action

What changed	Migration action needed?
The **-t** option Previously, if the **-t** option was not specified, **ssh-keyscan** searches only for SSH protocol version 1 keys ("rsa1") by default. Now, if the **-t** option is not specified, **ssh-keyscan** searches only for SSH protocol version 2 “rsa” and “ecdsa” keys by default.	Yes, if you search protocol version 1 keys ("rsa1") without specifying **-t** option. **Action:** Search protocol version 1 keys ("rsa1") with specifying **-t rsa1** .

Changes to the ssh-rand-helper command that might require a migration action

Table 14 lists the changes to the **ssh-rand-helper** command that might require a migration action and the accompanying actions.

Table 14. Changes to the ssh-rand-helper command that might require a migration action

What changed	Migration action needed?
The **ssh-rand-helper** command Now, the **ssh-rand-helper** is not supported.	Yes. If no migration action, the following message is returned: `FOTS1949 PRNG is not seeded. Please activate the Integrated Cryptographic Service Facility (ICSF).` **Action:** The new OpenSSH requires that a working `/dev/random` device be available to all OpenSSH client and server jobs. This requires that ICSF be configured to support `/dev/random` and that users have SAF authority to the CSFRNG service.

Changes to the users running ssh, sftp or scp client commands that might require a migration action

Table 15 on page 20 lists the changes to the users running the **ssh**, **sftp**, or **scp** commands that might require a migration action and the accompanying actions.

Table 15. Changes to the users running ssh, sftp or scp client commands that might require a migration action

What changed	Migration action needed?

Users running **ssh**, **sftp** or **scp** client commands when collecting SMF records.
New SMF subtype records have been added which requires additional setup.
	Yes, if you use **ssh**, **sftp** or **scp** client commands to collect SMF records.
	Action: Setup the users who run **ssh**, **sftp** or **scp** client commands to have READ access to the BPX.SMF SAF/RACF profile. For example:
	`RDEFINE FACILITY BPX.SMF UACC(NONE)`
	`PERMIT BPX.SMF CLASS(FACILITY) ID(userid) ACCESS(READ)`
	`SETROPTS RACLIST(FACILITY) REFRESH`

Changes to /samples/ssh_smf.h and FOTSMF77 in SYS1.MACLIB that might require a migration action

Table 16 lists the changes to `/samples/ssh_smf.h` and FOTSMF77 in SYS1.MACLIB that might require a migration action and the accompanying actions.

Table 16. Changes to /samples/ssh_smf.h and FOTSMF77 in SYS1.MACLIB that might require a migration action

What changed	Migration action needed?
`/samples/ssh_smf.h` and SYS1.MACLIB(FOTSMF77) Now, new Ciphers and MACs, new subtypes (Client Connection Started 94 and Server Connection Started 95), and SFTP target path have been updated to the `ssh_smf.h` and FOTSMF77. For more information, see Chapter 12, “SMF Type 119 records for OpenSSH,” on page 201.	Yes, if you use `ssh_smf.h` and FOTSMF77. **Action:** Update your application.

Chapter 5. For system administrators

This topic describes the various tasks that the system administrator handles.

Rule: All files used by IBM Ported Tools for z/OS: OpenSSH (such as key files and configuration files) must be in the IBM-1047 code set, except for the **rc** files (`/etc/ssh/sshrc` and `~/.ssh/rc`). Those files are parsed by `/bin/sh` and should be in the code set of the current locale. Do not use the `/etc/ssh/sshrc` file if there is a possibility of the users on the system running in different locales.

Restriction: IBM Ported Tools for z/OS: OpenSSH does not run in multibyte locales.

Differences between sftp and FTP

OpenSSH's **sftp** and IBM Communications Server's FTP with System SSL differ from each other. OpenSSH's **sftp** is an Open Source implementation of the IETF Secure Shell (SECSH) "SSH File Transfer Protocol" Internet Draft. OpenSSH uses a statically linked OpenSSL cryptographic library, System SSL, or ICSF to perform its cryptographic functions. OpenSSH provides some key management facilities with the **ssh-keygen** command. However, this support is not integrated with System SSL support provided by IBM. OpenSSH uses the security product when performing password authentication and when extracting keys from certificates associated with SAF key rings. The public key authentication processing itself is overseen by the OpenSSH daemon.

For information about the IETF SECSH internet drafts, see Appendix C, "RFCs and Internet drafts," on page 523.

The Communications Server FTP server and client support Transport Layer Security (TLS). The FTP client and server negotiate the use of TLS based on a subset of the FTP security negotiation functions documented in RFC 2228. FTP uses z/OS System SSL, and therefore can use the cryptographic hardware. For more information about FTP, see *z/OS Communications Server: IP Configuration Guide*.

Because **sftp** and FTP with System SSL do not use the same protocol, they cannot communicate with each other to establish a secure session.

Restriction: OpenSSH's **sftp** support does not include built-in support for MVS™ data sets. For alternate ways to access MVS data sets within **sftp**, see Appendix A, "Accessing MVS data sets within sftp," on page 517.

What you need to verify before using OpenSSH

Before using OpenSSH, the system administrator should check that all prerequisites have been met.

Steps for verifying the prerequisites for using OpenSSH

About this task

Before you begin: Perform the following steps to verify that the prerequisites for using OpenSSH have been met.

Procedure

1. Using Table 17 as a reference, check that certain directories were set up correctly when IBM Ported Tools for z/OS: OpenSSH was installed.

Table 17. List of directories and needed permissions

Directory	Permission	Owner	Notes
/var/empty	755	UID(0)	Must be empty. It is used as the home directory for the SSHD (unprivileged) user. For more information about privilege separation, see "Step for creating the sshd privilege separation user" on page 37.
/var/run	755	UID(0)	Holds the `sshd.pid` file, which contains the process ID of the most recently started OpenSSH daemon. If another directory is preferred, the PidFile configuration option can be specified in the daemon's **sshd_config** file. For more information, see sshd_config. Also holds the `sshd.mm.XXXXXXXX` temporary files which are used for compression with privilege separation.
/etc/ssh	755	UID(0)	Holds the configuration files for **ssh** and **sshd**.

2. Check that the **sshd** daemon has been installed with the program control, APF-authorized, and noshareas extended attributes. To verify that these extended attributes have been set properly, issue the following shell command:

```
ls -El /usr/sbin/sshd
```

The output should be similar to the following example:

```
-rwxr--r-- ap-- 2 SYSADM 1 5783552 Jul 9 08:24 /usr/sbin/sshd
```

The 'p' indicates that the program control extended attribute is set. The 'a' indicates that the APF-authorized extended attribute is set. The lack of an 's' after the 'p' indicates that the noshareas extended attribute is set. If the output is not correct, then you must set the attributes as follows.

- To set the noshareas extended attribute, issue the following shell command:

  ```
  extattr -s /usr/sbin/sshd
  ```

- If you are a UID(0) user with at least READ access to the BPX.FILEATTR.PROGCTL resource in the FACILITY class, you can set the program control extended attribute by issuing the following shell command:

  ```
  extattr +p /usr/sbin/sshd
  ```

- If you are a UID(0) user with at least READ access to the BPX.FILEATTR.APF resource in the FACILITY class, you can set the APF-authorized extended attribute by issuing the following shell command:

  ```
  extattr +a /usr/sbin/sshd
  ```

In addition, ensure that the Language Environment run-time libraries are defined to program control, the standard Language Environment library is HLQ.CEE.SCEERUN and the XPLINK is HLQ.CEE.SCEERUN2.

```
SETROPTS WHEN(PROGRAM)
RDEFINE PROGRAM * ADDMEM
('CEE.SCEERUN'/volser/NOPADCHK
'SYS1.LINKLIB'/'******'/NOPADCHK) UACC(READ)
SETROPTS WHEN(PROGRAM) REFRESH
```

3. Check that the **ssh**, **scp**, **sftp**, and **sftp-server** programs have been installed with the program control and noshareas extended attributes. To verify that this extended attribute is set properly, issue the following shell command for each program:

   ```
   ls -El progname
   ```

   where *progname* is `/bin/ssh`, `/bin/scp`, `/bin/sftp`, or `/usr/lib/ssh/sftp-server`.

   The output should be similar to the following example:

   ```
   -rwxr-xr-x -p- 2 SYSADM 1 5783552 Jul 9 08:24 progname
   ```

   The 'p' indicates that the program control extended attribute is set. The lack of an 's' after the 'p' indicates that the noshareas extended attribute is set. If the output is not correct, then you must set the attributes as follows.

   - To set the noshareas extended attribute, issue the following shell command:

     ```
     extattr -s progname
     ```

   - If you are UID(0) user with at least READ access to the BPX.FILEATTR.APF resource in the FACILITY class, you can set the program control extended attribute by issuing the following shell command:

     ```
     extattr +p progname
     ```

4. Check that the **ssh-keysign** program has been installed with the noshareas extended attribute. To verify that this extended attribute is set properly, issue the following shell command for the program:

   ```
   ls -El progname
   ```

   where progname is `/usr/lib/ssh/ssh-keysign`. The output should be similar to the following example:

   ```
   -rwxr-xr-x ---- 2 SYSADM 1 5783552 Jul 9 08:24 progname
   ```

   The third - in '----' indicates that the noshareas extended attribute is set. If the output is not correct, then you must set the noshareas extended attribute. For example, to set the noshareas extended attribute for `/usr/lib/ssh/ssh-keysign`, issue the following shell command:

   ```
   extattr -s /usr/lib/ssh/ssh-keysign
   ```

   If host-based authentication is used, check that the **ssh-keysign** program has been installed with setuid 0 .

Results

When you are done, you have verified that the prerequisites for using OpenSSH have been met.

For more information about program control, see *z/OS UNIX System Services Planning*.

Setting up the sshd daemon

Before the system administrator can start the **sshd** daemon, the following setup tasks must be done:

- The configuration files must be created or edited, as described in “Steps for creating or editing configuration files.”
- Server authentication must be set up as described in “Steps for setting up server authentication when keys are stored in UNIX files” on page 27 and “Steps for setting up server authentication when keys are stored in key rings” on page 29.
- The **sshd** privilege separation user must be created as described in “Step for creating the sshd privilege separation user” on page 37.

Setting up the message catalog for IBM Ported Tools for z/OS: OpenSSH is an optional task. The task is described in “Setting up the message catalog for IBM Ported Tools for z/OS: OpenSSH” on page 38.

Steps for creating or editing configuration files

About this task

Perform the following steps to create or edit the configuration files.

Procedure

1. Copy the configuration files from the `/samples` directory to the `/etc/ssh` directory. Store them in the IBM-1047 (EBCDIC) code set. Additionally, set the appropriate mode for some of the copied files.

   ```
   cp -p /samples/sshd_config      /etc/ssh/sshd_config
   cp -p /samples/ssh_config       /etc/ssh/ssh_config
   cp -p /samples/moduli           /etc/ssh/moduli
   cp -p /samples/zos_sshd_config  /etc/ssh/zos_sshd_config
   cp -p /samples/zos_ssh_config   /etc/ssh/zos_ssh_config
   chmod 600 /etc/ssh/sshd_config
   chmod 600 /etc/ssh/zos_sshd_config
   ```

   Table 21 on page 197 lists the permission and UID settings for each configuration file.

   Note: If you are migrating from a previous release, review your existing configuration files for any changes that you might want to migrate to the new release.

2. Modify the `/etc/ssh/sshd_config` file to control the SSH server's authentication methods allowed, protocols, and ciphers supported, port forwarding, and session control options. For more details, see sshd and sshd_config.

   Appendix B, “OpenSSH - port forwarding examples,” on page 519 has examples of port forwarding.

3. Modify the `/etc/ssh/ssh_config` file to control the SSH client-side authentication methods, protocols, ciphers, port forwarding settings and session control options. For more details, see ssh and ssh_config.

   Note:

   a. The settings in this configuration file provide system defaults. They can be overridden by the user's **ssh** configuration in `~/.ssh/config` file or by command-line options.
   b. The **ssh_config** file can be shared across multiple systems with client configuration options that are tailored to the specific local system being used. To share the file, preface groups of configuration options with the Host keyword.

4. Configure the TCP port. By default, **sshd** listens on TCP port 22. Because this is in the range of ports numbered 1–1023, it is considered to be a privileged TCP port. Only daemons running as a superuser are allowed to listen on these ports unless TCP is configured to unrestrict low ports.

   You can configure **sshd** to listen on a different port with the Port keyword or the **-p** command-line option (see sshd_config).

   Example: An example of an **sshd_config** entry is:

   ```
   Port 1022
   ```

   If you want to reserve the port for **sshd** daemon use, add the following lines to PROFILE.TCPIP within the Port statements:

   ```
   PORT
   22 TCP SSHD* ; port for sshd daemon
   ```

   The job name must have the wildcard format of SSHD* because as the sshd daemon starts, it creates child tasks starting with SSHDn where *n* is a number between 1 and 9. Depending on your system, the resulting daemon task will be one of these child tasks so a D OMVS,A=ALL will show SSHDn as the daemon task. Use of this wildcard means that TCP/IP cannot automatically restart the daemon if it goes down. See "Starting the sshd daemon" on page 38 for information about starting the OpenSSH daemon.

5. Set up random number generation.

   - Verify that ICSF is started and can provide secure random numbers. See "Using hardware support to generate random numbers" on page 49. For example, verify that `/dev/random` provides random data:

     ```
     head -c100 /dev/random | od -x
     ```

6. (Optional step.) Create an **sshrc** file. If you need to run host-specific commands whenever a user logs in to this host, create an `/etc/ssh/sshrc` file. It is a shell script run only for SSH logins, not for non-SSH logins (such as rlogin or telnet). Examples of use are logging or running **ssh-agent**. If you do not need to do this, then do not create the file. If you create the file, it must be a shell script in `/bin/sh` syntax.

7. If the TCPIP.DATA file on the system is located in the UNIX file system, for example, named `/etc/resolv.conf`, copy `/etc/resolv.conf` to `/var/empty/etc/resolv.conf`.

   ```
   cp -p /etc/resolv.conf /var/empty/etc/resolv.conf
   ```

   The OpenSSH daemon runs with privilege separation enabled by default. During privilege separation, the daemon cleaves itself into two processes, one with privileges and one without. The unprivileged user (the SSHD privilege separation user) handles network traffic and everything not requiring special privileges. This unprivileged process runs in a chroot jail of `/var/empty`. The **chroot** service changes the root directory from the current one to a new one; in this case, `/var/empty`. The root directory is the starting point for path searches of path names beginning with a slash. At some point, the privilege separation user invokes a TCP/IP system call which requires access to the TCPIP.DATA file. If this file is stored in the UNIX file system as `/etc/resolv.conf`, the privilege separation user will not have access to the file because it is not located off the new root file system of `/var/empty`. To make this file visible to the privilege separation user, the system administrator should copy /etc/resolv.conf to /var/empty/etc/resolv.conf.

Tip: Every time the installation changes the TCPIP.DATA statements, the TCPIP.DATA file must be recopied to the path name located off the /var/empty root, so that the updated information is found by the privilege separation user.

8. If your system is set up to run in another locale, see Chapter 7, “Globalization on z/OS systems,” on page 63 for information about setting up your system or user environment.

Results

When you are done, you have either created or edited the configuration files.

Setting up server authentication

The following are important notes for setting up server authentication.

1. To run **ssh-keyscan** against a host, the **sshd** daemon must be running on that host.
2. Verify all keys gathered via **ssh-keyscan** by displaying the key fingerprint with **ssh-keygen**.
3. For additional security, all host names and addresses can be hashed in the ssh_known_hosts file. The **ssh-keygen** and **ssh-keyscan** commands provide options for hashing host names and addresses.
4. If **ssh-keyscan** was not used to gather the host keys, then prepend the host name or address (for which the keys belong) to each key entry in the ssh_known_hosts file. **ssh-keyscan** automatically includes the host name or address in its output.
5. The system-wide ssh_known_hosts file is in the /etc/ssh directory.

Before the system administrator can start the **sshd** daemon, server authentication must be set up. Two types of server authentication are supported: host key exchange and GSS-API key exchange. During host key exchange, when a client attempts to establish a secure connection with the server, keys are used to determine the trustworthiness of the server. Those keys can be stored in either UNIX files or SAF key rings, or both. For more information about storing the key rings, see “Choosing between UNIX files and key rings” on page 61. Optionally, if GSS-API key exchange is configured on the SSH server and the SSH client, server identities and keys are managed by the Key Distribution Center (KDC). GSSAPI (Kerberos) key exchange is compatible with Microsoft Windows® domains and some Windows SSH products.

You need to know whether you want to use SSH protocol version 1, protocol version 2, or both. Protocol version 2 is the default. Both protocols support similar authentication methods, but protocol version 2 is preferred because it provides additional mechanisms for confidentiality and integrity. Protocol version 1 lacks a strong mechanism for ensuring the integrity of the connection.

Restriction: If you are using SSH protocol version 1, you cannot use key rings to hold your keys. You must use UNIX files to hold RSA keys used for SSH protocol version 1.

The procedures for setting up server authentication are described in the following sections:

- "Steps for setting up server authentication when keys are stored in UNIX files"
- "Steps for setting up server authentication when keys are stored in key rings" on page 29
- "Steps for setting up server authentication with GSS-API (Kerberos)" on page 37

Steps for setting up server authentication when keys are stored in UNIX files

About this task

Perform the following steps to perform setup for server authentication if you are storing the keys in UNIX files.

Procedure

1. Generate the host keys for the SSH server based on the protocol that you plan to use. (Host keys allow a client to verify the identity of the server.) The key files must be stored in the IBM-1047 (EBCDIC) code set. Assuming that the superuser running these commands is running in the default C locale, the key files are automatically stored in that code set.

   The following command will generate all of the host keys that do not already exist for all key types (rsa1, rsa, dsa, ecdsa):

   ```
   ssh-keygen -A
   ```

   To manually generate or replace selected SSH server host keys, use the following commands.

   If you are using SSH protocol version 1, issue:

   ```
   ssh-keygen -t rsa1 -f /etc/ssh/ssh_host_key -N ""
   ```

   If you are using SSH protocol version 2, issue:

   ```
   ssh-keygen -t dsa -f /etc/ssh/ssh_host_dsa_key -N ""
   ssh-keygen -t rsa -f /etc/ssh/ssh_host_rsa_key -N ""
   ssh-keygen -t ecdsa -f /etc/ssh/ssh_host_ecdsa_key -N ""
   ```

   The use of the **-N** option in the examples creates an empty passphrase for the host key. Host keys cannot have passphrases associated with them, because the daemon would have no way of knowing which passphrase to use with which host key.

2. Copy the local host's public keys to the `ssh_known_hosts` file at the remote host. The client uses the `ssh_known_hosts` file to verify the identity of the remote host.

   a. Log into the remote host.

   b. Append the local host's public keys to the `/etc/ssh/ssh_known_hosts` file at the remote host.

      If you are using SSH protocol version 1, use:

      ```
      /etc/ssh/ssh_host_key.pub
      ```

      If you are using SSH protocol version 2, use:

      ```
      /etc/ssh/ssh_host_dsa_key.pub
      /etc/ssh/ssh_host_rsa_key.pub
      ```

      You can use cut and paste to append the keys. Because a key is a long line, verify that the keys were not split across lines. Each key should be exactly one line of the file.

If you use FTP to move your public key files to another system, treat the files as text to enable any necessary conversion between ASCII and EBCDIC.

c. For each public key added to the remote `ssh_known_hosts` file, add the host name of the key to the start of the line. For more information, see "ssh_known_hosts file format" on page 139. All host names and addresses in this file can be hashed for additional security. The **ssh-keygen** command provides the **-H** option for this purpose.

d. Log off the system. Clients logging into the host can now verify the identity of that host.

---

3. Gather the public host keys of remote hosts and store them in either a file or a certificate.

   a. If the remote hosts are not z/OS systems or if they are z/OS systems that do not use key ring support, use **ssh-keyscan** to redirect the resulting output to a file. Verify the keys in that file and add them to the previously created `/etc/ssh/ssh_known_hosts` file. If you do not verify the keys before creating the `/etc/ssh/ssh_known_hosts` file, users might be vulnerable to attacks. For additional security, the **ssh-keyscan** command provides the **-H** option to hash all host names and addresses in the output. See ssh-keyscan for more information.

   b. If any remote hosts are z/OS systems with the host keys in a key ring, two methods of gathering and storing those keys on the local host are available. Either the public key is stored in the `/etc/ssh/ssh_known_hosts` file, or the public key is stored in a certificate associated with a key ring on the local host. That certificate is identified in the `/etc/ssh/ssh_known_hosts` file.

      1) Use **ssh-keyscan** as described earlier in this step, or

      2) Extract the public host keys from the remote host key ring as follows:

         - Use **ssh-keygen -e** on the remote host to export the public host key. For example:

           ```
           export _ZOS_SSH_KEY_RING_LABEL="SSHDAEM/SSHDring host-ssh-type"
           ssh-keygen -e > host-ssh-type.out
           ```

         - FTP the exported key to the local system.
         - Use **ssh-keygen -i** on the local system to import the public host key into a UNIX file. For example:

           ```
           ssh-keygen -i -f host-ssh-type.out >> /etc/ssh/ssh_known_hosts
           ```

Results

When you are done, you have performed setup for server authentication in which keys will be stored in UNIX files. Each time the host keys are regenerated, they must be redistributed and added to the key ring of the remote system.

Figure 1 on page 29 shows how the known_hosts file is created when keys are stored in UNIX files.

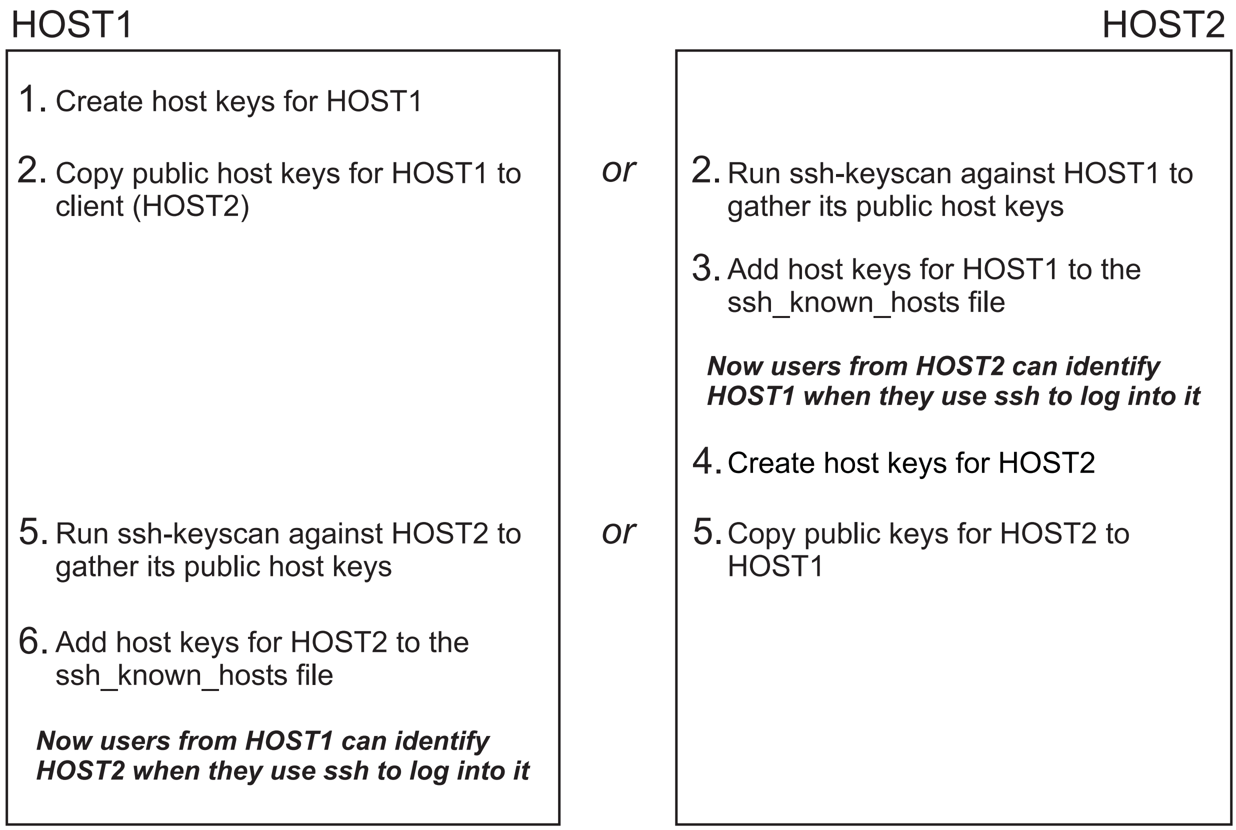

HOST1
HOST2
1. Create host keys for HOST1
2. Copy public host keys for HOST1 to client (HOST2)
or
2. Run ssh-keyscan against HOST1 to gather its public host keys
3. Add host keys for HOST1 to the ssh_known_hosts file
Now users from HOST2 can identify HOST1 when they use ssh to log into it
4. Create host keys for HOST2
5. Run ssh-keyscan against HOST2 to gather its public host keys
or
5. Copy public keys for HOST2 to HOST1
6. Add host keys for HOST2 to the ssh_known_hosts file
Now users from HOST1 can identify HOST2 when they use ssh to log into it

Figure 1. How the known_hosts file is created when keys are stored in UNIX files

Steps for setting up server authentication when keys are stored in key rings

About this task

The setup procedure has been divided into three steps:

- “Step 1: Generate the host keys for the SSH server” on page 30. Host keys allow a client to verify the identity of the server.
- “Step 2: Distribute the public keys from the local host to the remote hosts” on page 32. Clients use the `ssh_known_hosts` file to verify the identity of the remote host.
- “Step 3: Gather the public host keys of remote hosts” on page 34. Keys are verified and then added to the `/etc/ssh/ssh_known_hosts` file.

Use RACF® or a similar security product that supports key rings when storing key rings. SSH protocol version 2 is the only version that can be used when storing keys in key rings. If you want to use protocol version 1, then you must store the keys in UNIX files as described in “Steps for setting up server authentication when keys are stored in UNIX files” on page 27. Protocol version 2 provides additional mechanisms for confidentiality and integrity while protocol version 1 lacks a strong mechanism for ensuring the integrity of the connection. The key files must be stored in the IBM-1047 (EBCDIC) code set.

The examples provided for managing key rings and associated objects use the RACF RACDCERT command. If a different security product is used, consult that product's documentation to determine if it contains compatible support. For more information about the RACDCERT command, the necessary authority required to use the command, and any other options not described in this documentation, refer to *z/OS Security Server RACF Command Language Reference*.

In the examples, input names that are given in italics are variables that you can choose. Some of these names in italics contain hyphen characters (-) separating portions of the name. These hyphens are variable and are not required. The names given are merely suggestions and are consistently used throughout the examples. If you customize your own version in one step, that name will likely need to be used on other command steps as well.

The examples demonstrate using a self-signed certificate. Using a certificate chain, such as with root and intermediate certificate authority certificates, is supported. If you will be using more advanced certificate chains than the examples demonstrate, see “Validating certificates when using key rings” on page 62 for important considerations.

Step 1: Generate the host keys for the SSH server

Before you begin: You need to do the following tasks:

- Make sure that a unique user ID that will be used to start the OpenSSH daemon has already have been set up on your system. A unique user ID is necessary because RACF uses the user ID, not the UNIX UID, for access control to key rings. The examples in this step use SSHDAEM as the user ID that starts the daemon and that also owns the associated host key rings. For more information about setting up the user ID that will be used to start the OpenSSH daemon, see “Starting sshd as a stand-alone daemon” on page 38.
- Determine whether you are working with real or virtual key rings because the setup steps vary depending on the type of key ring is being used. See *z/OS Security Server RACF Security Administrator's Guide* for more information about real and virtual key rings.

Perform the following steps to generate the host keys for the SSH server.

1. Create a real key ring if you do not yet have one to use for the host public keys. Omit this step if you plan to use a virtual key ring. Use the RACDCERT ADDRING command to create the new key ring, specifying the owning user ID and the key ring name. The ID keyword must specify the user ID that will be starting **sshd**. The key ring name can be any unique name for this user ID.

   For example:

   ```
   RACDCERT ID(SSHDAEM) ADDRING(SSHDring)
   ```

2. Using the RACDCERT GENCERT command, generate a host certificate with public and private keys based on the algorithms that are supported on the server (either RSA, DSA, or both). For RSA keys, the minimum size is 768 bits and the maximum size is 32768 bits. Typically, 2048 bits are considered sufficient. DSA keys must be exactly 1024 bits as specified by FIPS 186-2. DSA keys larger than 1024 bits associated with certificates in a key ring are not supported by OpenSSH.

   Do not use variant characters in the label name for the certificate. The **sshd** daemon must run only in the C locale and therefore interprets the key files (that is, the known host and authorized key files) as encoded in code set IBM-1047.

   The following examples demonstrate how to create non-ICSF (Integrated Cryptographic Storage Facility) certificates in the RACF database.

Note: ICSF can not be used to store the certificates and associated keys.

- To generate a certificate and an RSA public/private key pair, storing the private key in the RACF database as a non-ICSF key:

  ```
  RACDCERT GENCERT ID(SSHDAEM) SUBJECTSDN(CN('host-ssh-rsa-cn'))
  SIZE(2048) WITHLABEL('host-ssh-rsa')
  ```

- To generate a certificate and a DSA public/private key pair, storing the private key in the RACF database as a non-ICSF key:

  ```
  RACDCERT GENCERT ID(SSHDAEM) SUBJECTSDN(CN('host-ssh-dsa-cn'))
  SIZE(1024) DSA WITHLABEL('host-ssh-dsa')
  ```

The SUBJECTSDN parameter offers several more customizable keywords, which are not shown in the preceding examples, that can be included in the distinguished name. The label assigned to the certificate must be chosen to be unique within the RACF database. The user ID must match the owner of the key ring.

3. If real key rings are being used, use the RACDCERT CONNECT command to connect the certificate to the host key ring. Omit this step if you plan to use virtual key rings. You must identify the user ID that owns the certificate and the user ID that owns the key ring. These are typically the same for this connect command. For example:

   ```
   RACDCERT CONNECT(ID(SSHDAEM) LABEL('host-ssh-type')
    RING(SSHDring) USAGE(PERSONAL)) ID(SSHDAEM)
   ```

4. Add a line in the z/OS-specific `zos_sshd_config` file for each certificate being used for a host key.
   - **For real key rings,** add the following line:

     ```
     HostKeyRingLabel "SSHDAEM/SSHDring host-ssh-type"
     ```

   - **For virtual key rings,** add the following line:

     ```
     HostKeyRingLabel "SSHDAEM/* host-ssh-type"
     ```

5. Restrict access to the key ring. To prevent access to the host private keys by any other user, permit only the user ID (for example, SSHDAEM) that starts the **sshd** daemon. See “Managing key rings and restricting access to them” on page 61 for more information. For example:
   - To prohibit universal access to SSHDring, using ring-specific profile checking:

     ```
     RDEFINE RDATALIB SSHDAEM.SSHDring.LST UACC(NONE)
     PERMIT SSHDAEM.SSHDring.LST CLASS(RDATALIB) ID(SSHDAEM) ACCESS(READ)
     ```

     If the RDATALIB class is not yet active and RACLISTed:

     ```
     SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
     ```

     Refresh the class:

     ```
     SETROPTS RACLIST(RDATALIB) REFRESH
     ```

   - To prohibit universal access to the SSHDAEM user's virtual key ring, using ring-specific profile checking:

     ```
     RDATALIB SSHDAEM.IRR_VIRTUAL_KEYRING.LST UACC(NONE)
     PERMIT SSHDAEM.IRR_VIRTUAL_LISTRING.LST CLASS(RDATALIB) ID(SSHDAEM) ACCESS(READ)
     ```

     If the RDATALIB class is not yet active and RACLISTed:

     ```
     SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
     ```

     Refresh the class:

```
SETROPTS RACLIST(RDATALIB) REFRESH
```

- To prohibit universal access to any key ring on the system, using global profile checking:

  ```
  RDEFINE FACILITY IRR.DIGTCERT.LISTRING UACC(NONE)
  ```

  If the FACILITY class is not yet active and RACLISTed:

  ```
  SETROPTS RACLIST(FACILITY) CLASSACT(FACILITY)
  ```

  Refresh the class:

  ```
  SETROPTS RACLIST(FACILITY) REFRESH
  ```

When you are done with Step 1, you have generated the host keys for the SSH server. Now go to "Step 2: Distribute the public keys from the local host to the remote hosts."

Step 2: Distribute the public keys from the local host to the remote hosts

Step 2 is intended for remote hosts that use key rings. If a remote host does not use key rings, then use **ssh-keygen** to distribute the public host keys as described in Step 3 in "Steps for setting up server authentication when keys are stored in UNIX files" on page 27.

Perform the following steps to distribute the public keys from the local host to the `ssh_known_hosts` file on the remote host.

1. Export each certificate in DER format without the private key into a data set using the RACDCERT EXPORT command. Specify the certificate identification and request CERTDER for the export format. Choose a data set to store the exported certificate and specify it on the DSN parameter. If the data set specified for DSN already exists, it is deleted and reallocated by the RACDCERT EXPORT command.

   For example:

   ```
   RACDCERT EXPORT(LABEL('host-ssh-type')) ID(SSHDAEM)
     FORMAT(CERTDER) DSN('host.sshcert.type')
   ```

2. Use FTP to distribute each exported certificate data set in binary format to the remote hosts.

3. On the remote host, if real key rings are being used, create a new key ring if you do not yet have a key ring to use for the known host public keys. Omit this step if you plan to use virtual key rings. Use the RACDCERT ADDRING command, specifying the owning user ID and the key ring name. If you have not yet created the user ID that will be starting the **sshd** daemon on this remote host, do that first. The user ID specified here must be the user ID that will be running the **sshd** daemon on this remote host which is assumed to be SSHDAEM in the following examples. The key ring name can be any unique name for this user ID.

   For example:

   ```
   RACDCERT ID(SSHDAEM) ADDRING(SSHKnownHostsRing)
   ```

4. On the remote host, use the RACDCERT ADD command to add the exported certificate on the remote host. Specify the data set that you distributed to this remote host by using FTP. Also specify the user ID that should own the

certificate and indicate that this certificate is trusted. The user ID specified here must be the user ID that will be running the **sshd** daemon on this remote host which is assumed to be SSHDAEM in the following examples. You will also specify the label for this certificate on this remote host. This label must be unique for the user ID within the RACF database and is used to identify this certificate on future commands and for reference as a known host certificate.

This certificate contains only the public key.

For example:

```
RACDCERT ADD('host.sshcert.type') ID(SSHDAEM)
  WITHLABEL('host-ssh-type') TRUST
```

5. On the remote host, if real key rings are being used, use the RACDCERT CONNECT command to connect each certificate into the known hosts key ring. Omit this step if you plan to use virtual key rings. You must identify the user ID that owns the certificate and the user ID that owns the key ring. These will typically be the same for this connect command.

   For example:

   ```
   RACDCERT CONNECT(ID(SSHDAEM) LABEL('host-ssh-type')
      RING(SSHKnownHostsRing)) ID(SSHDAEM)
   ```

6. On the remote host, edit the system-wide known_hosts file `/etc/ssh/ssh_known_hosts` to add a line for each host certificate connected in Step 4 on page 32. The line must contain the host name or host names followed by *zos-key-ring-label=“KeyRingOwner/KeyRingName label*.” For example:

   - **For a real key ring** (for example, SSHKnownHostsRing), add:

     ```
     host zos-key-ring-label="SSHDAEM/SSHKnownHostsRing host-ssh-type"
     ```

   - **For a virtual key ring** (for example, one owned by SSHDAEM), add:

     ```
     host zos-key-ring-label="SSHDAEM/* host-ssh-type"
     ```

   For more information, see the **sshd** command section “ssh_known_hosts file format” on page 139.

7. On the remote host, permit user access to the known hosts key ring. All OpenSSH client users on this system must have authority to read the public keys from this key ring. For details about the methods of permitting access, see “Managing key rings and restricting access to them” on page 61. For example:

   - To define universal access to the real key ring, SSHKnownHostsRing, using ring-specific profile checking:

     ```
     RDEFINE RDATALIB SSHDAEM.SSHKnownHostsRing.LST UACC(READ)
     ```

     If the RDATALIB class is not yet active and RACLISTed:

     ```
     SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
     ```

     Refresh the class:

     ```
     SETROPTS RACLIST(RDATALIB) REFRESH
     ```

   - To define universal access to the SSHDAEM user's virtual key ring, using ring-specific profile checking:

     ```
     RDEFINE RDATALIB SSHDAEM.IRR_VIRTUAL_KEYRING.LST UACC(READ)
     ```

     If the RDATALIB class is not yet active and RACLISTed:

     ```
     SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
     ```

Refresh the class:

```
SETROPTS RACLIST(RDATALIB) REFRESH
```

- To define (and permit) universal access to any key ring on the system, using global profile checking:

  ```
  RDEFINE FACILITY IRR.DIGTCERT.LISTRING UACC(UPDATE)
  ```

  If the FACILITY class is not yet active and RACLISTed:

  ```
  SETROPTS RACLIST(FACILITY) CLASSACT(FACILITY)
  ```

  Refresh the class:

  ```
  SETROPTS RACLIST(FACILITY) REFRESH
  ```

8. Log off the remote host.

When you are done with Step 2, you have distributed the public keys on the local host to the remote hosts. Now go to "Step 3: Gather the public host keys of remote hosts."

Step 3: Gather the public host keys of remote hosts

Step 3 is intended for remote hosts that use key rings. If a remote host does not use key rings, then use **ssh-keyscan** to gather the public host keys, as described in Step 3 on page 28 in "Steps for setting up server authentication when keys are stored in UNIX files" on page 27.

1. Create a new key ring if you do not yet have one to use for the host public keys on your local host. Omit this step if you plan to use virtual key rings. Use the RACDCERT ADDRING command, specifying the owning user ID and the key ring name. The ID keyword should specify the user ID that will be starting **sshd**. The key ring name can be any unique name for the specified user ID. For example:

   ```
   RACDCERT ID(SSHDAEM) ADDRING(SSHKnownHostsRing)
   ```

2. On the remote host, export each host key certificate in DER format without the private key and use FTP to distribute it in binary format to the local host. The RACDCERT EXPORT command can perform this type of export. Specify the certificate identification and request CERTDER for the export format. Choose a data set to store the exported certificate and specify it on the DSN parameter. If the data set specified for DSN already exists, it is deleted and reallocated by the RACDCERT EXPORT command. For example:

   ```
   RACDCERT EXPORT(LABEL('host-ssh-type')) ID(SSHDAEM)
     FORMAT(CERTDER) DSN('host.sshcert.type')
   ```

3. Use FTP to distribute each data set in binary format from the remote host to the local host.

4. On the local host, add each certificate into the SAF database. Use the RACDCERT ADD command to add the exported certificate on the remote host. Specify the data set that you copied from the local host using FTP, the user ID that should own the certificate, and indicate that this certificate is trusted. The user ID specified here must be the user ID that will be running the **sshd** daemon on this local host. You will also be specifying the label for this certificate on this local host. This label must be unique for the user ID within

the RACF database, and will be used to identify this certificate on future commands and for reference as a known host certificate.

This certificate will contain only the public key. For example:

```
RACDCERT ADD('host.sshcert.type') ID(SSHDAEM)
  WITHLABEL('host-ssh-type') TRUST
```

5. Connect each certificate into the known hosts key ring if a real key ring is being used. Omit this step if you plan to use virtual key rings. The RACDCERT CONNECT command can be used. You must identify the user ID that owns the certificate and the user ID that owns the key ring. These will typically be the same for this connect command. For example:

```
RACDCERT CONNECT(ID(SSHDAEM) LABEL('host-ssh-type')
  RING(SSHKnownHostsRing)) ID(SSHDAEM)
```

6. Edit the local host's system-wide known_hosts file `/etc/ssh/ssh_known_hosts` to add a line for each of the host certificates imported in Step 4 on page 34. The line must contain the host name or host names followed by *zos-key-ring-label="KeyRingOwner/KeyRingName label"*. For example:

   - **If a real key ring is being used** (for example, SSHKnownHostsRing), issue:

     ```
     mvshost zos-key-ring-label="SSHDAEM/SSHKnownHostsRing host-ssh-type"
     ```

   - **If a virtual key ring is being used** (for example, one owned by SSHDAEM), issue:

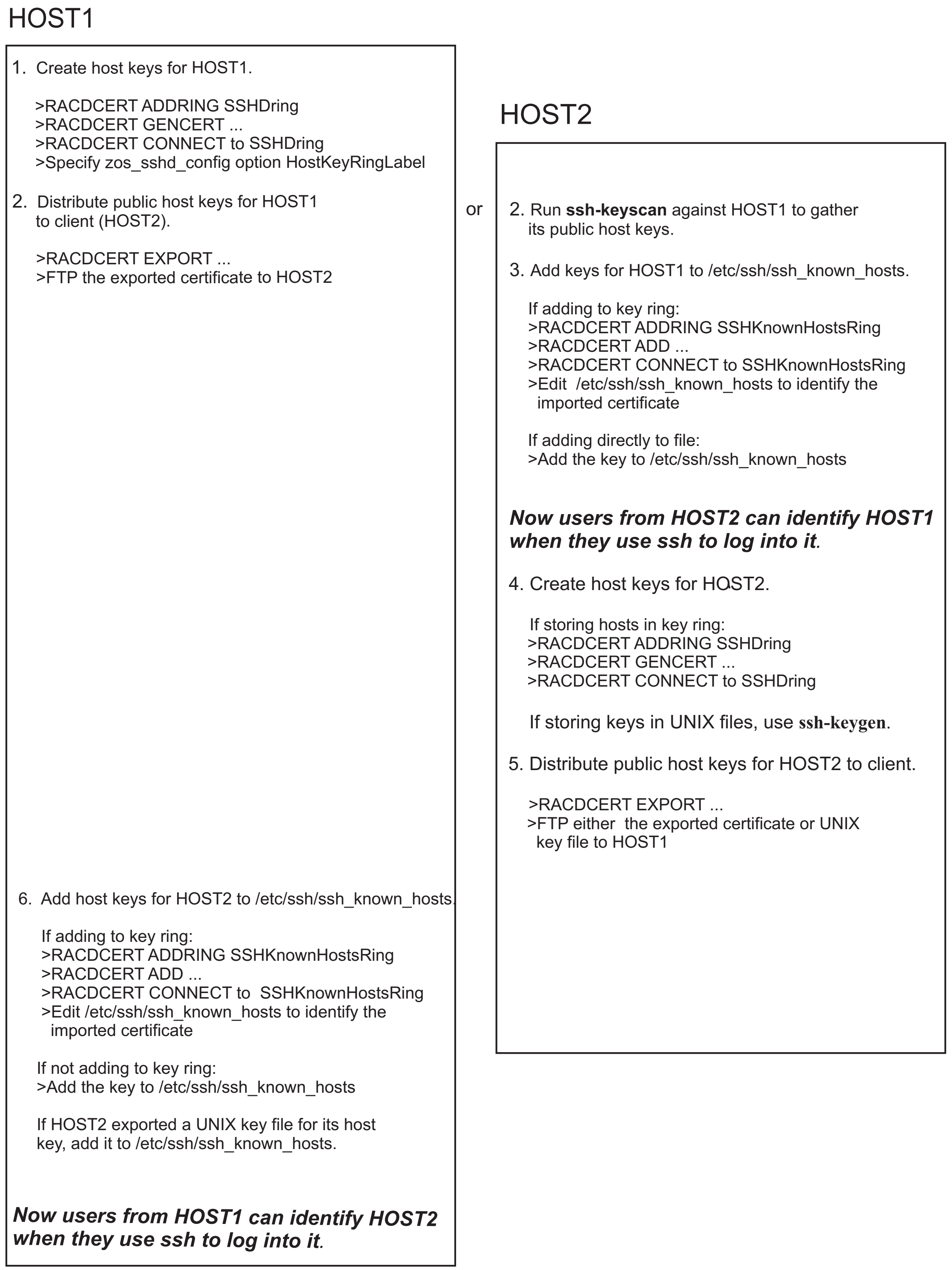
     ```
     mvshost zos-key-ring-label="SSHDAEM/* host-ssh-type"
     ```

   For more information, see the **sshd** command section "ssh_known_hosts file format" on page 139.

7. On the local host, permit user access to the known hosts key ring. For details about the methods of permitting access, see Step 7 on page 33 in "Step 2: Distribute the public keys from the local host to the remote hosts" on page 32.

When you are done with Step 3, you have gathered the public host keys of remote hosts and edited the local `/etc/ssh/ssh_known_hosts` file to include the imported host certificates. Now clients can verify the identity of remote hosts. Each time the host keys are regenerated in the key ring, they must be redistributed and added to the key ring of the remote system.

Figure 2 on page 36 shows a high-level view of the operations performed to set up the server's host keys when they are stored in real key rings.



HOST1

1. Create host keys for HOST1.

>RACDCERT ADDRING SSHDring
>RACDCERT GENCERT ...
>RACDCERT CONNECT to SSHDring
>Specify zos_sshd_config option HostKeyRingLabel

2. Distribute public host keys for HOST1 to client (HOST2).

>RACDCERT EXPORT ...
>FTP the exported certificate to HOST2

or

HOST2

2. Run **ssh-keyscan** against HOST1 to gather its public host keys.

3. Add keys for HOST1 to /etc/ssh/ssh_known_hosts.

If adding to key ring:
>RACDCERT ADDRING SSHKnownHostsRing
>RACDCERT ADD ...
>RACDCERT CONNECT to SSHKnownHostsRing
>Edit /etc/ssh/ssh_known_hosts to identify the imported certificate

If adding directly to file:
>Add the key to /etc/ssh/ssh_known_hosts

Now users from HOST2 can identify HOST1 when they use ssh to log into it.

4. Create host keys for HOST2.

If storing hosts in key ring:
>RACDCERT ADDRING SSHDring
>RACDCERT GENCERT ...
>RACDCERT CONNECT to SSHDring

If storing keys in UNIX files, use **ssh-keygen**.

5. Distribute public host keys for HOST2 to client.

>RACDCERT EXPORT ...
>FTP either the exported certificate or UNIX key file to HOST1

6. Add host keys for HOST2 to /etc/ssh/ssh_known_hosts.

If adding to key ring:
>RACDCERT ADDRING SSHKnownHostsRing
>RACDCERT ADD ...
>RACDCERT CONNECT to SSHKnownHostsRing
>Edit /etc/ssh/ssh_known_hosts to identify the imported certificate

If not adding to key ring:
>Add the key to /etc/ssh/ssh_known_hosts

If HOST2 exported a UNIX key file for its host key, add it to /etc/ssh/ssh_known_hosts.

Now users from HOST1 can identify HOST2 when they use ssh to log into it.

Figure 2. How the server's host keys are set up when they are stored in real key rings

Steps for setting up server authentication with GSS-API (Kerberos)

About this task

Perform the following steps to perform setup for server authentication with GSS-API key exchange.

1. Refer to *z/OS Integrated Security Services Network Authentication Service Administration* . This reference defines the steps for configuring a Key Distribution Center (KDC). At a minimum, follow the steps to make the Network Authentication Service operational and to configure the primary security server for the realm.
2. For SSH servers, modify the `/etc/ssh/sshd_config` file to enable the GSS-API options **GSSAPIAuthentication** and **GSSAPIKeyExchange**.
3. Using GSSAPI in SSHD requires the use of a new DLL: `/usr/lib/ssh/zsshgss.so`. The `/usr/lib/ssh` directory must be added to the LIBPATH environment variable for the sshd process. For example, if you are starting an `/etc/ssh/sshd.sh` script from BPXBATCH, add this export:

   ```
   export LIBPATH=$LIBPATH:/usr/lib/ssh
   ```
4. For SSH client machines, modify the `/etc/ssh/ssh_config` file to enable the GSSAPI options **GSSAPIAuthentication** and **GSSAPIKeyExchange**. These option may alternatively be enabled in an individual user's `~/.ssh/ssh_config` file or by using command line options on the **`ssh`**, **`sftp`**, or **`scp`** commands.
5. Setup a host-based service principal for the SSH server by adding a Kerberos segment to the user that SSHD runs under. The principal name, excluding the realm, must be `host/default_host_name`, where `default_host_name` is the fully qualified lower-case default host name. This should match the name returned by z/OS UNIX command **`hostname -r`**. For example, to associate the principal for host `test.server.myco.com` with the SSHDAEM user:

   ```
   ALTUSER SSHDAEM PASSWORD(password) NOEXPIRED
      KERB(KERBNAME('host/test.server.myco.com'))
   ALTUSER SSHDAEM NOPASSWORD
   ```

When you are done, you have performed setup for server authentication with GSS-API.

Step for creating the sshd privilege separation user

About this task

Privilege separation (where the OpenSSH daemon creates an unprivileged child process to handle incoming network traffic) is enabled in the default configuration for **sshd**.

Before you begin: You need to know the new group ID and unused nonzero user ID that you want to use. The user ID and group ID for the privilege separation user “SSHD” is not the same user ID that will be used to start the OpenSSH daemon. The user ID you choose for the SSHD user should be unprivileged.

You must also be logged onto TSO/E with RACF SPECIAL authority. (Instead of using RACF, you could use an equivalent security product if it supports the SAF interfaces required by z/OS UNIX, which are documented in *z/OS Security Server RACF Callable Services*.)

Perform the following step to create the **sshd** privilege separation user.

- Set up a user account for the **sshd** privilege separation user by issuing the following commands where *xxx* is an unused group ID, and *yyy* is an unused nonzero user ID.

```
ADDGROUP SSHDG OMVS(GID(xxx))
ADDUSER SSHD DFLTGRP(SSHDG) OMVS(UID(yyy) HOME('/var/empty')
  PROGRAM('/bin/false')) NOPASSWORD
```

  Tip: If you have a user ID naming policy that does not allow you to assign this user as "SSHD", you can create an "sshd" entry in the user ID alias table, and map it to the user ID that was actually defined. See *z/OS UNIX System Services Planning* for more information about the user ID alias table.

When you are done, you have created the **sshd** privilege separation user.

Setting up the message catalog for IBM Ported Tools for z/OS: OpenSSH

Setting up the message catalog for IBM Ported Tools for z/OS: OpenSSH is an optional task. To see message numbers (for example, FOTSnnnn) associated with OpenSSH error messages, no special OpenSSH message catalog setup is required. If you do not want to see message numbers, then you must set the environment variable _ZOS_OPENSSH_MSGCAT="NONE" before running an OpenSSH command. This setting can be applied to all shell users by exporting it from the default system-wide user environment files, `/etc/profile` and `/etc/csh.cshrc`. The _ZOS_OPENSSH_MSGCAT environment variable identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

Table 18. Values for the _ZOS_OPENSSH_MSGCAT environment variable

Value	**Result**
"openssh.cat"	Message numbers are associated with OpenSSH error messages by default.
"openssh"	Message numbers are associated with OpenSSH error messages if the NLSPATH environment variable includes the following path: /usr/lib/nls/msg/%L/%N.cat.
"NONE"	Message numbers are not associated with OpenSSH error messages.
Unset or set to an invalid value	Message numbers are associated with OpenSSH error messages by default.

Starting the sshd daemon

You can start the **sshd** daemon in one of two ways:

- As a stand-alone daemon, as described in “Starting sshd as a stand-alone daemon.” As a stand-alone daemon, **sshd** listens for TCP connections on a port (default 22), and starts child processes to handle the requested connections.
- As a daemon running under **inetd**, as described in “Starting sshd as a daemon running under inetd” on page 41. The **inetd** program listens on the specified port and starts an instance of the **sshd** daemon for each requested connection.

Starting sshd as a stand-alone daemon

The **sshd** daemon can be started as a stand-alone daemon.

This setup assumes that RACF is used as your security product. If you use a different security product, you need to determine the equivalent setup for that product. You also need RACF SPECIAL (administrator) authority to perform the RACF setup.

You need to decide which user ID will be used to start the daemon. The user ID might already have been set up on your system. Follow these rules:

- The user ID must have a UID of 0 and ACCESS(READ) permission to BPX.DAEMON.
- Do not choose "SSHD" as the user name to assign to the daemon. The user name "SSHD" is reserved for the privilege separation user, which is not a UID(0) user ID.
- If the host system has the BPX.POE resource in the FACILITY class defined, the UID invoking the OpenSSH daemon must have ACCESS(READ) permission.
- If the SERVAUTH class is active, the user ID might need to be authorized to some of the network resources protected by the SERVAUTH class. For more information about the SERVAUTH class, see *z/OS Communications Server: IP Configuration Guide*.

Example: The following example assumes that the SSHDAEM user ID is defined as UID(0) and has READ access to the BPX.DAEMON profile in the FACILITY class. It also assumes that the SSHDAEM user ID was set up like the OMVSKERN user ID. For more information about how to set up OMVSKERN, see the section on preparing RACF in *z/OS UNIX System Services Planning*.

```
SETROPTS CLASSACT(FACILITY)
SETROPTS RACLIST(FACILITY)
RDEFINE FACILITY BPX.DAEMON UACC(NONE)
PERMIT BPX.DAEMON CLASS(FACILITY) ID(SSHDAEM) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH
```

The section on establishing the correct level of security for daemons in *z/OS UNIX System Services Planning* discusses the z/OS UNIX level of security.

Ways to start sshd as a stand-alone daemon

There are several ways to start and restart **sshd**. The method used depends on the level of control that the installation has chosen for daemons.

Using BPXBATCH

You can start **sshd** with a cataloged procedure by using BPXBATCH to invoke a daemon program located in the z/OS UNIX file system. If you use BPXBATCH as a started procedure to initiate the SSHD job, it will complete typically with a return code of CC=0. A forked copy of the daemon will be left running, which is normal.

Note: ICSF must be running prior to starting **sshd**.

These steps explain what to do.

1. Create a cataloged procedure.

   Example: Following is a sample procedure:

   ```
   //SSHD    PROC
   //SSHD    EXEC PGM=BPXBATCH,REGION=0M,TIME=NOLIMIT,
   //        PARM='PGM /bin/sh -c /etc/ssh/sshd.sh'
   //* STDIN and STDOUT are both defaulted to /dev/null
   //STDERR  DD PATH='/tmp/sshd.stderr',
   //           PATHOPTS=(OWRONLY,OCREAT,OAPPEND),PATHMODE=(SIRWXU)
   ```

The following is the sample shell script to be used with the preceding sample procedure. The sample procedure assumes that this sample shell script is stored in `/etc/ssh/sshd.sh` and is executable by the caller (for example, `chmod 700 /etc/ssh/sshd.sh`).

```
#!/bin/sh
export _EDC_ADD_ERRNO2=1
nohup /usr/sbin/sshd -f /etc/ssh/sshd_config &
sleep 1
```

Specifying REGION=0M in the JCL is equivalent to specifying MEMLIMIT=NOLIMIT. Options for altering this behavior include utilizing IEFUSI to set MEMLIMIT ceilings for your system because IEFUSI settings override the JCL. Alternatively, you can use SMFPRMxx system default settings, but this works only if there are no REGION or MEMLIMIT specifications in the JCL.

2. For this **sshd** cataloged procedure to obtain control with superuser and daemon authority, you must add it to the STARTED class.

   The procedure in this example is named SSHD because it starts the **sshd** daemon. It should not be confused with the SSHD privilege separation user, which is an unprivileged user ID that the daemon uses to execute unprivileged areas of code.

   Example: This example assumes that the SSHDAEM user ID is defined as UID(0), and has READ access to the BPX.DAEMON profile in the FACILITY class. For more information about how to set up SSHDAEM, see "Starting sshd as a stand-alone daemon" on page 38. Following is an example of a cataloged procedure:

   ```
   SETROPTS GENERIC(STARTED)
   RDEFINE STARTED SSHD.* STDATA(USER(SSHDAEM)
   GROUP(OMVSGRP) TRUSTED(NO))
   SETROPTS RACLIST(STARTED) REFRESH
   ```

   The section about using started procedures in *z/OS Security Server RACF Security Administrator's Guide* contains more information about using started procedures and the STARTED class.

3. To start **sshd**, issue the following command from the MVS console:

   ```
   S SSHD
   ```

   You should see the message IEF695I on the MVS syslog. The user ID indicated in the message should be defined as UID(0) with READ access to the BPX.DAEMON profile in the FACILITY class. The group indicated in the message should have an OMVS segment containing a GID value. With the default values from Step 2 (SSHDAEM and OMVSGRP), the message would look like the following output: :

   ```
   IEF695I START SSHD     WITH JOBNAME SSHD   IS ASSIGNED TO
   USER SSHDAEM   ,GROUP OMVSGRP
   ```

   The user ID and group must not be SSHD and SSHDG because this would indicate that the daemon was started with the SSHD privilege separation user.

   If the **sshd** daemon is terminated, you can issue `S SSHD` to restart it.

Using the /etc/rc shell script

You can put the command in the `/etc/rc` shell script to start the daemon automatically during initialization. For information about starting programs from `/etc/rc`, see the section on customizing `/etc/rc` in *z/OS UNIX System Services Planning*.

When UNIX systems are initialized (IPLed or restarted), the /etc/rc shell script is run to perform system initialization functions and to start daemons. If a daemon terminates, a superuser must restart the daemon.

To start **sshd** from the /etc/rc shell script, add the following to the /etc/rc file:

| **Note:** ICSF must be running prior to starting **sshd**.

```
 _BPX_JOBNAME=SSHD /usr/sbin/sshd &
```

In this example, the _BPX_JOBNAME environment variable is set to assign a job name of SSHD to the **sshd** daemon. Doing so allows the operator to have better control over managing the **sshd** daemon.

When started from the/etc/rc shell script, stdin and stdout are set to **/dev/null** and stderr is set to **/etc/log** for recording any errors. If you want to separate the standard error of **sshd** from that of all /etc/rc error output, you can specify the **sshd** command to redirect standard error as follows:

```
_BPX_JOBNAME=SSHD /usr/sbin/sshd 2>/tmp/sshd.stderr &
```

If the **sshd** daemon process is stopped, it must be started by a user ID with appropriate privileges. For more information about setting up the user ID that will be used to start the OpenSSH daemon, see “Starting sshd as a stand-alone daemon” on page 38.

From the shell

If you are running with UNIX-level security, (for example, without BPX.DAEMON), you can start **sshd** from a superuser ID in the UNIX shell. This security level is not generally adequate for z/OS systems.

Issue:

```
_BPX_JOBNAME=SSHD /usr/sbin/sshd &
```

For an explanation about using &, see *z/OS UNIX System Services Planning*.

Restarting the sshd daemon without bringing it down

If the server configuration files are changed after the **sshd** daemon is running, the changes do not affect the daemon, unless a SIGHUP signal is sent to the daemon process. To restart the **sshd** daemon, reading the configuration files, including z/OS-specific files, without terminating existing SSH connections, issue

```
kill -s HUP $(cat /var/run/sshd.pid)
```

The name of the /var/run/sshd.pid file can be changed by using the **sshd_config** keyword PidFile.

SIGHUP does not reset command-line options (which might override the configuration files). If you want to change a command-line option, the daemon will have to be stopped and then restarted with the new command-line option.

Starting sshd as a daemon running under inetd

You can start the **sshd** daemon as a daemon running under **inetd**.

Steps for starting the sshd daemon under inetd

About this task

Before you begin: You need to be familiar with **inetd** configuration. You should also be aware that starting **sshd** through **inetd** could decrease performance of **ssh** connection startup time on your system. For every **ssh** connection started, **inetd** will start a new **sshd**. The **sshd** daemon startup incurs some overhead due to basic initialization and protocol version 1 server key generation.

Perform the following steps to start the **sshd** daemon under **inetd**.

Procedure

1. In the TCP/IP services configuration file, add an entry to establish the connection between TCP/IP and z/OS UNIX. This is the `/etc/services` file or the hlq.ETC.SERVICES data set, where **hlq** is the prefix defined by DATASETPREFIX in the TCP/IP profile "TCPIP" by default). The format is:

   ```
   ssh 22/tcp
   ```

2. In the `/etc/inetd.conf` file, add a line similar to the following example:

   ```
   ssh stream   tcp      nowait   SSHDAEM  /usr/sbin/sshd  sshd -i
   ```

   The **-i** option specifies **inetd** behavior, with a single connection on a TCPIP socket attached to **sshd**'s stdin and stdout.

Results

When you are done, you have started the **sshd** daemon under **inetd**.

Restarting the sshd daemon under inetd without bringing it down

If **inetd** is currently running, send it a SIGHUP signal to allow the new configuration files with **sshd** settings to be read.

Stopping the sshd daemon

About this task

To stop the **sshd** daemon from the MVS console, follow these steps:

Procedure

1. Determine the address space ID (ASID) of the **sshd** process. Issue:

   ```
   D A,SSHD*
   ```

   The ASID of the SSHD daemon will be returned.
2. Using the ASID obtained in Step 1, determine the process ID (PID) of the **sshd** process. Issue:

   ```
   D OMVS,ASID=aaaa
   ```

   where *aaaa* is the ASID obtained in Step 1. The PID of the daemon will be returned.
3. Using the PID obtained in Step 2, stop the **sshd** daemon. Issue:

```
F BPXOINIT,TERM=pppppppp
```

where *pppppppp* is the PID obtained in Step 2 on page 42.

Results

To stop **sshd** from z/OS UNIX, follow these steps:

1. Determine the process ID (PID) of the **sshd** daemon by looking at the contents of the file `/var/run/sshd.pid`. By default, the **sshd** PID is written to `/var/run/sshd.pid` when **sshd** is started. The name of the `/var/run/sshd.pid` file can be changed by using the **sshd_config** keyword PidFile. To find the PID, issue:

   ```
   cat /var/run/sshd.pid
   ```

   The PID of the **sshd** daemon will be returned.
2. Issue the z/OS UNIX **kill** command against the PID that was obtained in Step 1. For example:

   ```
   kill $(cat /var/run/sshd.pid)
   ```

   or

   ```
   kill pppppppp
   ```

   where *ppppppp* is the PID obtained in Step 1.

To stop the **sshd** daemon with a cataloged procedure using BPXBATCH, follow these steps:

1. Create a cataloged procedure. For example:

   ```
   //STOPSSHD PROC
   //STOPSSHD EXEC PGM=BPXBATCH,
   // PARM='PGM /bin/sh -c /etc/ssh/stopsshd.sh'
   //* STDIN and STDOUT are both defaulted to /dev/null
   //STDERR DD PATH='/tmp/sshd.stderr',
   // PATHOPTS=(OWRONLY,OCREAT,OAPPEND),PATHMODE=(SIRWXU)
   ```

   The following is the sample shell script to be used with the preceding sample procedure. The sample procedure assumes that this sample shell script is stored in the `/etc/ssh/stopsshd.sh` file and is executable by the caller (for example, `chmod 700 /etc/ssh/stopsshd.sh`).

   ```
   #!/bin/sh
   kill $(cat /var/run/sshd.pid)
   ```

   By default, the **sshd** PID is written to the `/var/run/sshd.pid` file when **sshd** is started. If the name of the **sshd** PID file was changed by using the **sshd_config** PidFile keyword then this sample shell script must be changed accordingly. (The keyword is described in PidFile.)
2. For the cataloged procedure to obtain control with superuser and daemon authority, you must add it to the STARTED class.

   Example: This example assumes that the SSHDAEM user ID is defined as UID(0) and has READ access to the BPX.DAEMON profile in the FACILITY class. For more information about how to set up SSHDAEM, see “Starting sshd as a stand-alone daemon” on page 38.

   ```
   SETROPTS GENERIC(STARTED)
   RDEFINE STARTED STOPSSHD.* STDATA(USER(SSHDAEM)
   GROUP(OMVSGRP) TRUSTED(NO))
   SETROPTS RACLIST(STARTED) REFRESH
   ```

The section about using started procedures in *z/OS Security Server RACF Security Administrator's Guide* contains more information about using started procedures and the STARTED class.

3. To stop the **sshd** daemon, issue the following command from the MVS console:

   ```
   S STOPSSHD
   ```

   Whenever the sshd daemon is started, you can issue S STOPSSHD to stop it.

Running the sshd daemon in a multilevel-secure environment

The OpenSSH daemon (**sshd**) can be used on a multilevel-secure system to control a user's security label at login. Review *z/OS Planning for Multilevel Security and the Common Criteria* before using the daemon on a multilevel-secure system.

The OpenSSH daemon will attempt to derive a security label from the user's port of entry, as defined in a NetAccess profile. To successfully login to a multilevel-secure system, the login user ID must be permitted to the security label defined in the NetAccess profile for the client IP address. These checks are performed for any user invoking **ssh**, **scp**, or **sftp** to perform remote operations on the multilevel-secure system. For more information about NetAccess profiles and running daemons in a multilevel-secure environment, see *z/OS Communications Server: IP Configuration Guide*.

Verifying security labels for directories

Verify that the following directories have been assigned the appropriate security labels.

Directory	Permission	Owner	Security label
/var/empty	755	UID(0)	SYSHIGH
/var/run	755	UID(0)	SYSLOW
/usr/lib/ssh	755	UID(0)	SYSLOW
/etc/ssh	755	UID(0)	SYSLOW

Configuring sshd for multilevel security

The OpenSSH daemon must be started by a UID(0) user ID running with a security label of SYSMULTI, and the user ID must be authorized to the SERVAUTH NETACCESS profiles. The privilege separation user ("SSHD") must be assigned and permitted to the SYSMULTI seclabel. Assign a security label of SYSHIGH to the `/var/empty` directory.

If the host system has the BPX.POE resource in the FACILITY class defined, the UID invoking the OpenSSH daemon must have ACCESS(READ) permission.

Guidelines: In a multilevel-secure environment:

1. **sshd** should not be invoked through **inetd**.
2. Port forwarding should be disabled because it could allow a user to bypass NetAccess profile settings. It is disabled by default. See the description of the **sshd_config** keywords AllowTcpForwarding and X11Forwarding.

If users are attempting login with password authentication and do not have authorization to log in from their IP address, then the login will fail at password entry and a message should be written to the MVS console by the security product.

If they are attempting login via public key authentication and do not have authorization to log in from their IP address, the attempted login will be terminated before the users enter a passphrase.

The following output is a sample failure of a client public key authentication in a multilevel-secure environment:

```
debug3: send_pubkey_test
debug2: we sent a publickey packet, wait for reply
Connection closed by UNKNOWN
```

The OpenSSH daemon writes an error message to the UNIX syslog for these failures.

Considerations for running the OpenSSH daemon when TERMINAL classes are defined

The OpenSSH daemon recognizes TERMINAL class settings.

- If the user is attempting login with password authentication and does not have authorization to log in from their terminal, then the login will fail at password entry and a message should be written to the MVS console by the security product.
- If the user is attempting login via public key authentication and does not have authorization to log in from their terminal, the attempted login will be terminated before the user enters a passphrase.

The following output is a sample client public key authentication failure when a TERMINAL class is enabled:

```
debug3: send_pubkey_test
debug2: we sent a publickey packet, wait for reply
Connection closed by UNKNOWN
```

The OpenSSH daemon writes an error message to the UNIX syslog for these failures.

Limiting file system name space for sftp users

Some administrators might want to limit the file system name space that is accessible by users during file transfer operations. This task can be accomplished by configuring the **sshd** daemon to change the root directory of the **sftp** user connection. The administrator uses the **sshd_config** keyword ChrootDirectory to set up the environment. The keyword is described in ChrootDirectory.

After the environment has been set up, searches for file system objects (files and directories) are relative to the user's new root directory. If the new root directory does not contain a duplicate of the required programs or support files needed by the user, then the session might not be usable. The "internal-sftp" subsystem can be used to overcome this setup problem for **sftp** users. Specifying "internal-sftp" on either the **sshd_config** keywords Subsystem or ForceCommand causes the **sshd** daemon to implement an in-process **sftp** server. Such a server does not require duplication of the **sftp-server** command or other support files in the new root directory in order to connect via **sftp**. Thus, combining the use of the **sshd_config** keyword ChrootDirectory and the "internal-sftp" subsystem enables full **sftp** file transfer functionality, while limiting the file system objects that are accessible to the user. (The two keywords are described in Subsystem and ForceCommand.)

Note that specifying "internal-sftp" on the **sshd_config** keyword ForceCommand enables an in-process **sftp** server to be the only command to be run, regardless of the command specified by the user. For example, this prevents the user from running **scp** or from starting an interactive shell session via **ssh** on the server. In addition, the in-process **sftp** server allows users without shell access on the server to still transfer files via **sftp**. Using the ForceCommand keyword in this manner allows the administrator to apply this restriction to a limited set of users when placed inside a Match keyword as described in Match.

Public key authentication can also be used with the **sshd_config** keyword ChrootDirectory. However, the **sshd** daemon will search for the user's public keys (see the **sshd_config** keyword AuthorizedKeysFile) starting from the original root directory, not the new root directory specified by the ChrootDirectory keyword. Therefore, depending on the location of the new root directory, the user might not have access to their own public keys used during authentication.

Example 1: Use the **sshd_config** keyword ChrootDirectory and "internal-sftp" subsystem to cause the **sshd** daemon to set a user's root directory to the user's home directory.

Server (name is "server1") **sshd_config** keywords:

```
Subsystem sftp internal-sftp
   ChrootDirectory %h
```

Client (user "employee1", home directory is `/u/employee1`):

```
> sftp server1
 Connecting to server1...
 sftp> pwd
 Remote working directory: /
 sftp> ls -a
   .        ..               .profile     .sh_history
 .ssh         myfile
```

After connecting and setting the root directory, the **sshd** daemon also attempts to change the user's current working directory to the user's home directory, relative to the root directory that is now in effect. For example, if the user's home directory were `/u/employee1`, then the **sshd** daemon would attempt to set the user's current working directory relative to the root directory (which also happens to be `/u/employee1`). Therefore, the **sshd** daemon sets the user's current working directory to `/u/employee1/u/employee1`, if the directory exists. This action might or might not be what is desired.

Example 2: An example of using the **sshd** keyword ChrootDirectory and the "internal-sftp" subsystem for a specific group of users. Users who are members of the group SFTPUSERS will have their root directory set to "/files/repository" and be forced into using **sftp**, regardless of the command they are attempting to run. If they are not members, their root directory will not be changed when connecting. They will also not be limited to only using **sftp** unless other **sshd** keywords were in effect for those users, such as a different ForceCommand in another Match block.

Server (name is "server1") **sshd_config** keywords:

```
Subsystem sftp internal-sftp
Match group SFTPUSERS
   ChrootDirectory /files/repository
   ForceCommand internal-sftp
```

Client (user "employee1" in group SFTPUSERS, home directory is `/u/employee1`):

```
> sftp server1
 Connecting to server1...
 sftp> pwd
 Remote working directory: /
 sftp> ls -a
 ...          file1        file2
```

Configuring the system for X11 forwarding

X11 forwarding allows users who have an account on a UNIX machine to open a connection to the X11 interface remotely from another computer. Because this connection uses SSH, the communication between the systems is encrypted. X11 forwarding works only if the system being connected to has both SSH and X11 forwarding enabled.

Guideline: Enable X11 forwarding with caution. Users with the ability to bypass file permissions on the remote host (for the user's X authorization database) can access the local X11 display through the forwarded connection. Unauthorized users might then be able to perform activities such as keystroke monitoring.

Steps for configuring the system for X11 forwarding

About this task

Before you begin: You need to know what local directory you want to copy the files from `/usr/lpp/tcpip/X11R6/Xamples/clients/xauth` to.

Perform the following steps to configure your system for X11 forwarding. The first two steps explain how to install the xauth sample program.

Procedure

1. Copy the files from the `/usr/lpp/tcpip/X11R6/Xamples/clients/xauth` directory to a local directory.

   Example: Copy the files from the `/usr/lpp/tcpip/X11R6/Xamples/clients/xauth` directory to the local directory `/u/Billy/XauthBuild`.

   ```
    cp -R /usr/lpp/tcpip/X11R6/Xamples/clients/xauth  /u/Billy/XauthBuild
   ```

2. Edit the Makefile in your copied directory.
   a. Change CFLAGS to:

      ```
      CFLAGS = -D_ALL_SOURCE -DTCPCONN -DUNIXCONN -I/usr/lpp/tcpip/X11R6/include
      ```

   b. Change SYSLIBS to:

      ```
      SYSLIBS =  -lXaw -lXmu -lXt -lSM -lICE -lXext -lX11 -lXau
      ```

      These changes enable the xauth program to run without using DLLs. If you want xauth to use DLLs, enable the PermitUserEnvironment **sshd** configuration option so that LIBPATH can be read from the user's environment file. However, because enabling might allow users to bypass access restrictions, enabling it is not recommended.

c. Compile the code by issuing **make**. You will need the _C89_CCMODE environment variable set. To enable it only for this command invocation, issue **make** as follows:

```
_C89_CCMODE=1 make
```

d. Move the xauth binary to the desired installation location.

3. Configure the server for X11 forwarding.
   a. Verify that the **sshd** configuration variable UseLogin is disabled. It is disabled by default.
   b. Change the **sshd** configuration variable X11Forwarding to "yes".
   c. Verify that the **sshd** configuration variable X11UseLocalhost is set to "yes". (The default setting is "yes".)
   d. Set the **sshd** and **ssh** configuration variable XAuthLocation to the full path name of the new xauth executable in both the system-wide **ssh** and **sshd** configuration files. The xauth program might need to support the generate command in order to allow **ssh** to successfully set up untrusted X11 forwarding.

   Optionally, you can set X11Display Offset to a desired value.

Results

When you are done, you have configured your system for X11 forwarding. Users will have to configure their setup for X11 forwarding, as described in “Steps for configuring your setup for X11 forwarding” on page 83.

When users cannot log in using ssh, scp or sftp

Certain setup problems or configurations might prevent a user from using **ssh**, **scp** or **sftp** to login.

Table 19. Setup and configuration problems that can prevent users from logging in using ssh, scp, or sftp

Problem	**Solution**
The user's files and directories are not sufficiently protected from others.	In the **sshd_config** description, see StrictModes and ChrootDirectory.
The system administrator limited the number of concurrent connection attempts (unauthenticated users).	In the **sshd_config** description, see MaxStartups. The default is 10:30:100. You might want to change the MaxStartups value.
The system administrator denied a particular user, group, or IP address to the system.	In the **sshd_config** description, see AllowUsers, DenyUsers, AllowGroups, and DenyGroups. In the **sshd** description, see from=pattern-list. In the **sshd** description, see /etc/nologin. In the **sshd_config** description, see MaxAuthTries.
The user waited too long to enter the password.	In the **sshd_config** description, see LoginGraceTime.
The user is trying to use a certain authentication method but is failing.	The system administrator might have disabled that authentication method. See sshd_config.
The user has an incorrect public host key in the known_hosts file.	Verify the public host key for the remote host, and update the known_hosts file.

Using hardware support to generate random numbers

OpenSSH uses hardware support (`/dev/random` or `/dev/urandom`) to generate random numbers. `/dev/random` is now required and **`ssh-rand-helper`** is not used or provided. ICSF HCR77A0 allows `/dev/random` to be used without a cryptography card. If there is no cryptography card, ICSF HCR77A0 or later is required. Starting with ICSF version HCR77A1, CSF.CSFSERV.AUTH.CSFRNG.DISABLE is now available. If defined, no SAF authorization checks will be performed. Disabling the SAF check may improve performance.

Rule: In order for OpenSSH to use the hardware support (`/dev/random` or `/dev/urandom`) to collect random numbers, the Integrated Cryptographic Service Facility (ICSF) started task must be running and the user ID must have READ access to the CSFRNG (random number generate service) profile in the RACF CSFSERV class. If the user ID does not have READ access to the CSFRNG profile, a RACF warning is issued on the MVS console.

Example: A warning for user WELLIE1 would look like the following output:

```
ICH408I USER(WELLIE1   ) GROUP(SYS1   ) NAME(WELLIE1)
 CSFRNG CL(CSFSERV )
 INSUFFICIENT ACCESS AUTHORITY
 FROM CSFRNG (G)
 ACCESS INTENT(READ)  ACCESS ALLOWED(NONE)
```

For more information about ICSF, see *z/OS Cryptographic Services ICSF Overview*.

Steps for authorizing users to the random number generate service (CSFRNG)

About this task

Before you begin: You need to be sure that the CSFRNG resource profile has been defined. If it hasn't, then issue the following command where CSFSERV is the class name and CSFRNG is the profile name:

```
RDEFINE CSFSERV CSFRNG UACC(NONE)
```

Perform the following steps to authorize users to the random number generate service (CSFRNG):

Procedure

1. Use one of the following commands to give READ access to the CSFRNG profile, based on your site's security policy:
   - To give a user READ access to the CSFRNG profile, where *userid* is the UID for the specified user, issue:

     ```
     PERMIT CSFRNG CLASS(CSFSERV) ID(userid) ACCESS(READ)
     ```

     If you choose to give READ access to individual users, you need to repeat this step for each user who requires access.
   - To give READ access for a specific group to the CSFRNG profile where *groupid* is the GID for the specified group, issue:

     ```
     PERMIT CSFRNG CLASS(CSFSERV) ID(groupid) ACCESS(READ)
     ```

     Verify that the intended user IDs are added to the group.
   - To give READ access for all RACF-defined users and groups to the CSFRNG profile, issue:

```
PERMIT CSFRNG CLASS(CSFSERV) ID(*) ACCESS(READ)
```

Giving all users and groups READ access to the CSFRNG profile is an unconditional way to authorize users. The security administrator must take the site's security policy into consideration when deciding whether to give all RACF-defined users and groups access to CSFRNG. *z/OS Cryptographic Services ICSF Administrator's Guide*has information about the CSFRNG profile.

- Starting with ICSF version HCR77A1, you can disable checking of this resource:

```
RDEFINE XFACILIT CSF.CSFSERV.AUTH.CSFRNG.DISABLE UACC(READ)
SETROPTS REFRESH RACLIST(XFACILIT)
```

2. Verify that all user IDs given access to this class have an OMVS segment defined and are not using the default OMVS segment.

3. Refresh the CSFSERV class.

```
SETROPTS RACLIST(CSFSERV) REFRESH
```

Results

When you are done, you have authorized users to the random number generate service (CSFRNG).

Setting up OpenSSH to collect SMF records

You can set up the system and OpenSSH to collect SMF Type 119 records for both the client and the server.

Steps for setting up the system to collect OpenSSH SMF records

About this task

Perform the following steps to set up the system to collect OpenSSH SMF records.

Procedure

1. Update the SMFPRMxx parmlib member to activate SMF data collection for Type 119 and subtype 94, 95, 96, 97, and 98 records. For example:

```
 SYS(TYPE(119(94:98)))
```

2. Update the SMFPRMxx parmlib member to indicate which SMF exits (IEFU83 or IEFU84) are desired. For example:

```
SYS(EXITS(IEFU83,IEFU84))
```

3. In order to collect record subtype 94 (“Client connection started”), the user running the **ssh**, **sftp**, or **scp** client commands must have READ access to the BPX.SMF.119.94 SAF/RACF profile. For example:

```
RDEFINE FACILITY BPX.SMF.119.94 UACC(NONE)
PERMIT BPX.SMF.119.94 CLASS(FACILITY) ID(userid) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH
```

4. In order to collect record subtype 96 (“Server transfer completion record ”), the user running the **sftp-server** or **scp** server commands must have READ access to the BPX.SMF.119.96 SAF/RACF profile. For example:

```
RDEFINE FACILITY BPX.SMF.119.96 UACC(NONE)
PERMIT BPX.SMF.119.96 CLASS(FACILITY) ID(userid) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH
```

5. In order to collect record subtype 97 ("Client transfer completion record "), the user running the **sftp** or **scp** client commands must have READ access to the BPX.SMF.119.97 SAF/RACF profile. For example:

```
RDEFINE FACILITY BPX.SMF.119.97 UACC(NONE)
PERMIT BPX.SMF.119.97 CLASS(FACILITY) ID(userid) ACCESS(READ)
SETROPTS RACLIST(FACILITY) REFRESH
```

Results

When you are done, you have set up the system to collect SMF records. For more information, see:

- *z/OS MVS System Management Facilities (SMF)*
- *z/OS MVS Initialization and Tuning Reference*

Steps for setting up OpenSSH to collect SMF records

About this task

Before you begin: You need to make sure that the system has been set up to collect OpenSSH SMF records as described in "Steps for setting up the system to collect OpenSSH SMF records" on page 50. You also need to ensure that you have done the steps listed in "What you need to verify before using OpenSSH" on page 21.

Perform the following steps to set up OpenSSH to collect SMF records.

Procedure

1. To enable SMF recording for the client side, in the /etc/ssh/zos_ssh_config file, set the keyword:

```
ClientSMF    TYPE119_U83
```

or

```
ClientSMF    TYPE119_U84
```

Restriction: The ClientSMF keyword can only be set in the z/OS-specific system-wide OpenSSH client configuration file. See zos_ssh_config for more information.

2. To enable SMF recording for the server side, in the /etc/ssh/zos_sshd_config file, set the keyword:

```
ServerSMF    TYPE119_U83
```

or

```
ServerSMF    TYPE119_U84
```

Restriction: The ServerSMF keyword can only be set in the z/OS-specific OpenSSH daemon configuration file. See zos_sshd_config for more information.

Results

When you are done, you have set up OpenSSH to collect SMF records.

Setting up OpenSSH to use ICSF cryptographic operations

OpenSSH can be set up to use Integrated Cryptographic Service Facility (ICSF) to implement certain ciphers, MAC (message authentication code) and key exchange algorithms. This extension enables OpenSSH to use hardware support when applicable. For more information about ICSF, see *z/OS Cryptographic Services ICSF Overview*.

Steps for setting up OpenSSH to use ICSF cryptographic operations

About this task

Perform these steps to use ICSF to implement the following OpenSSH ciphers:

aes128-cbc
aes192-cbc
aes256-cbc
aes128-ctr
aes192-ctr
aes256-ctr
rijndael-cbc@lysator.liu.se (same as aes256-cbc)
3des-cbc
blowfish-cbc
arcfour
arcfour128
arcfour256

ICSF will use CP Assist for Cryptographic Function (CPACF) hardware support when applicable for the aes128-cbc, aes192-cbc, aes256-cbc, aes128-ctr, aes192-ctr, aes256-ctr, rijndael-cbc@lysator.liu.se and 3des-cbc ciphers. Any cipher not in the previous list is not supported by ICSF.

Procedure

1. Verify that ICSF has been started.

2. Verify that the OpenSSH users, including the **sshd** privilege separation user and the user that starts the **sshd** daemon, have READ access to the CSFIQA, CSF1TRC, CSF1TRD, CSF1SKE and CSF1SKD profiles in the RACF CSFSERV general resource class. See *z/OS Cryptographic Services ICSF Administrator's Guide* for more information about setting up profiles in the CSFSERV general resource class.

3. To use ICSF on the client side, set the CiphersSource keyword to "any" or "ICSF" in the z/OS-specific OpenSSH client configuration files, **zos_ssh_config** or **zos_user_ssh_config**. For example:

   ```
   CiphersSource any
   ```

   or

   ```
   CiphersSource ICSF
   ```

4. To use ICSF on the server side, set the **zos_sshd_config** keyword CiphersSource to "any" or "ICSF". For example:

   ```
   CiphersSource any
   ```

or

```
CiphersSource ICSF
```

5. Modify the client and server side ciphers lists according to the following requirements:
   a. If the CiphersSource keyword is set to "ICSF", modify the ciphers list to contain only ciphers supported by ICSF.
   b. If the CiphersSource keyword is set to "ICSF" and if privilege separation is enabled, remove the arcfour, arcfour128 and arcfour256 ciphers from the server side ciphers list.
   c. ICSF PKCS #11 services can be configured to operate in compliance with FIPS 140-2 specifications via the ICSF FIPSMODE installation option. If FIPS 140-2 compliance is required and OpenSSH is not exempt from compliance, remove the blowfish-cbc, arcfour, arcfour128 and arcfour256 ciphers and all ciphers not supported by ICSF from the ciphers list. In addition, the CiphersSource keyword must be set to "ICSF" to ensure that ICSF FIPS 140-2 compliant ciphers are used.
   d. (Optional step.) The default client configuration file (`ssh_config`) now defaults to prefer ciphers that are implemented by ICSF. Review this list and reorder to your site's requirements.

      Note: The order of the Ciphers list in the server configuration file (`sshd_config`) is not significant. You may choose to remove Ciphers that are not supported by ICSF from either list, but this may result in a failure to negotiate a session with a partner that does not support any of these algorithms.

   Example ciphers list when setting the CiphersSource keyword to "any". This is the same as the default list if not specified. While the ciphers list is typically one long unbroken line, it is not shown as one unbroken line due to space limitations:

   ```
   Ciphers aes128-ctr,aes192-ctr,aes256-ctr,arcfour256,arcfour128,
   aes128-gcm@openssh.com,aes256-gcm@openssh.com,aes128-cbc,
   3des-cbc,aes192-cbc,aes256-cbc,
   arcfour,blowfish-cbc,cast128-cbc,rijndael-cbc@lysator.liu.se
   ```

   Example client side ciphers list when setting the CiphersSource keyword to "ICSF" but note that while the ciphers list is typically one long unbroken line, it is not shown as one unbroken line due to space limitations:

   ```
   Ciphers aes128-ctr,aes192-ctr,aes256-ctr,aes128-cbc,3des-cbc,aes192-cbc,
   aes256-cbc,blowfish-cbc,arcfour256,arcfour128,arcfour
   ```

   Example server side ciphers list when setting the CiphersSource keyword to "ICSF":

   ```
   Ciphers aes128-cbc,3des-cbc,aes192-cbc,aes256-cbc,blowfish-cbc
   ```

   Example ciphers list when ICSF FIPS 140-2 compliant ciphers are required:

   ```
   Ciphers aes128-cbc,3des-cbc,aes192-cbc,aes256-cbc
   ```

   For more information about ciphers lists, refer to the **ssh_config** and **sshd_config** keyword Ciphers.

Results

When you are done, you have set up OpenSSH to use ICSF to implement the applicable ciphers.

Perform these steps to use ICSF to implement the following OpenSSH MAC algorithms:

hmac-md5
hmac-md5-etm@openssh.com
hmac-md5-96
hmac-md5-96-etm@openssh.com
hmac-sha1
hmac-sha1-etm@openssh.com
hmac-sha1-96
hmac-sha1-96-etm@openssh.com
hmac-sha2-256
hmac-sha2-256-etm@openssh.com
hmac-sha2-512
hmac-sha2-512-etm@openssh.com
hmac-ripemd160
hmac-ripemd160@openssh.com
hmac-ripemd160-etm@openssh.com

ICSF will use CP Assist for Cryptographic Function (CPACF) hardware support when applicable for the hmac-sha1 and hmac-sha1-96, all hmac-sha2 MAC algorithms and their "-etm@openssh.com" variants. Any MAC algorithm not in the previous list is not supported by ICSF.

1. Verify that ICSF has been started.

2. Verify that the OpenSSH users, including the **sshd** privilege separation user and the user that starts the **sshd** daemon, have READ access to the CSFIQA, CSF1TRC, CSF1TRD, and CSFOWH profiles in the RACF CSFSERV general resource class. See *z/OS Cryptographic Services ICSF Administrator's Guide* for more information about setting up profiles in the CSFSERV general resource class.

3. To use ICSF on the client side, set the MACsSource keyword to "any" or "ICSF" in the z/OS-specific OpenSSH client configuration files **zos_ssh_config** or **zos_user_ssh_config**. For example:

   ```
   MACsSource any
   ```

   or

   ```
   MACsSource ICSF
   ```

4. To use ICSF on the server side, set the **zos_sshd_config** keyword MACsSource to "any" or "ICSF". For example:

   ```
   MACsSource any
   ```

   or

   ```
   MACsSource ICSF
   ```

5. Modify the client and server side MAC algorithms lists according to the following requirements:

   a. If the MACsSource keyword is set to "ICSF", modify the MAC algorithms list to contain only MAC algorithms supported by ICSF.

   b. ICSF PKCS #11 services can be configured to operate in compliance with FIPS 140-2 specifications via the ICSF FIPSMODE installation option. If FIPS 140-2 compliance is required and OpenSSH is not exempt from compliance, remove the hmac-md5, hmac-md5-96, hmac-ripemd160 and hmac-ripemd160@openssh.com MAC algorithms and all MAC algorithms not supported by ICSF from the MAC algorithms list. In addition, the MACsSource keyword must be set to "ICSF" to ensure ICSF FIPS 140-2 compliant MAC algorithms are used.

c. (Optional step.) The default client configuration file (`ssh_config`) now defaults to prefer MACs that are implemented by ICSF. Review this list and reorder to your site's requirements.

   Note: The order of the MACs list in the server configuration file (`sshd_config`) is not significant. You may choose to remove MACs that are not supported by ICSF from either list, but this may result in a failure to negotiate a session with a partner that does not support any of these algorithms.

Example MAC algorithms list when setting the MACsSource keyword to "any". This is the same as the default list if not specified. While the MAC algorithms list is typically one long unbroken line, it is not shown as one unbroken line due to space limitations:

```
MACs hmac-md5-etm@openssh.com,hmac-sha1-etm@openssh.com,
umac-64-etm@openssh.com,umac-128-etm@openssh.com,
hmac-sha2-256-etm@openssh.com,hmac-sha2-512-etm@openssh.com,
hmac-ripemd160-etm@openssh.com,hmac-sha1-96-etm@openssh.com,
hmac-md5-96-etm@openssh.com,hmac-md5,hmac-sha1,
umac-64@openssh.com,umac-128@openssh.com,hmac-sha2-256,
hmac-sha2-512,hmac-ripemd160,hmac-ripemd160@openssh.com,
hmac-sha1-96,hmac-md5-96
```

Example MAC algorithms list when setting the MACsSource keyword to "ICSF":

```
MACs hmac-md5-etm@openssh.com,hmac-sha1-etm@openssh.com,
hmac-sha2-256-etm@openssh.com,hmac-sha2-512-etm@openssh.com,
hmac-ripemd160-etm@openssh.com,hmac-sha1-96-etm@openssh.com,
hmac-md5-96-etm@openssh.com,hmac-md5,hmac-sha1,
hmac-sha2-256,hmac-sha2-512,hmac-ripemd160,hmac-ripemd160@openssh.com,
hmac-sha1-96,hmac-md5-96
```

Example MAC algorithms list when ICSF FIPS 140-2 compliant MAC algorithms are required:

```
MACs hmac-sha1-etm@openssh.com,hmac-sha2-256-etm@openssh.com,
hmac-sha2-512-etm@openssh.com,hmac-sha1-96-etm@openssh.com,
hmac-sha1,hmac-sha2-256,hmac-sha2-512,hmac-sha1-96
```

For more information about MAC algorithms, refer to the **ssh_config** and **sshd_config** keyword MACs.

When you are done, you have set up OpenSSH to use ICSF to implement the applicable MAC algorithms.

Perform these steps to use ICSF to implement the following OpenSSH KexAlgorithms:

ecdh-sha2-nistp256
ecdh-sha2-nistp384
ecdh-sha2-nistp521
diffie-hellman-group-exchange-sha256
diffie-hellman-group-exchange-sha1
diffie-hellman-group14-sha1
diffie-hellman-group1-sha1

All key exchange algorithms are done in software.

1. Verify that ICSF has been started.

2. Verify that the OpenSSH users, including the **sshd** privilege separation user and the user that starts the **sshd** daemon, have READ access to the CSFIQA, CSF1TRC, CSF1GAV, CSF1GKP, and CSF1DVK profiles in the RACF CSFSERV general resource class. See *z/OS Cryptographic Services ICSF Administrator's Guide* for more information about setting up profiles in the CSFSERV general resource class.

3. To use ICSF on the client side, set the KexAlgorithmsSource keyword to "any" or "ICSF" in the z/OS-specific OpenSSH client configuration files **zos_ssh_config** or **zos_user_ssh_config**. For example:

   ```
   KexAlgorithmsSource any
   ```

   or

   ```
   KexAlgorithmsSource ICSF
   ```

4. To use ICSF on the server side, set the **zos_sshd_config** keyword KexAlgorithmsSource to "any" or "ICSF". For example:

   ```
   KexAlgorithmsSource any
   ```

   or

   ```
   KexAlgorithmsSource ICSF
   ```

5. Modify the KexAlgorithmsSource according to the following requirements:

   a. The KexAlgorithmsSource keyword must be set to "ICSF" to ensure that ICSF FIPS 140-2 compliant key exchange algorithms are used.

   Example KexAlgorithms list when setting the KexAlgorithmsSource keyword to "any". This is the same as the default list if not specified. While the KexAlgorithms list is typically one long unbroken line, it is not shown as one unbroken line due to space limitations:

   ```
   KexAlgorithms ecdh-sha2-nistp256,ecdh-sha2-nistp384,
   ecdh-sha2-nistp521,diffie-hellman-group-exchange-sha256,
   diffie-hellman-group-exchange-sha1,diffie-hellman-group14-sha1,
   diffie-hellman-group1-sha1
   ```

   Example client side KexAlgorithms list when setting the KexAlgorithmsSource keyword to "ICSF". While the KexAlgorithms list is typically one long unbroken line, it is not shown as one unbroken line due to space limitations:

   ```
   KexAlgorithms ecdh-sha2-nistp256,ecdh-sha2-nistp384,
   ecdh-sha2-nistp521,diffie-hellman-group-exchange-sha256,
   diffie-hellman-group-exchange-sha1,
   diffie-hellman-group14-sha1,diffie-hellman-group1-sha1
   ```

   Example KexAlgorithms list when ICSF FIPS 140-2 compliant KexAlgorithms are required:

   ```
   KexAlgorithms ecdh-sha2-nistp256,ecdh-sha2-nistp384,
   ecdh-sha2-nistp521,diffie-hellman-group-exchange-sha256,
   diffie-hellman-group-exchange-sha1,
   diffie-hellman-group14-sha1,diffie-hellman-group1-sha1
   ```

   For more information about KexAlgorithms lists, refer to the **ssh_config** and **sshd_config** keyword KexAlgorithms.

When you are done, you have set up OpenSSH to use ICSF to implement the applicable key exchange algorithms.

To determine the cipher, MAC, and key exchange algorithm source and FIPS status used by OpenSSH, start **ssh** in debug mode and look for debug statements like the following examples:

```
debug1: mac_setup_by_alg: hmac-sha1 from source ICSF, used in FIPS mode
debug1: cipher_init: aes128-cbc from source ICSF, used in FIPS mode
debug1: choose_kex: ecdh-sha2-nistp384 from source ICSF, used in FIPS mode
debug1: mac_setup_by_alg: hmac-sha1 from source ICSF
debug1: cipher_init: aes128-cbc from source ICSF
```

When OpenSSH is set up to use ICSF to implement applicable ciphers or MAC algorithms, the debug mode also provides ICSF Query Algorithm (CSFIQA) debug statements to help determine how (for example, by using software or CPACF) ICSF is implementing the ciphers and MAC algorithms. For example:

```
debug2: ----------------------------------
debug2: CRYPTO   SIZE     KEY      SOURCE
debug2: ----------------------------------
debug2: AES      256      SECURE   COP
debug2: AES      256      SECURE   CPU
debug2: DES      56       SECURE   COP
debug2: DES      56       SECURE   CPU
debug2: MDC-2    128      NA       CPU
debug2: MDC-4    128      NA       CPU
debug2: MD5      128      NA       SW
debug2: RNGL     8192     NA       COP
debug2: RPMD-160 160      NA       SW
debug2: RSA-GEN  4096     SECURE   COP
debug2: RSA-KM   4096     SECURE   COP
debug2: RSA-SIG  4096     SECURE   COP
debug2: SHA-1    160      NA       CPU
debug2: SHA-2    512      NA       CPU
debug2: TDES     168      SECURE   COP
debug2: TDES     168      SECURE   CPU
```

Figure 3. CSFIQUA debug statements. An example of CSFIQA debug statements

For more information about the CSFIQA utility and the information that it returns, see *z/OS Cryptographic Services ICSF Application Programmer's Guide*. Refer to *z/OS Cryptographic Services ICSF System Programmer's Guide* for more information about the available cryptographic hardware features.

When modifying the client and server ciphers and MAC algorithms lists, it is important to note that the client selects the cipher and MAC algorithm to use during an SSH session from the lists offered by the server. If the client and server fail to negotiate a cipher or MAC algorithm, the SSH session will end. In addition, the client can choose any cipher and MAC algorithm from the servers lists even if the cipher and MAC algorithm is at the end of a list.

ICSF PKCS #11 services can be configured to operate in compliance with FIPS 140-2 specifications by way of the ICSF FIPSMODE installation option. When FIPS 140-2 compliance is required, OpenSSH can use ICSF to implement the aes128-cbc, aes192-cbc, aes256-cbc, aes128-ctr, aes192-ctr, and aes256-ctr, rijndael-cbc@lysator.liu.se and 3des-cbc ciphers and the hmac-sha1 and hmac-sha2 prefixed MAC algorithms. Other ciphers and MAC algorithms cannot be implemented using ICSF unless OpenSSH is exempt from FIPS 140-2 compliance. If OpenSSH is not exempt, OpenSSH will fail at runtime if it uses ICSF to implement a cipher or

MAC algorithm that is not FIPS 140-2 compliant. See *z/OS Cryptographic Services ICSF System Programmer's Guide* for more information about the ICSF FIPSMODE installation option.

OpenSSH is not a full FIPS 140-2 compliant application even if ICSF is used to implement the ciphers and MAC algorithms in compliance with FIPS 140-2 specifications.

Usage notes

- OpenSSH uses the session object token, SYSTOK-SESSION-ONLY, to exploit the ICSF PKCS #11 support.
- Starting with ICSF version HCR77A0, the CLEARKEY.*token-label* resources in the CRYPTOZ class is introduced. The `CLEARKEY.SYSTOK-SESSION-ONLY` resource should be defined, otherwise users of OpenSSH should have READ access to it.
- Starting with ICSF version HCR77A1, CSF.CSFSERV.AUTH.CSFOWH.DISABLE and CSF.CSFSERV.AUTH.CSFRNG.DISABLE are introduced. If they are defined, no SAF authorization checks will be performed. Disabling the SAF check may improve performance.
- This support applies to SSH protocol version 2 only.
- **sshd** will not use ICSF to implement the arcfour, arcfour128 and arcfour256 ciphers when privilege separation is enabled.
- **ssh** and **sshd** will fail if ICSF ciphers or MAC algorithms are required but ICSF is not available.
- ICSF ciphers and MAC algorithms are not supported when the **ssh -f** option or the **ssh ~&** escape character are used.

Setting up OpenSSH to run in FIPS mode

National Institute of Standards and Technology (NIST) is the US federal technology agency that works with industry to develop and apply technology, measurements, and standards. One of the standards published by NIST is the Federal Information Processing Standard Security Requirements for Cryptographic Modules referred to as 'FIPS 140-2'. FIPS 140-2 provides a standard by which the integrity of cryptographic modules and the keys they handle can be measured and assured.

OpenSSH can be setup to run in FIPS 140 mode with z/OS System SSL and Integrated Cryptographic Service Facility (ICSF) PKCS #11 Service support. This enables OpenSSH to use hardware cryptography support when applicable. ICSF HCR77A0 or later is required in FIPS mode. For more information about ICSF, see *z/OS Cryptographic Services ICSF Overview*.

Steps for setting up OpenSSH to run in FIPS mode

About this task

Perform these steps to enable OpenSSH to run in FIPS mode:

Procedure

1. Verify the ICSF is started and running in FIPS 140-2. Refer to *z/OS Cryptographic Services ICSF System Programmer's Guide* section “2.2.1 Parameters in the installation options data set”, which describes the ICSF FIPSMODE parameter. Also see *z/OS Cryptographic Services ICSF Writing PKCS#11 Applications* section “1.5 Operating in compliance with FIPS 140-2”, which contains information regarding the ICSF setup for FIPS 140 mode.

2. Configure SystemSSL for FIPS 140-2. Refer to *z/OS Cryptographic Services System SSL Programming* to setup the System SSL support in FIPS 140-2.
3. Verify that RACF authority is setup properly.
4. Verify that the OpenSSH users, including the **sshd** privilege separation user and the user that starts the **sshd** daemon, have READ access to the CSFIQA, CSF1HMG, CSFOWH, CSF1TRC, CSF1TRD, CSFRNG, CSF1GAV, CSF1GKP, CSF1DVK, CSF1SKE and CSF1SKD profiles in the RACF CSFSERV general resource class. See *z/OS Cryptographic Services ICSF Administrator's Guide*for more information about setting up profiles in the CSFSERV general resource class.
5. To enable FIPS mode on the client side, set the FIPSMODE keyword to `yes` and set the CiphersSource, MACsSource, KexAlgorithmsSource keywords to `any` or `ICSF` in the z/OS-specific OpenSSH client configuration files, zos_ssh_config or zos_user_ssh_config.
6. To enable FIPS 140 mode on the service side, set the FIPSMODE keyword to `yes` and set the zos_sshd_config keywords CiphersSource, MACsSource, KexAlgorithmsSource to `any` or `ICSF`.
7. When setting the CiphersSource, MACsSource and KexAlgorithmsSource keywords to `ICSF`, modify the appropriate ciphers, MACs, and key exchange algorithms lists to only contain ciphers, MACs, and key exchange algorithms supported by ICSF in FIPS mode rather than those don't. You can further modify the lists to prefer ciphers, MACs, and key exchange algorithms that comply with FIPS 140 mode when applicable to those that don't. For more information about ciphers, MACs and key exchange algorithms lists, refer to the `ssh_config` and **sshd_config** keywords Ciphers, MACs and KexAlgorithms.
8. Set protocol keyword to 2 in the configuration files **ssh_config** and **sshd_config**.
9. Setup key rings for server authentication. See the “Steps for setting up server authentication when keys are stored in key rings” on page 29.
10. Setup key rings for user authentication. See the “Steps for setting up user authentication when using key rings to store keys” on page 76.
11. (Optional step.) When setting the CiphersSource, MACsSource and KexAlgorithmsSource keywords to `any`, modify the appropriate ciphers, MACs and key exchange algorithms lists so that ciphers, MACs and key exchange algorithms implemented by ICSF and comply with FIPS 140 mode are allowed to be used rather than those that do not. You can further modify the lists to prefer ciphers, MACs and key exchange algorithms that use hardware support when applicable to those that do not. For more information about ciphers, MACs and key exchange algorithms lists, refer to the **ssh_config** and **sshd_config** keywords Ciphers, MACs and KexAlgorithms.

Results

Note: FIPS mode applies to protocol version 2 only. FIPS mode support key rings for key storage only.

When you are done, you have set up OpenSSH to run in FIPS mode.

Managing OpenSSH user heap

While using OpenSSH, you may encounter situations where the user heap is exhausted when running with a limited amount of storage. This can be caused by certain code paths (for example, file transfers via **sftp**) in OpenSSH making repeated use of the XL C/C++ runtime library realloc() function. In certain situations, heap fragmentation can occur, causing future requests to allocate user heap to fail and causing OpenSSH commands to fail with the following error message:

```
"FOTS2050 xrealloc: out of memory"
```

If you encounter this problem, you can take one of the following actions:

- Set the _CEE_RUNOPTS="HEAP(,,,FREE)" environment variable when invoking OpenSSH commands. Language Environment will free all unused storage after a call to the XL C/C++ Run-time Library realloc() function, making it unlikely that the user heap will be exhausted during normal use. However, application performance might be affected. For more information about heap tuning, see *z/OS Language Environment Programming Reference*.
- Set the _CEE_REALLOC_CONTROL="256K,25" environment variable when invoking OpenSSH commands. Language Environment will optimize heap storage reallocation for OpenSSH. See *z/OS XL C/C++ Programming Guide* for more information about the _CEE_REALLOC_CONTROL environment variable.
- Increase the amount of storage available to the processes running OpenSSH commands. For example, use a REGION of 32MB or larger and ensure that the IEFUSI or IEALIMIT exits are not further restricting the region size.

Chapter 6. Security topics when using key rings for key management

This topic discusses security topics in connection with key rings. OpenSSH can be configured to support keys in both UNIX files and key rings for both server and user authentication.

Choosing between UNIX files and key rings

Using UNIX files to store the keys is the common method supported on all OpenSSH implementations. Consider what other OpenSSH hosts you will be communicating with; that is, are they z/OS or non-z/OS? Also consider whether the z/OS systems are using key rings.

On the other hand, key rings provide commonality with other z/OS products that store keys in the security product. They can be real or virtual key rings. To use SAF key rings, you must have RACF or an alternative security product with compatible support. Authority must also be given to user IDs to manage the key rings. For more information about key rings, see *z/OS Security Server RACF Security Administrator's Guide*.

Restriction: If you are using SSH protocol version 1, you cannot use key rings to hold your keys. You must use UNIX files to hold RSA keys used for SSH protocol version 1.

Managing key rings and restricting access to them

Authorized applications use commands or system services provided by the security product to manage key rings. This documentation typically refers to RACF commands when presenting examples of how to set up key rings. If a different security product is used, consult that product's documentation to determine whether it contains compatible support. For more information about the RACF commands referred to in this documentation, the necessary authority required to use the commands, and any other options not described in this documentation, see *z/OS Security Server RACF Command Language Reference*.

To restrict access to key rings, two methods are available: global profile checking and ring-specific profile checking.

- **Ring-specific profile checking**, which has precedence over global profile checking, uses a resource with one of the following formats to provide access control to a specific key ring.
  - For real key rings: <KeyRingOwner>.<KeyRingName>.LST
  - For virtual key rings: <KeyRingOwner>.IRR_VIRTUAL_KEYRING.LST

  For more details about name restrictions and other considerations for using ring-specific profile checking, see the description of RACF authorization in the R_datalib interface section in *z/OS Security Server RACF Callable Services*.
- **Global profile checking** uses the IRR.DIGTCERT.LISTRING resource in the FACILITY class and applies to all key rings.

Guideline: Global profile checking applies to all key rings. Ring-specific profile checking applies to a specific key ring. Ring-specific checking has precedence over global profile checking. The method that is chosen must work with the methods of permitting and securing access to other key rings being used for OpenSSH key management or other key ring usage on your system. Because of the wide scope of coverage that global profile checking provides, ring-specific profile checking is typically the more appropriate method to use.

Validating certificates when using key rings

Each time a certificate is accessed to retrieve a public or private key, OpenSSH asks System SSL to validate the certificate first. Some of the checks performed on the certificate and all certificates in the certification chain include verifying that the current time is within the validity period, checking that the certificate is not revoked, and ensuring that the certification chain leads to a certificate obtained from a trusted data source. For a complete list of the items being validated, see the usage information for the **gsk_validate_certificate** system call in *z/OS Cryptographic Services System SSL Programming*

Although the examples used in this book do not demonstrate using root and intermediate certificate authority (CA) certificates, they are supported in the certification chain of certificates used by z/OS OpenSSH key ring support. OpenSSH treats the key ring as a trusted certificate source. Because of this, for OpenSSH to successfully validate the certification chain, all certificates in the chain must be connected to the same key ring as the end entity certificate.

Chapter 7. Globalization on z/OS systems

This topic discusses globalization on z/OS systems and the changes that must be made in order for OpenSSH to fit the globalization model.

Setting up for globalization on z/OS systems

Setting up your system or user environment for globalization on z/OS systems is a little different from what most users are accustomed to when setting up globalization on ASCII platforms. On z/OS systems, an extra step is typically needed when changing the locale. This step involves setting the character set conversion for the controlling terminal to use the correct ASCII and EBCDIC coded character sets. This action is necessary because most PC terminal emulators require ASCII data, but the z/OS shells use EBCDIC data.

For example, when using a PC emulator to interactively log into an ASCII UNIX operating system, a user will:

- On the PC, change the emulator's coded character set to match the coded character set of the remote session's locale.
- In the UNIX shell, assign the environment variable LC_ALL to a new locale, where the ASCII coded character set of that locale matches the emulator's setting.

When interactively logging into an EBCDIC z/OS UNIX operating system, the user will:

- On the PC, change the emulator's coded character set to match the ASCII coded character set of the remote session's locale. For example, the user might change the translation settings in their emulator to use coded character set ISO/IEC 8859-2 (Latin-2).
- In the UNIX shell:
  - Assign the environment variable LC_ALL to a new locale, whose EBCDIC coded character set is compatible with the ASCII coded character set used in the emulator. To determine if a coded character set is compatible with a particular locale, refer to the section in *z/OS XL C/C++ Programming Guide* that discusses locales supplied with z/OS XL C/C++.

    For example, a user might issue:

    ```
    export LC_ALL=Hu_HU.IBM-1165
    ```

    LC_ALL can be assigned after making the **ssh** connection by using the SendEnv **ssh** keyword to send the client's LC_ALL environment variable to the server. The server must be configured to accept this variable using the AcceptEnv **sshd** keyword. Before using this support, the client's LC_ALL variable must be set to a locale that is a valid locale name on the z/OS server.

    Refer to the descriptions of the **ssh_config** keyword SendEnv and the **sshd_config** keyword AcceptEnv for more information about these options.
  - If a terminal type (tty) is allocated, issue the **chcp** command to assign the EBCDIC and ASCII coded character sets, as appropriate. The specified ASCII coded character set should match that of the client emulator's setting.

    For example, a user might issue:

    ```
    chcp -a ISO8859-2 -e IBM-1165
    ```

On z/OS systems, in daemons such as **rlogind**, **telnetd**, and **sshd**, conversion between ASCII and EBCDIC occurs in the forked daemon process which handles the user's connection. This process allocates the terminal (tty) for the end user. On ASCII platforms, no conversion is necessary.

OpenSSH and globalization

OpenSSH assumes that all text data traveling across the network is encoded in ISO/IEC 8859-1 (Latin-1). Specifically, OpenSSH treats data as text and performs conversion between the ASCII Latin-1 coded character set and the EBCDIC-coded character set of the current locale in the following scenarios:

- **ssh** login session
- **ssh** remote command execution
- **scp** file transfers
- **sftp** file transfers when the ascii subcommand is specified

The OpenSSH daemon (**sshd**) can understand and handle non-Latin-1 coded character sets on the network for interactive sessions, specifically sessions with a tty allocated. However, not all EBCDIC-coded character sets are compatible with ISO 8859-1. To determine if a coded character set is compatible with a particular locale, see the information about locales supplied with z/OS XL C/C++ in *z/OS XL C/C++ Programming Guide*.

Warning: If there is no one-to-one mapping between the EBCDIC coded character set of the session data and ISO 8859-1, then nonidentical conversions might occur. Specifically, substitution characters (for example, IBM-1047 0x3F) are inserted into the data stream for those incompatible characters. See “Configuring the OpenSSH daemon” on page 65 and “Configuring the OpenSSH client” on page 65 for more information.

Sessions that are considered interactive include:

- The **ssh** login session when a tty is allocated. This is the default behavior.
- The **ssh** remote command execution, when the **-t** option is used to allocate a tty.

The following scenarios are considered noninteractive and continue to interpret network data as ISO 8859-1:

- The **ssh** login session when the **-T** option is specified (which disables tty allocation.)
- The **ssh** remote command execution when the **-t** option is not specified. The default behavior is not to allocate a tty for remote command execution.
- The **scp** file transfers
- The **sftp** file transfers when the ascii subcommand is specified

The support provided by IBM Ported Tools for z/OS: OpenSSH is summarized in Table 20 on page 65. It lists the expected coded character set for the network data during both interactive and noninteractive OpenSSH sessions with various peers.

Table 20. Summary of support provided by OpenSSH V1R2

Scenario	Session is:	Client is running:	Server is running:	Coded character set of network data is:
1	Interactive	z/OS	z/OS	ASCII coded character set as defined by the **chcp** setting. **Restriction:** The z/OS client expects Latin-1, so the ASCII coded character set must be handled accordingly on the server side. See "Configuring the OpenSSH daemon" for more information.
2	Interactive	Non-z/OS UNIX (such as AIX®, Linux) or PC	z/OS	ASCII coded character set as defined by the **chcp** setting.
3	Interactive	z/OS	Non-z/OS UNIX (such as AIX, Linux) or PC	ISO 8859-1
4	Noninteractive	z/OS	z/OS	ISO 8859-1
5	Noninteractive	Non-z/OS UNIX (such as AIX, Linux) or PC	z/OS	ISO 8859-1
6	Noninteractive	z/OS	Non-z/OS UNIX (such as AIX, Linux) or PC	ISO 8859-1

Note that some OpenSSH sessions transfer data as binary. In other words, no character translation is performed. These include:

- **sftp** sessions (when the ascii subcommand is not used)
- Port-forwarded sessions
- X11-forwarded sessions

Limitation: IBM Ported Tools for z/OS: OpenSSH does not support multibyte locales.

Configuring the OpenSSH daemon

The OpenSSH daemon (**sshd**) must be run in the POSIX C locale. In most cases, this occurs without any action on behalf of the user. However, an alternate locale could inadvertently be picked up through the shell profile of the user ID invoking the daemon, or through the ENVAR run-time option in CEEPRMxx member of SYS1.PARMLIB. You can enforce LC_ALL=C by using STDENV in the BPXBATCH job that starts the daemon.

For more information about the POSIX C locale, see *z/OS XL C/C++ Programming Guide*.

Configuring the OpenSSH client

The OpenSSH daemon (**sshd**) can understand and handle non-Latin-1 coded character sets for interactive sessions, specifically those with a tty allocated. However, the OpenSSH client (**ssh**) still expects network data to be encoded in ISO 8859-1.

If the EBCDIC coded character set for your sessions is compatible with ISO 8859-1, the following setup is not required. To determine if a coded character set is compatible with a particular locale, refer to the section on locales supplied with z/OS XL C/C++ in *z/OS XL C/C++ Programming Guide*.

If **chcp** is issued in your environment, verify that the SSH peer supports the specified ASCII coded character set.

For example, if you are using a PC to connect directly to z/OS, you issue the **chcp** command in the remote z/OS shell to assign the ASCII-coded character set for the terminal to match that of the PC emulator. The daemon inherits the **chcp** setting to translate the network data accordingly. The SSH peer, the PC emulator, must also support the new ASCII coded character set. This can be determined by checking your emulator's configuration.

If you are issuing the **ssh** client from z/OS to connect to a z/OS platform running in another locale, you need to verify that the ASCII coded character set of the remote session (set by **chcp**) is ISO 8859-1, which is what the z/OS **ssh** client expects.

Warning: If there is no one-to-one mapping between the EBCDIC coded character set of the session data and ISO 8859-1, then nonidentical conversions might occur. Specifically, substitution characters (for example, IBM-1047 0x3F) may be inserted into the data stream for those incompatible characters.

If the EBCDIC coded character set of your target locale is not compatible with ISO 8859-1, then nonidentical conversions may occur in either of these scenarios:
- You are running in the target locale when issuing the **ssh** command locally.
- You are running in the target locale in your remote **ssh** session.

To avoid nonidentical conversions, you can force the **ssh** client process to run in the C locale. Note also that the remote session's shell must also be configured to run in either the C locale or a locale with a coded character set that is compatible with ISO 8859-1.

To force the local **ssh** client process to run in a C locale, you can run **ssh** as follows:

```
 LC_ALL=C ssh [arguments]
```

where arguments represents the remainder of the arguments passed to **ssh**.

You can set up a shell alias to avoid repeatedly typing the previous command. For example:

```
alias ssh="LC_ALL=C ssh"
```

Configuring ssh when LC_ALL is set through shell profiles

If all the following are true for your environment:

- Your system is configured to run in a locale other than the default C locale
- The corresponding ASCII coded character set for your locale is **not** ISO 8859-1
- You changed the system-wide locale by setting LC_ALL through shell profiles (for example, `/etc/profile` or `$HOME/.profile`.)

then perform the following steps as part of your OpenSSH system-wide setup.

If you have changed the locale at a system-wide level, consider defining this alias in an area where it can be picked up by all users and inherited by all subshells. Shell aliases are typically defined through the file named by the ENV variable of /bin/sh. Users may have defined their own ENV setting in one of their shell profiles. For this setup, the ENV variable should be exported so it is inherited by subshells.

- For /bin/sh users, this alias should be defined in the ENV file.
- For /bin/tcsh users, this alias should be defined in /etc/csh.cshrc.

Steps to follow for setting up a system-wide alias for ssh

The steps assume that you are using the /bin/sh shell.

1. Create a UNIX file /etc/ssh/.sshalias that contains the following line:
   ```
   alias ssh="LC_ALL=C ssh"
   ```
2. Ensure that the UNIX permissions for this file are world-readable. From the UNIX prompt, issue:
   ```
   chmod 744 /etc/ssh/.sshalias
   ```
3. Notify users to either add the **ssh** alias to their ENV file or read in the previous ENV file from their user-defined ENV file. For example, users can add to their ENV file the following line, which reads in (or “sources”) the new **ssh** alias file using the **dot** command:
   ```
   . /etc/ssh/.sshalias
   ```
4. Verify that the **ssh** alias is set properly. From a ***new*** UNIX shell, issue:
   ```
   > alias ssh
   ssh="LC_ALL=C ssh"
   >
   ```

Configuring ssh when LC_ALL is set through the ENVAR run-time option in CEEPRMxx

If all the following statements are true for your environment

- Your system is configured to run in a locale other than the default C locale
- The corresponding ASCII code page for your locale is not ISO 8859-1
- You changed the system-wide locale by setting LC_ALL through the ENVAR run-time option in a CEEPRMxx member of SYS1.PARMLIB or through the operator command SETCEE.
  - For information about SETCEE, see *z/OS MVS System Commands*.
  - *z/OS MVS Initialization and Tuning Reference* contains information about the ENVAR run-time option for CEEPRMxx.

then perform the following steps as part of your OpenSSH system-wide setup.

Create an alias for the **ssh** command which forces **ssh** to run in a C locale. This alias should be defined in an area where it will be picked up by all users and all subshells, even when a login shell is not used. Shell aliases are typically defined through the file named by the ENV variable of /bin/sh. The ENVAR run-time option in CEEPRMxx can also be used to set a shell alias.

Steps to follow for setting up a system-wide alias for ssh through the ENVAR run-time option of CEEPRMxx

1. Create a UNIX file /etc/ssh/.sshalias which contains the following line:
   ```
   alias ssh="LC_ALL=C ssh"
   ```
2. Ensure that the UNIX permissions for this file are world-readable. From the UNIX prompt, issue:

```
chmod 744 /etc/ssh/.sshalias
```

3. Notify users to define this alias if they already have created their own ENV file. Users might have defined their own ENV setting in one of their shell profiles. Their ENV setting is not inherited for remote command execution or remote **ssh** processes, because these are not login shells. However, ENV will be initialized to their own setting for interactive shells, where users might later be issuing the **ssh** command. Their ENV setting overrides the ENVAR setting through CEEPRMxx, so they need to pick up your alias for local **ssh** command invocations.

   - For /bin/sh users, this alias should be defined in the file specified by the ENV variable.
   - For /bin/tcsh users, this alias should be defined in /etc/csh.cshrc.

   The subsequent examples all assume that one is working with /bin/sh users.

   Notify users to either add the **ssh** alias to their ENV file or read in your ENV file from their ENV file. For example, users might add to their ENV file the following line, which reads in (or "sources") the new **ssh** alias file using the **dot** command:

   ```
   .  /etc/ssh/.sshalias
   ```

4. Issue the operator command SETCEE to change the CEEPRMxx setting dynamically. For example:

   ```
   SETCEE  CEEDOPT,ENVAR('LC_ALL=Hu_HU.IBM-1165','ENV=/etc/ssh/.sshalias')
   ```

5. Verify that the **ssh** alias is set properly. From a new UNIX shell, issue:

   ```
   > echo $ENV
   /etc/ssh/.sshalias
   > alias ssh
   ssh="LC_ALL=C ssh"
   >
   ```

Configuring sftp

By default, **sftp** treats files as binary. Use sftp if you do not want your data files altered. If you want your data files translated between ASCII and EBCDIC, use **iconv** to convert the files at the start or end of the **sftp** transfer.

If you have existing sftp jobs that use the ascii sftp subcommand: The ascii **sftp** subcommand converts between ASCII ISO 8859-1 and the EBCDIC of the current locale. If the file data on the network is in a coded character set that is not ISO 8859-1, then you must adjust existing jobs to transfer files as binary and use **iconv** for the data conversion.

Configuring scp

By default, **scp** treats files as text. It assumes that all data going over the network is encoded in ASCII coded character set ISO 8859-1. The EBCDIC coded character set of the current locale is used for data conversion. On the remote system, the locale of the **scp** process is determined by how LC_ALL is initialized on that system. If LC_ALL is set through a shell profile (for example, /etc/profile), then it will not be inherited by the remote **scp** process. Specifically, the remote **scp** process will run in a C locale. Figure 4 on page 69 shows the change in locales; for example, if a user on Host GERMANY running in locale De_DE.IBM-273 uses **scp** to transfer a file to a remote host, the file contents are converted from IBM-273 to ISO 8859-1 to go over the network and from ISO 8859-1 to IBM-1047 on the target system.

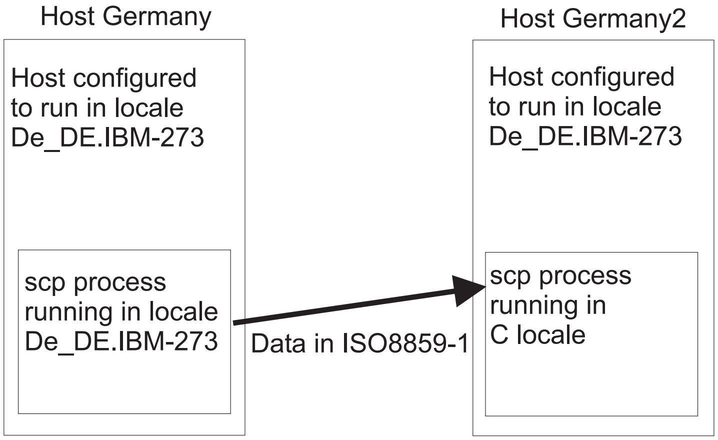

Host Germany
Host configured to run in locale De_DE.IBM-273
scp process running in locale De_DE.IBM-273
Data in ISO8859-1
Host Germany2
Host configured to run in locale De_DE.IBM-273
scp process running in C locale

Figure 4. Using scp when LC_ALL is set through shell profiles

If LC_ALL is set through the ENVAR run-time option in the CEEPRMxx member, then the new locale is inherited by the remote **scp** process. Specifically, the EBCDIC coded character set of that locale is used. See Figure 5 for an example of using **scp** when LC_ALL is set through ENV in CEEPRMxx. If a user on Host GERMANY running in locale De_DE.IBM-273 uses **scp** to transfer a file to a remote host, the file contents are converted from IBM-273 to ISO 8859-1 to go over the network, and from ISO 8859-1 to IBM-273 on the target system.

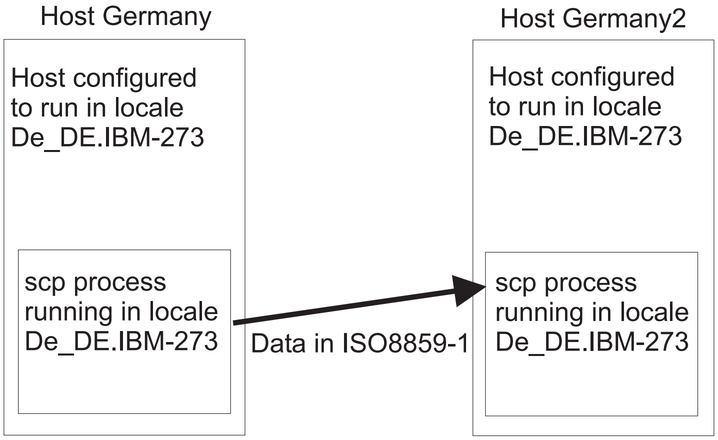

Host Germany
Host configured to run in locale De_DE.IBM-273
scp process running in locale De_DE.IBM-273
Data in ISO8859-1
Host Germany2
Host configured to run in locale De_DE.IBM-273
scp process running in locale De_DE.IBM-273

Figure 5. Using scp when LC_ALL is set through ENV in CEEPRMxx

Warning: If a file is encoded in an EBCDIC coded character set whose compatible ASCII coded character set is not ISO 8859-1, then nonidentical conversions might occur. Specifically, substitution characters (for example, IBM-1047 0x3F) might replace characters that do not have a mapping between the specified EBCDIC coded character set and ISO 8859-1. To determine if a coded character set is compatible with a particular locale, see the information about locales supplied with z/OS XL C/C++ in *z/OS XL C/C++ Programming Guide*.

If the EBCDIC coded character set for your sessions is compatible with ISO 8859-1 and the preceding text conversions are satisfactory for your environment, the following setup is not required.

If you have existing scp jobs

If you are changing the locale on a system whose ASCII coded character set is not Latin-1 and you have existing **scp** jobs configured, you can:

- Convert those jobs to use **sftp**.
- Force **scp** to treat files as though they are encoded in IBM-1047, so substitution characters are not introduced. This can be done through a shell alias, as described in “Configuring scp when LC_ALL is set through shell profiles.”
- If you intend to configure a new locale through a shell profile, then continue to “Configuring scp when LC_ALL is set through shell profiles.”
- If you intend to configure a new locale using CEEPRMxx to specify run-time options, then continue to “Configuring scp when LC_ALL is set through the ENVAR run-time option in CEEPRMxx.”

Configuring scp when LC_ALL is set through shell profiles

If all the following are true for your environment:

- Your system is configured to run in a locale other than the default C locale
- The corresponding ASCII coded character set for your locale is **not** ISO 8859-1
- You changed the system-wide locale by setting LC_ALL through shell profiles (for example, `/etc/profile` or `$HOME/.profile`.
- You do not want to convert existing **scp** workloads to **sftp** workloads

then perform the following steps as part of your OpenSSH system-wide setup.

If you have changed the locale at a system-wide level, consider defining this alias in an area where it can be picked up by all users and inherited by all subshells. Shell aliases are typically defined through the file named by the ENV variable of `/bin/sh`. Users might have defined their own ENV setting in one of their shell profiles. For this setup, the ENV variable should be exported so it is inherited by subshells.

- For `/bin/sh` users, this alias should be defined in the ENV file.
- For `/bin/tcsh` users, this alias should be defined in `/etc/csh.cshrc`.

Steps to follow for setting up a system-wide alias for scp

The steps assume that you are using the `/bin/sh` shell.

1. Create a UNIX file, `/etc/ssh/.sshalias`, that contains the following line:
   ```
   alias scp="LC_ALL=C scp"
   ```
2. Ensure that the UNIX permissions for this file are world-readable. From the UNIX prompt, issue:
   ```
   chmod 744 /etc/ssh/.sshalias
   ```
3. Notify users to either add the **scp** alias to their ENV file or read in the previous ENV file from their user-defined ENV file. For example, users can add to their ENV file the following line, which reads in (or “sources”) the new **scp** alias file using the **dot** command:
   ```
   .  /etc/ssh/.sshalias
   ```
4. Verify that the **scp** alias is set properly. From a ***new*** UNIX shell, issue:
   ```
   > alias scp
   scp="LC_ALL=C scp"
   >
   ```

Configuring scp when LC_ALL is set through the ENVAR run-time option in CEEPRMxx

If all the following are true for your environment:

- Your system is configured to run in a locale other than the default C locale

- The corresponding ASCII code page for your locale is **not** ISO 8859-1
- You changed the system-wide locale by setting LC_ALL through the ENVAR run-time option in a CEEPRMxx member or through the SETCEE operator command.
  – For information about SETCEE, see *z/OS MVS System Commands*.
  – *z/OS MVS Initialization and Tuning Reference* contains information about the ENVAR run-time option for CEEPRMxx.
- You do not want to convert existing **scp** workloads to **sftp** workloads

then perform the following steps as part of your OpenSSH system-wide setup.

Steps to follow for setting up a system-wide alias for scp through the ENVAR run-time option of CEEPRMxx

1. Create a UNIX file `/etc/ssh/.sshalias` that contains the following line:
   ```
   alias scp="LC_ALL=C scp"
   ```
2. Ensure the UNIX permissions for this file are world-readable. From the UNIX prompt, issue:
   ```
   chmod 744 /etc/ssh/.sshalias
   ```
3. Notify users to define this alias if they already have created their own ENV file. Users might have defined their own ENV setting in one of their shell profiles. Their ENV setting is not inherited for remote command execution or remote **scp** processes, because these are not login shells. However, ENV is initialized to their own setting for interactive shells, where users might later be issuing the **scp** command. Their ENV setting overrides the ENVAR setting through CEEPRMxx, so they need to pick up your alias for local **scp** command invocations.
   - For `/bin/sh` users, this alias must be defined in the file specified by the ENV variable.
   - For `/bin/tcsh` users, this alias must be defined in `/etc/csh.cshrc`.

   The subsequent examples all assume that you are working with `/bin/sh` users.

   Notify users to either add the **scp** alias to their ENV file or read in your ENV file from their ENV file. For example, users can add to their ENV file the following line, which reads in (or “sources”) the new **scp** alias file using the **dot** command:
   ```
   .  /etc/ssh/.sshalias
   ```
4. Issue the SETCEE operator command to change the CEEPRMxx setting dynamically. For example:
   ```
   SETCEE  CEEDOPT,ENVAR('LC_ALL=Hu_HU.IBM-1165','ENV=/etc/ssh/.sshalias')
   ```
5. Verify that the **scp** alias is set properly. From a ***new*** UNIX shell, issue:
   ```
   > echo $ENV
   /etc/ssh/.sshalias
   > alias scp
   scp="LC_ALL=C scp"
   >
   ```

Customizing your UNIX environment to run in another locale

To configure your UNIX environment to run in another locale, see the section on customizing for your national code page in *z/OS UNIX System Services Planning*.

Rule: All files used by OpenSSH (such as key files and configuration files) must be in the IBM-1047 coded character set, with the exception of the**rc** files (`/etc/ssh/sshrc` and `~/.ssh/rc`). The **rc** files are parsed by `/bin/sh` and should be in the coded character set of the current locale. Do not use the `/etc/ssh/sshrc` file if there is a possibility of the users on the system running in different locales.

Warning: While it is possible to set LC_ALL through the ENVAR run-time option of the CEEPRMxx member, configuring the locale in this way might cause unexpected results. Specifically, it is possible that daemons or long-running processes might expect to run in a C locale. Verify that all these processes support running in your alternate locale. Additionally, some system administration user IDs might need to run in a C locale, for editing configuration files which expect to be encoded in IBM-1047.

Chapter 8. Getting ready to use OpenSSH

This topic discusses the setup tasks that the user must do. It includes the steps for generating user keys, which is a required step, and also discusses how to set up the system for X11 forwarding, which is an optional step.

Requirement: All files used by OpenSSH (such as key files and configuration files) must be in the IBM-1047 code set, with the exception of the **rc** files (`/etc/ssh/sshrc` and `~/.ssh/rc`). The **rc** files are parsed by `/bin/sh` and must be in the code set of the current locale. Do not use the `/etc/ssh/sshrc` file if users on the system might be running in different locales.

Restriction: OpenSSH does not run in multibyte locales.

In this chapter

This chapter covers the following subtasks.

Subtasks	**Associated procedure (see . . .)**
Setting up the OpenSSH client configuration files	"Steps for setting up the OpenSSH client configuration files"
Setting up user authentication	"Steps for setting up user authentication when using UNIX files to store keys" on page 75 "Steps for setting up user authentication when using key rings to store keys" on page 76
Configuring your setup for X11 forwarding	"Steps for configuring your setup for X11 forwarding" on page 83

Setting up the OpenSSH client configuration files

The settings in the OpenSSH client configuration files (**ssh_config** and **zos_user_ssh_config**) provide system defaults and can be overridden by command-line options. By prefacing groups of configuration options with the Host keyword, you can share these configuration files across multiple systems with client configuration options that are tailored to the specific local system being used.

Steps for setting up the OpenSSH client configuration files

About this task

Before you begin: You must be running in the default C locale before performing these steps.

Procedure

1. Customize the OpenSSH client configuration file.
   a. Copy the sample **ssh_config** configuration file from the `/samples` directory to your `~/.ssh` directory.

```
cp /samples/ssh_config ~/.ssh/config
chmod 644 ~/.ssh/config
```

b. Modify the ~/.ssh/config file to control the SSH client-side authentication methods attempted, protocols and ciphers supported, and session control options. For details, see ssh and zos_user_ssh_config.

Note: If you are migrating from a previous release, review your existing configuration files for any changes that you might want to migrate to the new release.

2. Customize the z/OS-specific per-user client configuration file.
   a. Copy the sample **zos_user_ssh_config** file from the /samples directory to the ~/.ssh directory.

```
cp /samples/zos_user_ssh_config ~/.ssh/zos_user_ssh_config
chmod 644 ~/.ssh/zos_user_ssh_config
```

   b. Modify the **zos_user_ssh_config** file to control the z/OS-specific per-user client options. For details, see ssh and ssh_config.

Results

When you are done, you have set up the OpenSSH client configuration files.

Setting up user authentication

Before clients can verify their identities to the server, user authentication must be set up first. While passwords may be used for authentication, SSH public key and GSS-API (Kerberos) authentication are more secure. For SSH public key authentication, a user creates both a public and private key and then transfers a copy of the public key to the SSH server being accessed. The private key is kept on the user's local machine and is used to verify the identity of the user when the user attempts to connect to the SSH server. The public and private keys must be correct for the server to allow the connection. Those keys can be stored in either UNIX files or SAF key rings, or both. For more information about storing the key rings, see "Choosing between UNIX files and key rings" on page 61. If GSS-API authentication is configured on the SSH server and the SSH client, then this mechanism may be used so that identities and keys are managed by the Key Distribution Center (KDC). This mechanism is compatible with Microsoft Windows® domains and some Windows SSH products.

Restriction: If you are using SSH protocol version 1, you cannot use key rings to hold your keys. You must use UNIX files to hold RSA keys used for SSH protocol version 1.

The procedures for setting up user authentication are described in the following sections:

- "Steps for setting up user authentication when using UNIX files to store keys" on page 75
- "Steps for setting up user authentication when using key rings to store keys" on page 76
- "Steps for setting up user authentication with GSS-API (Kerberos)" on page 82

Steps for setting up user authentication when using UNIX files to store keys

About this task

Perform the following steps to set up user authentication.

Procedure

1. Generate public and private key pairs, based on the SSH protocol you plan to use, protocol version 1 or protocol version 2.

   If you are using SSH protocol version 1, issue:

   ```
   ssh-keygen -t rsa1
   ```

   If you are using SSH protocol version 2, issue:

   ```
   ssh-keygen -t rsa
   ssh-keygen -t dsa
   ```

2. On the remote host, distribute the public keys to all remote hosts that you plan to log in to, using public key authentication. By default, OpenSSH uses the `authorized_keys` file to store these public keys. Figure 6 on page 76 shows an example of the steps to follow in order to create an `authorized_keys` file when keys are stored in UNIX files.

   a. Create or edit the `~/.ssh/authorized_keys` file for your accounts on both local and remote systems.

   b. Append the public keys to the `~/.ssh/authorized_keys` file as follows:

      - To enable local users to log into a remote account, append the local user's public keys (those ending with a "pub" suffix) to the remote user's `~/.ssh/authorized_keys` file.
      - To enable remote users to log into a local account, append the remote user's public keys (those ending with a "pub" suffix) to the local user's `~/.ssh/authorized_keys` file.

      You can append the public keys by using cut and paste. Because a key is a long line, make sure that the keys are not split across lines. Each key should be exactly one line of the file.

      If you use FTP to copy your public key files to another system, treat the files as text to enable any necessary conversion between ASCII and EBCDIC.

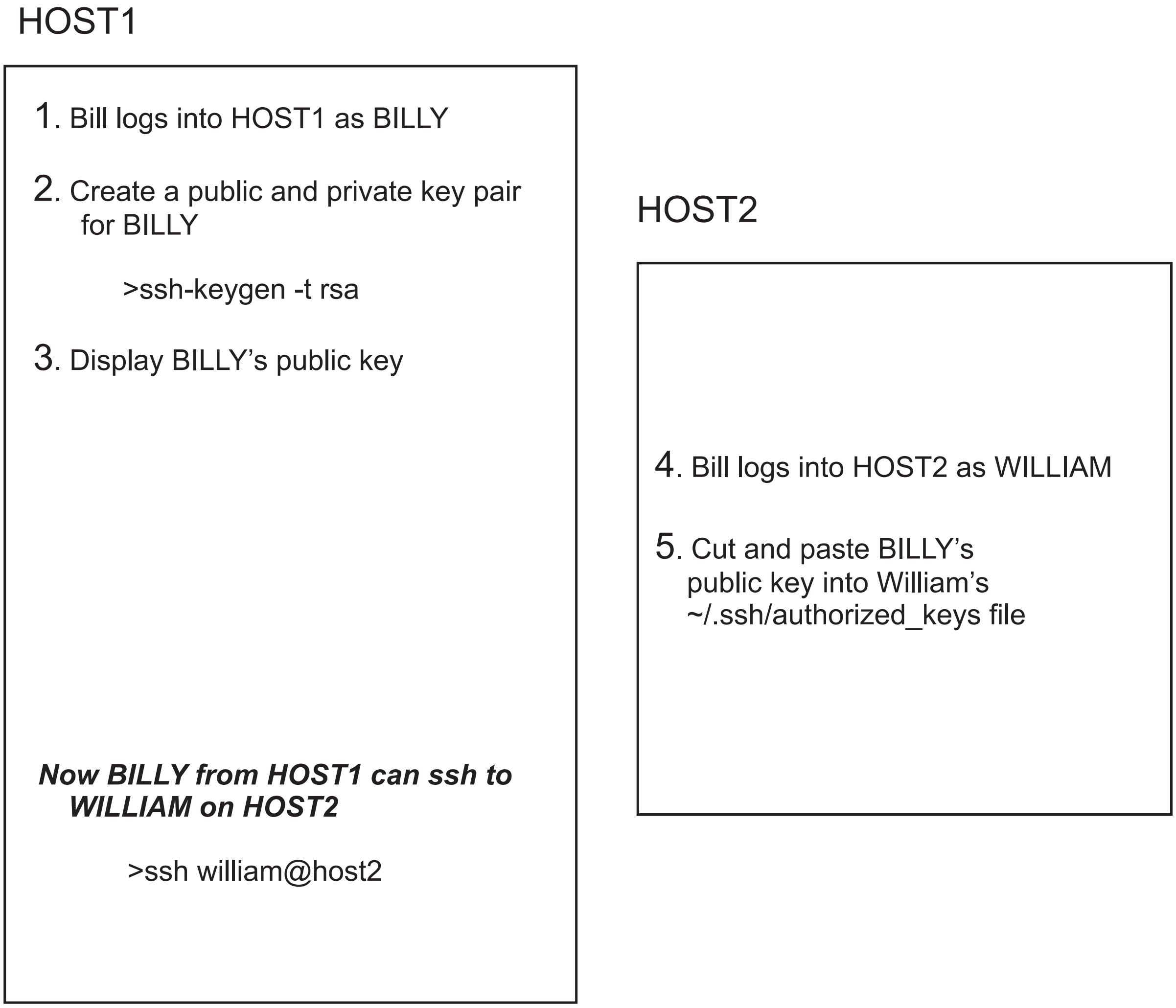
3. On the remote host that you plan to log into, verify that your home directory (for example, ~/), the `.ssh` subdirectory, and the `authorized_keys` file are not writable by other users. The default configuration of the OpenSSH daemon enables StrictModes, which verifies these settings before allowing public key authentication.

Results

When you are done, you have set up user authentication. Every time you regenerate the keys, you must update the `authorized_keys` file on remote systems.

Example of user authorization when using UNIX files to store keys

An employee named Bill has two accounts on two systems where UNIX files are used to store keys. His user name on HOST1 is BILLY. On HOST2, his user name is WILLIAM. While logged into HOST1, he wants to be able to access HOST2 using **ssh** with public key authentication. Figure 6 shows how the process would work.



HOST1

1. Bill logs into HOST1 as BILLY

2. Create a public and private key pair for BILLY

```
>ssh-keygen -t rsa
```

3. Display BILLY's public key

Now BILLY from HOST1 can ssh to WILLIAM on HOST2

```
>ssh william@host2
```

HOST2

4. Bill logs into HOST2 as WILLIAM

5. Cut and paste BILLY's public key into William's ~/.ssh/authorized_keys file

Figure 6. Accessing a remote system using ssh with public key authentication when keys are stored in UNIX files

Steps for setting up user authentication when using key rings to store keys

About this task

The setup procedure has been divided into two steps:

- "Step 1. Construct the key ring" on page 77
- "Step 2. Distribute the public keys to all remote hosts" on page 79

Notes about the command example

The examples for managing key rings and associated objects use the RACDCERT RACF command. If you are using an alternate security product, consult that product's documentation to determine if it contains compatible support. For more information about the RACDCERT command, the necessary authority required to use the command, and any other options not described, see *z/OS Security Server RACF Command Language Reference*.

In the examples, input names that are given in italics are variables, which you can choose. Some of these names in italics contain hyphen characters (-) separating portions of the name. These hyphens are variable and are not required. The names given are suggestions and are consistently used throughout the examples (for example, if you customize your own version in one step, that name will likely need to be used on other command steps as well).

The examples demonstrate using a self-signed certificate. Using a certificate chain, such as with root and intermediate certificate authority certificates, is supported. If you will be using more advanced certificate chains than the examples demonstrate, see “Validating certificates when using key rings” on page 62 for important considerations.

Step 1. Construct the key ring

In this step, you will construct a key ring, if one is needed, generate certificates, connect them to the user's key ring, and set up permission to access the key ring.

Before you begin: You need to know the following facts:

- Which protocol version you will be using. If you are using SSH protocol version 1, you cannot use key rings to hold your keys. You must use UNIX files to hold RSA keys used for SSH protocol version 1.
- Whether you are working with real or virtual key rings because the setup steps vary depending on the type of key ring is being used. See *z/OS Security Server RACF Security Administrator's Guide* for more information about real and virtual key rings.

1. Create a real key ring if you do not yet have one for your keys. Omit this step if you plan to use a virtual key ring. If you already have a key ring or are using a virtual key ring, go to Step 2. Use the RACDCERT ADDRING command to create the new key ring, specifying the owning user ID and the key ring name. The ID keyword must specify the user ID that will be authenticating with the keys within it. The key ring name can be any unique name for this user ID.

   Example: To define the SSHring key ring, issue:

   ```
   RACDCERT ADDRING(SSHring) ID(userID)
   ```

   On this command example, and all that follow, the ID() keyword can be omitted if the invoking user is the same as the authenticating user ID.

2. Using the RACDCERT GENCERT command, generate a certificate with public and private keys, based on the algorithms that are supported on the server (either RSA, DSA, or both.) For RSA keys, the minimum size is 768 bits, the maximum size is 32768 bits. Typically, 2048 bits is considered sufficient. DSA keys must be exactly 1024 bits as specified by FIPS 186-2. OpenSSH does not support DSA keys larger than 1024 bits that are associated with certificates in a key ring.

   Do not use variant characters in the label name for the certificate.

Although the examples demonstrate how to create non-ICSF (Integrated Cryptographic Storage Facility) certificates in the RACF database, ICSF can also be used to store the certificate and associated keys for RSA only. These can be generated by software using ICSF or by hardware using a PCI Cryptographic Coprocessor (PCICC). For more information, refer to *z/OS Cryptographic Services ICSF Administrator's Guide*.

- To generate a certificate and an RSA public/private key pair, storing the private key in the RACF database as a non-ICSF key:

  ```
  RACDCERT GENCERT SUBJECTSDN(CN('uniq-ssh-rsa-cn')) SIZE(2048)
   WITHLABEL('uniq-ssh-rsa') ID(userID)
  ```

- To generate a certificate and a DSA public/private key pair, storing the private key in the RACF database as a non-ICSF key:

  ```
  RACDCERT GENCERT SUBJECTSDN(CN('uniq-ssh-dsa-cn')) SIZE(1024) DSA
   WITHLABEL('uniq-ssh-dsa') ID(userID)
  ```

The SUBJECTSDN parameter offers additional customizable keywords, which are not documented in this section, that can be included in the distinguished name. The label assigned to the certificate must be unique within the RACF database.

3. If real key rings are being used, use the RACDCERT CONNECT command to connect the certificate to the user's key ring. Omit this step if virtual key rings are being used. If you are not the certificate owner, you must identify the user ID that owns the certificate. If you are not the key ring owner, you must identify the user ID that owns the key ring. These will normally be the same for this connect command.

   ```
   RACDCERT CONNECT(ID(userID) LABEL('uniq-ssh-type') RING(SSHring)
    USAGE(PERSONAL)) ID(userID)
   ```

4. Update the user's z/OS-specific per-user client configuration file (`~/.ssh/zos_user_ssh_config`) to indicate the location of the user's keys when using key rings.

   - **If real key rings are being used,** add the following line:

     ```
     IdentityKeyRingLabel "userID/SSHring uniq-ssh-type"
     ```

   - **If virtual key rings are being used,** add the following line:

     ```
     IdentityKeyRingLabel "userID/* uniq-ssh-type"
     ```

5. Permit access to the key ring for the user, using either ring-specific profile checking or global profile checking. These are discussed in "Managing key rings and restricting access to them" on page 61.

   For example:

   - To define individual user access to the real key ring, SSHring, using ring-specific profile checking:

     ```
     RDEFINE RDATALIB userID.SSHring.LST UACC(NONE)
     PERMIT userID.SSHring.LST CLASS(RDATALIB) ID(userID) ACCESS(READ)
     ```

     If the RDATALIB class is not yet active and RACLISTed:

     ```
     SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
     ```

     Refresh the class:

     ```
     SETROPTS RACLIST(RDATALIB) REFRESH
     ```

   - To define individual user access to the virtual key ring, using ring-specific profile checking:

```
RDEFINE RDATALIB userID.IRR_VIRTUAL_KEYRING.LST UACC(NONE)
PERMIT userID.IRR_VIRTUAL_LISTRING.LST CLASS(RDATALIB) ID(userID) ACCESS(READ)
```

If the RDATALIB class is not yet active and RACLISTed:

```
SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
```

Refresh the class:

```
SETROPTS RACLIST(RDATALIB) REFRESH
```

- To define individual user access, using global profile checking:

  ```
  RDEFINE FACILITY IRR.DIGTCERT.LISTRING UACC(READ)
  ```

  If the FACILITY class is not yet active and RACLISTed:

  ```
  SETROPTS RACLIST(FACILITY) CLASSACT(FACILITY)
  ```

  Refresh the class:

  ```
  SETROPTS RACLIST(FACILITY) REFRESH
  ```

Step 2. Distribute the public keys to all remote hosts

In this step, you will distribute the public keys to all remote hosts that you plan to log in to, using public key authentication. Figure 7 on page 82 shows an example of the steps to follow in order to create an `authorized_keys` file when keys are stored in key rings.

1. Export the public keys to remote hosts that store user's keys in a UNIX file (the `authorized_keys` file).
   - On the local host, use **ssh-keygen -e** to export the public key into a UNIX file.

     Example:

     ```
     _ZOS_SSH_KEY_RING_LABEL="userID/SSHring uniq-ssh-type" ssh-keygen -e > uniq-ssh.type
     ```
   - Use FTP to distribute the *uniq-ssh.type* file to the remote host.
   - On the remote host, use **ssh-keygen -i** to import the public key, appending it to the `authorized_keys` file:

     ```
     ssh-keygen -i -f uniq-ssh.type >> ~/.ssh/authorized_keys
     ```
   - You have now completed distribution of the public keys to remote hosts that store user keys in a UNIX files . If you have other remote hosts that store user keys in key rings, then continue on to the next step to export the public keys to remote hosts. Otherwise, you have completed Step 2.
2. Export the public keys to remote hosts that store users's keys in a certificate associated with a key ring. First, the public keys must be exported from the certificate. The RACDCERT EXPORT command can perform this type of export. Specify the certificate identification and request CERTDER for the export format. Choose a data set to store the exported certificate and specify it on the DSN parameter. If the data set specified for DSN already exists, it is deleted and reallocated by the RACDCERT EXPORT command.

   If the public key will be stored in a certificate associated with a key ring on the remote host, then export the certificate in DER format (without the private key) into a data set for each public key that needs to be distributed to remote hosts.

   For example:

   ```
   RACDCERT EXPORT(LABEL('uniq-ssh-type')) ID(userID)
    FORMAT(CERTDER) DSN('userid.sshcert.type')
   ```

3. Use FTP to distribute the exported certificate data set in binary format to the remote hosts.

4. On the remote host, create a real key ring if you do not yet have one for your keys. Omit this step if you plan to use a virtual key ring.

   ```
   RACDCERT ID(userID) ADDRING(SSHAuthKeysRing)
   ```

5. On the remote hosts, add each user certificate into the user's SAF database.

   The RACDCERT ADD command can be used to add the exported certificate on the remote host. Specify the data set that you copied to the remote host using FTP, the user ID that should own the certificate, and indicate that this certificate is trusted. The specified user ID must be the user ID that you want to be able to connect to from the local host with the matching key. You will specify the label for this certificate on this remote host. This label must be unique for the user ID within the RACF database, and is used to identify this certificate on future commands and in authorized key files.

   This certificate only contains the public key.

   Example:

   ```
   RACDCERT ADD('userid.sshcert.type') ID(userID)
    WITHLABEL('uniq-ssh-type') TRUST
   ```

6. On the remote hosts, connect each certificate to the user's key ring.

   The RACDCERT CONNECT command can be used to connect each certificate to the user's key ring if real key rings are being used. Omit this step if virtual key rings are being used and go to Step 7. You must identify both the user ID that owns the certificate and the user ID that owns the key ring. These will normally be the same for this connect command.

   Example:

   ```
   RACDCERT CONNECT(ID(userID) LABEL('uniq-ssh-type')
    RING(SSHAuthKeysRing) USAGE(PERSONAL)) ID(userID)
   ```

7. On the remote host, edit the `authorized_keys` file to add one line containing the *zos-key-ring-label* option for each public key that was added to the key ring. (See "Format of the authorized_keys file" on page 136 in the **sshd** command section for more information.)

   For example:

   - **If a real key ring is being used,** add the following line:

     ```
     zos-key-ring-label="userID/SSHAuthKeysRing uniq-ssh-type"
     ```

   - **If a virtual key ring is being used,** add the following line:

     ```
     zos-key-ring-label="userID/* uniq-ssh-type"
     ```

8. On the remote host, permit access to this key ring for the user. There are two ways to provide access: ring-specific profile checking and global profile checking. Both are discussed in "Managing key rings and restricting access to them" on page 61.

   For example:

   - To define individual user access to the real key ring, SSHAuthKeysRing, using ring-specific profile checking:

     ```
     RDEFINE RDATALIB userID.SSHAuthKeysRing.LST UACC(NONE)
     PERMIT userID.SSHAuthKeysRing.LST CLASS(RDATALIB) ID(userID) ACCESS(READ)
     ```

If the RDATALIB class is not yet active and RACLISTed:

```
SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
```

Refresh the class:

```
SETROPTS RACLIST(RDATALIB) REFRESH
```

- To define individual user access to the virtual key ring, using ring-specific profile checking:

```
RDEFINE RDATALIB userID.IRR_VIRTUAL_KEYRING.LST UACC(NONE)
PERMIT userID.IRR_VIRTUAL_KEYRING.LST CLASS(RDATALIB) ID(userID) ACCESS(READ)
```

If the RDATALIB class is not yet active and RACLISTed:

```
SETROPTS RACLIST(RDATALIB) CLASSACT(RDATALIB)
```

Refresh the class:

```
SETROPTS RACLIST(RDATALIB) REFRESH
```

- To define individual user access, using global profile checking:

```
RDEFINE FACILITY IRR.DIGTCERT.LISTRING UACC(READ)
```

If the FACILITY class is not yet active and RACLISTed:

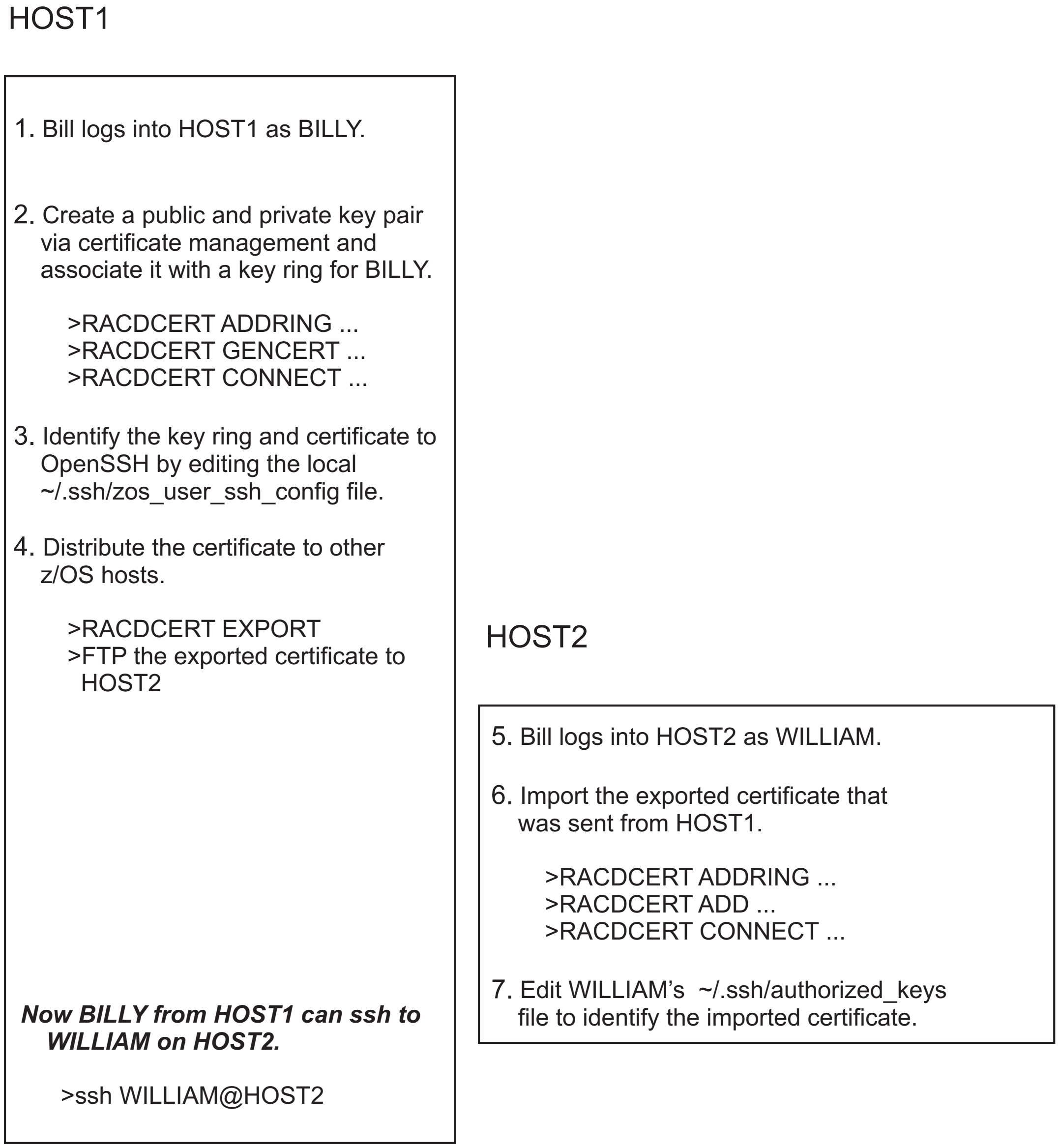
```
SETROPTS RACLIST(FACILITY) CLASSACT(FACILITY)
```

Refresh the class:

```
SETROPTS RACLIST(FACILITY) REFRESH
```

When you are done, you have set up user authentication when using key rings to store keys. Every time the user keys are regenerated in the key ring, they must be redistributed and added to the key ring on the remote systems that contain the authorized keys.

Example of user authorization when keys are stored in key rings



1. Bill logs into HOST1 as BILLY.

2. Create a public and private key pair via certificate management and associate it with a key ring for BILLY.

```
>RACDCERT ADDRING ...
>RACDCERT GENCERT ...
>RACDCERT CONNECT ...
```

3. Identify the key ring and certificate to OpenSSH by editing the local ~/.ssh/zos_user_ssh_config file.

4. Distribute the certificate to other z/OS hosts.

```
>RACDCERT EXPORT
>FTP the exported certificate to
 HOST2
```

5. Bill logs into HOST2 as WILLIAM.

6. Import the exported certificate that was sent from HOST1.

```
>RACDCERT ADDRING ...
>RACDCERT ADD ...
>RACDCERT CONNECT ...
```

7. Edit WILLIAM's ~/.ssh/authorized_keys file to identify the imported certificate.

Now BILLY from HOST1 can ssh to WILLIAM on HOST2.

```
>ssh WILLIAM@HOST2
```

Figure 7. Accessing a remote system using ssh with public key authentication when keys are stored in real key rings

Steps for setting up user authentication with GSS-API (Kerberos)

About this task

Perform the following steps to perform setup for user authentication with GSS-API.

Procedure

1. For SSH servers, modify the `/etc/ssh/sshd_config` file to enable the GSS-API option **GSSAPIAuthentication**. It is a good idea to also enable option **GSSAPIKeyExchange**, so that server authentication can be done with GSS-API key exchange if supported by the client.
2. For SSH client machines, modify the `/etc/ssh/ssh_config` file to enable the GSSAPI option **GSSAPIAuthentication**. It is a good idea to also enable option **GSSAPIKeyExchange**, so that server authentication can be done with GSS-API

key exchange if supported by the server. These option may alternatively be enabled in an individual user's `~/.ssh/ssh_config` file or by using command line options on the **ssh**, **sftp**, or **scp** commands.

3. For z/OS machines that run a KDC, refer to *z/OS Cryptographic Services ICSF Administrator's Guide*to define user local principals for the z/OS userids that run the SSH client. For example:

   ```
   ALTUSER userid PASSWORD(password) NOEXPIRED KERB(KERBNAME('userid'))
   ```

4. For z/OS SSH servers where the KDC is not on z/OS, the following command allows you to map a foreign principal to a local z/OS userid:

   ```
   RDEFINE KERBLINK /.../foreign.realm/userid APPLDATA('userid')
   ```

5. On the SSH client, use the **kinit** command to obtain a ticket granting ticket from the KDC. For z/OS client machines running a KDC, the **kinit -s** command will obtain a ticket for the current z/OS userid without prompting for a password. For z/OS client machines that do not run a KDC, specify the principal name on the **kinit** command and respond to the prompt for a password.

Results

When you are done, you have performed setup for user authentication with GSS-API.

Steps for configuring your setup for X11 forwarding

About this task

X11 forwarding allows users who have an account on a UNIX machine to open a connection to the X11 interface remotely from another computer. Because this connection uses SSH, the communication between the systems is encrypted. X11 forwarding will only work if the system being connected to has both SSH and X11 forwarding enabled.

Before you begin: You need to know whether the system administrator has configured **sshd** on the remote host for X11 forwarding as described in “Steps for configuring the system for X11 forwarding” on page 47.

Perform the following steps to configure your system for X11 forwarding.

Procedure

1. Enable X11 forwarding for your local SSH client. You can do this in one of two ways:
   a. Set the ForwardX11 configuration variable to yes in your `~/.ssh/config` file. This can be done on a per-host basis. This is useful if you want to always enable X11 forwarding.
   b. Invoke **ssh** with the **-X** option. Use this if you want to enable X11 forwarding for this session only.

2. In your local SSH configuration file (`~/.ssh/config`), specify the location of the xauth program on the remote system. This step is required only if the xauth program is installed somewhere other than the default location (`/usr/X11R6/bin/xauth`). The xauth program might need to support the generate command in order to allow **ssh** to successfully set up untrusted X11 forwarding.

Provided is an example of a **ssh** configuration file entry, using the default xauth location:

```
XAuthLocation /usr/X11r6/bin/xauth
```

3. In your remote user account, if xauth is compiled to use DLLs, then set LIBPATH in `~/.ssh/environment` to include `/usr/lib`.

   For example:

   ```
   LIBPATH=/usr/lib
   ```

Results

When you are done, you have configured your setup for X11 forwarding.

Chapter 9. OpenSSH command descriptions

scp — Secure copy (remote file copy program)

Format

scp [**–12346BCpqrv**] [**–c** *cipher*] [**–F** *ssh_config*] [**–i** *identity_file*] [**–l** *limit*] [**–o** *ssh_option*] [**–P** *port*] [**–S** *program*] [[*user*@]*host1*:]*file1* ... [[*user*@]*host2*:]*file2*

Description

scp copies files between hosts on a network. It uses **ssh** for data transfer and uses the same authentication and provides the same security as **ssh**. **rcp** (remote copy) is a traditional UNIX utility that allows a user to copy files between remote hosts. Copies between two remote hosts are also permitted. When copying between two remote hosts, only options **-v**, **-r** and **-p** are passed to the remote host regardless of what the user specifies on the command line. Unlike **rcp**, **scp** asks for passwords, password phrases, or passphrases if they are needed for authentication.

File names can contain a user and host specification to indicate that the file is to be copied to the host or from the host. To prevent **scp** from treating the names containing ':' as specifiers, local file names can be made explicit by using absolute or relative path names.

IPv6 addresses can be specified by enclosing the address in square brackets.

scp assumes that files are text. Files copied between EBCDIC and ASCII platforms are converted.

If the source path name is a symbolic link, **scp** copies the file to which the symbolic link points. In other words, symbolic links are followed.

OpenSSH can be configured to collect SMF client and server transfer completion records that are associated with **scp**. See "Setting up OpenSSH to collect SMF records" on page 50 for more information. See Chapter 12, "SMF Type 119 records for OpenSSH," on page 201 for more information about the SMF client and server transfer completion records (subtypes 97 and 96 respectively). SMF records are not collected for local-to-local copies.

OpenSSH can be set up to use ICSF to implement certain **ssh** ciphers and MAC algorithms. This extension enables **scp** (via **ssh**) to use hardware support when applicable. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

OpenSSH can be set up to run in FIPS mode. This extension enables **scp** to comply with FIPS 140-2 mode when applicable. See "Setting up OpenSSH to run in FIPS mode" on page 58 for more information. OpenSSH can be set up to use ICSF to implement certain **ssh** Key Exchange algorithms. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

Restriction: The maximum full path name length is 1023 bytes for files processed by **scp**. Exceeding this maximum might result in unexpected behavior.

Options

–1 Specifies that **scp** is to use protocol version 1 only.

–2 Specifies that **scp** is to use protocol version 2 only.

| **–3** Copies between two remote hosts are transferred through the local host. Without this option, the data is copied directly between the two remote hosts.

| **Note:** This option disables the progress meter.

–4 Forces **scp** to use IPv4 addresses only. If both **–4** and **–6** are specified, **scp** uses the option that appears last on the command line.

–6 Forces **scp** to use IPv6 addresses only. If both **–4** and **–6** are specified, **scp** uses the option that appears last on the command line.

–B Selects batch mode; while in batch mode, prompts are not issued for passwords, password phrases, or passphrases, but they are still required for OpenSSH. To avoid password prompts, use public-key authentication with an **ssh-agent** or host-based authentication.

–c *cipher*
Selects the cipher to use for encrypting the data transfer. This option is directly passed to **ssh**. For more information, see the **ssh** -c option or the **ssh_config** keyword Ciphers.

–C Enables compression. Passes the **–C** flag to **ssh** to enable compression.

–F *ssh_config*
Specifies an alternative per-user configuration file for **ssh**. This option is directly passed to **ssh**. This option has no effect on the z/OS-specific configuration files.

–i *identity_file*
| Selects the file from which the identity (private key) for RSA, DSA, or ECDSA authentication is read. This option is directly passed to **ssh**. For more information, see ssh.

–l Limits the used bandwidth, specified in Kbits.

–o *ssh_option*
Can be used to pass options to **ssh** in the format used in the **ssh_config** configuration file. This option is useful for specifying options for which there is no separate **scp** command-line flag. For full details of the available options and their values, see ssh_config. The z/OS-specific per-user OpenSSH client configuration options (see zos_user_ssh_config) can be specified on **-o**, but the z/OS-specific system-wide options (see zos_ssh_config) cannot.

For example:

1. To use protocol version 1:
```
scp -oProtocol=1
```
2. To disable password authentication:
```
scp -oPasswordAuthentication=no
```

–p Preserves modification times, access times, and modes from the original file.

–P *port*
Specifies the port to connect to on the remote host.

–q Quiet. Disables the progress meter as well as the warning and diagnostic messages from **ssh**.

–r Recursively copies entire directories.

Note: `scp` follows symbolic links encountered in the tree traversal.

–S *program*
Name of program to use for the encrypted connection. The program must understand **ssh** options. On z/OS, if this option is specified, then `scp` will hang unless the program provides SMF information.

–v Verbose mode. Causes **scp** and **ssh** to print debugging messages about their progress, which is helpful in debugging connection, authentication, and configuration problems.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_DEBUG_TIMESTAMP
If this variable is specified to YES, it will contain the timestamp in the debug information. If it is specified to CPU, the CPU time will be used as the timestamp.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SMF_FD
Set to the file descriptor number used for interprocess communication during SMF-related processing. This environment variable is only used internally and is not for external specification.

Exit values

0 Successful completion

>0 An error occurred.

Related information

sftp, **ssh**, **sshd**, **ssh-add**, **ssh-agent**, **ssh_config**, **ssh-keygen**, **zos_ssh_config**, **zos_user_ssh_config**

Authors

Timo Rinne and Tatu Ylonen

sftp — Secure file transfer program

Format

sftp [**1246Cpqrv**] [**–B** *buffer_size*] [**–b** *batchfile*] [**–c***cipher*] [**–D***sftp_server_path*] [**–F** *ssh_config*] [**–i***identity_file*] [**–l***limit*] [**–o** *ssh_option*] [**–P** *port*] [**–R** *num_requests*] [**–S** *program*] [**–s** *subsystem* | *sftp_server*] *host*

sftp [[*user*@]*host*[:*file* [*file*]]]

sftp [[*user*@]*host*[:*dir*[/]]]

sftp -b batchfile [*user*@]*host*

Description

sftp is an interactive file transfer program similar to **ftp** which performs all operations over an encrypted **ssh** transport. It uses many features of **ssh**, such as public key authentication and compression.

sftp connects and logs into the specified host and then enters a subcommand mode.

- The second usage format retrieves files automatically if a non-interactive authentication method is used; otherwise it does so after successful interactive authentication.
- The third usage format allows **sftp** to start in a remote directory.
- The fourth usage format allows for automated sessions using the **-b** option. In such cases, you might have to configure public key authentication to eliminate the need to enter a password at connection time. For more information, see sshd and ssh-keygen.

IPv6 addresses can be specified by enclosing the address in square brackets.

By default, **sftp** assumes files are binary. Files copied between EBCDIC and ASCII platforms are not converted. Use the ascii subcommand to transfer files in ASCII between the local host and the remote host.

OpenSSH can be configured to collect SMF client transfer completion records that are associated with **sftp**. See “Setting up OpenSSH to collect SMF records” on page 50 for more information. See Chapter 12, “SMF Type 119 records for OpenSSH,” on page 201 for more information about the SMF client transfer completion records (subtype 97).

OpenSSH can be set up to use ICSF to implement certain **ssh** ciphers and MAC algorithms. This extension enables **sftp** (via **ssh**) to use hardware support when applicable. See “Setting up OpenSSH to use ICSF cryptographic operations” on page 52 for more information.

OpenSSH can be set up to run in FIPS mode. This extension enables **sftp** to comply with FIPS 140-2 mode when applicable. See “Setting up OpenSSH to run in FIPS mode” on page 58 for more information. OpenSSH can be set up to use ICSF to implement certain **ssh** Key Exchange algorithms. See“Setting up OpenSSH to use ICSF cryptographic operations” on page 52 for more information.

Restriction: The maximum full path name length is 1023 bytes for files processed by **sftp**. Exceeding this maximum might result in unexpected behavior.

Options

–1 Specifies the use of SSH protocol version 1. Because SSH protocol version 1 does not support subsystems, you must specify **–s** with an **sftp-server** path when using this option. This option is only supported if both the local and remote hosts are z/OS systems.

–2 Forces SSH to try protocol version 2 only. If both **–1** and **–2** are specified, **sftp** uses the option that appears last on the command line.

–4 Forces SSH to use IPv4 addresses only. If both **–4** and **–6** are specified, **sftp** uses the option that appears last on the command line.

–6 Forces SSH to use IPv6 addresses only. If both **–4** and **–6** are specified, **sftp** uses the option that appears last on the command line.

–b *batchfile*

Batch mode reads a series of commands from an input batchfile instead of stdin. Because it lacks user interaction, use it in conjunction with noninteractive authentication. A batchfile of '-' can be used to indicate standard input. **sftp** ends and the exit value is set to nonzero only if any of the following commands fail: **get**, **put**, **reget**,**rename**, **ln**, **rm**, **rmdir**, **mkdir**, **cd**, **ls**, **lcd**, **chmod**, **chown**, **chgrp**, **lpwd**, **df**, **symlik** and **lmkdir**. For an exception, see “Limitations” on page 90. This option causes **sftp** to pass `-oBatchMode=yes` to **ssh**.

Ending on error can be suppressed on a command-by-command basis by prefixing the command with a '-' character.

For example:

```
-rm /tmp/file*
```

–B *buffer_size*

Specifies the size of the buffer that **sftp** uses when transferring files. Larger buffers require fewer round trips at the cost of higher memory consumption. The default is 32768 bytes. If specifying buffer_size > INT_MAX, **sftp** only allocates INT_MAX at most. For more information, see “Limitations” on page 90.

–c *cipher*

Selects the cipher to use for encrypting the data transfers. This option is directly passed to **ssh**.

–C Enables compression. This option is passed to **ssh**.

–D *sftp-server_path*

Connects directly to the local **sftp-server** (instead of by way of **ssh**). This option might be used in debugging the client and server.

Restriction: When this option is specified, SMF client transfer completion records (subtype 97) are not collected.

–F *ssh_config*

Specifies an alternative per-user **ssh_config** configuration file for **ssh**. This option is directly passed to **ssh**. It has no effect on the z/OS-specific configuration files.

–i *identity_file*

Selects the file from which the identity (private key) for public key authentication is read. This option is directly passed to **ssh**. See page for more information.

–l *limit*

Limits the used bandwidth, specified in Kbit/s.

–o *ssh_option*

Can be used to pass options to **ssh** in the format used in the **ssh_config** and **zos_user_ssh_config** configuration files. This is useful for specifying options for which there is no separate **sftp** command-line flag. For full details of the available options and their values, see ssh_config and zos_user_ssh_config. The z/OS-specific per-user OpenSSH client configuration options can be specified on **-o**, but the z/OS-specific system-wide options (see zos_ssh_config) cannot.

Example: To specify an alternate port, use:

```
sftp -oPort=24
```

sftp always passes the following options to **ssh**:

- ForwardX11=no
- ForwardAgent=no
- PermitLocalCommand=no
- ClearAllForwardings=yes

–p Preserves modification times, access times, and modes from the original files transferred.

–P *port*
Specifies the port to connect to on the remote host.

–q Quiet mode: disables the progress meter as well as warning and diagnostic messages from **ssh**.

–r Recursively copy entire directories when uploading and downloading.

Note: **sftp** does not follow symbolic links found in tree traversal.

–R *num_requests*
Specifies the number of requests that can be outstanding at any one time. Increasing this might slightly improve file transfer speed, but increases memory usage. The default is 16 outstanding requests.

–s *subsystem* | *sftp_server*
Specifies the SSH protocol version 2 subsystem or the path for an sftp server on the remote host. An **sftp-server** path is useful for using **sftp** over SSH protocol version 1 or when the remote **sshd** does not have an **sftp** subsystem configured.

–S *program*
Name of the program to use for the encrypted connection. The program must understand **ssh** options. On z/OS, if this option is specified, then **sftp** will hang unless the program provides SMF information.

–v Enables verbose mode. This option is also passed to **ssh**. Multiple **–v** options increase the verbosity. You can specify up to three **-v** options.

Limitations

Due to limitations in the SECSH protocol with regards to EBCDIC platforms, **sftp** used with SSH protocol version 1 is only supported from z/OS to z/OS. (For information about the IETF SECSH internet drafts, see Appendix C, “RFCs and Internet drafts,” on page 523).

The biggest buffer size that can be allocated is 2147483647(INT_MAX) bytes. INT_MAX is defined in limits.h.

When using **put -p** in conjunction with **-b**, if a failure occurs when preserving permissions or access time on the remote system, **sftp** will not exit and the exit value will not be set to nonzero.

Subcommands

sftp understands a set of commands (subcommands) similar to those of **ftp**.

The following rules apply:

- Commands are not case sensitive.
- Path names that contain spaces must be enclosed in quotes.
- Glob characters (also called wildcard characters) in path names must be escaped with backslash characters (\). For more information about wildcard characters, refer to the section on file name generation in the **sh** command description in *z/OS UNIX System Services Command Reference*.
- Characters preceded by an unescaped pound sign (#) are treated as a comment. Input up to but not including the next newline is discarded.

ascii Changes the data transfer type to ASCII.

For outgoing files, convert from EBCDIC code page of the current locale into ASCII before transferring them to the remote host. For incoming files, convert from ASCII into the code page of the current locale before restoring them on the local host.

Restriction: The ascii subcommand is only valid for file transfers between UNIX platforms. It is not valid for file transfers between Windows and UNIX platforms.

binary Changes the data transfer type to binary. This is the default.

bye Quits **sftp**.

cd *path*
Changes the remote directory to *path*.

lcd *path*
Changes the local directory to *path*.

chgrp *grp path*
Changes group of file *path* to *grp*. *grp* must be a numeric GID. *path* can contain glob characters and match multiple files.

chmod *mode path*
Changes permissions of file *path* to *mode*. *path* can contain glob characters and match multiple files.

chown *own path*
Changes owner of file *path* to *own*. *own* must be a numeric UID. *path* can contain glob characters and match multiple files.

df [-hi] [*path*]
Display usage information for the filesystem holding the current directory (or path if specified). If the `-h` flag is specified, the capacity information will be displayed using "human-readable" suffixes. The `-i` flag requests display of inode information in addition to capacity information. This command is only supported on servers that implement the ``statvfs@openssh.com'' extension.

exit Quits **sftp**.

get [–aPpr] *remote-path* **[***local-path***]**
Retrieves the *remote-path* and stores it on the local machine. If the local path name is not specified, it is given the same name it has on the remote machine. *remote-path* can contain glob characters and match multiple files. If it matches multiple files and *local-path* is specified, then *local-path* must

specify a directory. If the **–P** or **–p** flag is specified, then the file's full permissions and access time are copied as well.

If the `-a` flag is specified, then attempt to resume partial transfers of existing files.

Note:
Resumption assumes that any partial copy of the local file matches the remote copy. If the remote file differs from the partial local copy then the resultant file is likely to be corrupt.

If the `-r` flag is specified, then directories will be copied recursively. In this case, the local directory will be created if it does not already exist.

Note:
`sftp` does not follow symbolic links when performing recursive transfers.

help Displays help text.

lls [*ls-options* **[***path***]]**
Displays local directory listing of either *path* or current directory if *path* is not specified. *ls-options* is case sensitive. *ls-options* can contain any flags supported by the local system's **ls** command. *path* can contain glob characters and match multiple files.

lmkdir *path*
Creates local directory specified by *path*.

ln [-s] *oldpath newpath*
Creates a symbolic link from *oldpath* to *newpath* on the remote host. If the `-s` flag is specified, the created link is a symbolic link, otherwise it is a hard link. Same as **symlink** if `-s` is specified.

lpwd Prints local working directory.

ls [–1afhlnrSt] [*path***]**
Displays remote directory listing of either *path* or current directory if *path* is not specified. *path* can contain glob characters and match multiple files.

The following flags are recognized and the behavior of **ls** is altered accordingly:

-1 Produces single-column output.

-a Lists files beginning with a dot (.).

-f Does not sort the listing. The default sort order is lexicographical.

-h When used with a long format option, use unit suffixes: Byte, Kilobyte, Megabyte, Gigabyte, Terabyte, Petabyte, and Exabyte in order to reduce the number of digits to four or fewer using powers of 2 for sizes (K=1024, M=1048576, and so forth).

-l Displays additional details including permissions and ownership information.

-n Produces a long listing with user and group information presented numerically.

-r Reverses the sort order of the listing.

-S Sorts the listing by file size.

-t Sorts the listing by last modification time.

lumask *umask*
Sets local umask to *umask*.

mkdir *path*
Creates remote directory specified by *path*.

progress
Toggles display of progress meter.

put [–Ppr] *local-path* **[***remote-path***]**
Uploads *local-path* and stores it on the remote machine. If the *remote-path* name is not specified, it is given the same name it has on the local machine. *local-path* can contain glob characters and match multiple files. If it matches multiple files and *remote-path* is specified, then *remote-path* must specify a directory. If the **–P** or **–p** flag is specified, then the file's permissions and access time are copied as well.

If the **-r** flag is specified, then directories will be copied recursively. In this case, the remote directory must already exist.

Note:
`sftp` does not follow symbolic links when performing recursive transfers.

When using **put -p** with **-b**, if a failure occurs when preserving permissions or access time on the remote system, **sftp** will not exit and the exit value will not be set to nonzero.

pwd Displays the remote working directory.

quit Quits **sftp**.

reget [-Ppr] ***remote-path [local-path]***
Resume download of remote-path. Equivalent to **get** with the **-a** flag set.

rename *oldpath newpath*
Renames the remote file from *oldpath* to *newpath*.

rmdir *path*
Removes the remote directory specified by *path*.

rm *path*
Deletes the remote file specified by *path*.

symlink *oldpath newpath*
Creates a symbolic link from *oldpath* to *newpath* on the remote host. Same as **ln**.

version
Displays the **sftp** version.

! Escapes to local shell.

! *command*
Executes *command* in the local shell.

? Synonym for **help**.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_DEBUG_TIMESTAMP
If this variable is specified to YES, it will contain the timestamp in the debug information. If it is specified to CPU, the CPU time will be used as the timestamp.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SMF_FD
Set to the file descriptor number used for interprocess communication during SMF-related processing. This environment variable is only used internally and is not for external specification.

Exit values

0 Successful completion

>0 An error occurred. This exit value only occurs when **-b batchfile** is used and any of the following commands fail: **get**, **put**, **rename**, **ln**, **rm**, **rmdir**, **mkdir**, **cd**, **ls** ,**lcd**, **chmod**, **chown**, **chgrp**, **lpwd**, and **lmkdir**. For an exception, see "Limitations" on page 90.

Related information

scp, **ssh**, **ssh-add**, **ssh_config**, **ssh-keygen**, **sftp-server**, **sshd**, **zos_ssh_config**, **zos_user_ssh_config**

Author

Damien Miller

sftp-server — SFTP server subsystem

Format

sftp-server [**-ehR**] [**-d***start-directory*] [**-f** *log_facility*] [**-l** *log_level*] [**-u***umask*]

Description

sftp-server is a program that implements the server side of the SFTP protocol. It expects client requests from standard input and writes responses to standard output. **sftp-server** is not intended to be called directly, but by specifying the **sshd_config** keyword Subsystem. See Subsystem for more information about the keyword.

OpenSSH can be configured to collect SMF server transfer completion records that are associated with **sftp-server**. See "Setting up OpenSSH to collect SMF records" on page 50 for more information. See Chapter 12, "SMF Type 119 records for OpenSSH," on page 201 for more information about the SMF server transfer completion records (subtype 96).

OpenSSH can be set up to use ICSF to implement certain **sshd** ciphers and MAC algorithms. This extension enables **sftp-server** (by way of **sshd**) to use hardware support when applicable. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

sftp-server can convert the files with specified file extensions configured by SftpServerConvert in the `zos_sshd_config` file.4 See SftpServerConvert for more information. For outgoing files, **sftp-server** converts the files from EBCDIC code page of the current locale into ASCII before transferring them to the remote client host. For incoming files, **sftp-server** converts the files from ASCII into the code page of the current locale before restoring them on the local host.

OpenSSH can be set up to run in FIPS mode. This extension enables **sftp-server** to comply with FIPS 140-2 mode when applicable. See “Setting up OpenSSH to run in FIPS mode” on page 58 for more information. OpenSSH can be set up to use ICSF to implement certain **ssh** Key Exchange algorithms. See“Setting up OpenSSH to use ICSF cryptographic operations” on page 52 for more information.

Restriction: The maximum full path name length is 1023 bytes for files processed by **sftp-server**. Exceeding this maximum might result in unexpected behavior.

Options

–d *start-directory*
: Specifies an alternate starting directory for users. The pathname may contain the following tokens that are expanded at runtime: `%%` is replaced by a literal '%', `%d` is replaced by the home directory of the user being authenticated, and `%u` is replaced by the username of that user. The default is to use the user's home directory. This option is useful in conjunction with the **sshd_config ChrootDirectory** option.

–e **sftp-server** sends log messages to standard error instead of the system log.

–f *log_facility*
: Specifies the facility code that is used when logging messages from **sftp-server**. The possible values are: DAEMON, USER, AUTH, LOCAL0, LOCAL1, LOCAL2, LOCAL3, LOCAL4, LOCAL5, LOCAL6, LOCAL7. The default is AUTH.

For more information about these log facilities, see the syslog daemon section in *z/OS Communications Server: IP Configuration Reference*.

–h Displays a summary of options.

–l *log_level*
: Specifies which messages will be logged by **sftp-server**. The possible values are: QUIET, FATAL, ERROR, INFO, VERBOSE, DEBUG, DEBUG1, DEBUG2, and DEBUG3. INFO and VERBOSE log transactions that **sftp-server** performs on behalf of the client. DEBUG and DEBUG1 are equivalent. DEBUG2 and DEBUG3 each specify higher levels of debugging output. The default is ERROR.

These logging levels are similar to the syslog daemon priority codes, which are described in the syslog daemon section in *z/OS Communications Server: IP Configuration Reference*.

-R Places this instance of **`sftp-server`** into a read-only mode. Attempts to open files for writing, as well as other operations that change the state of the file system, will be denied.

-u*umask*
: Sets an explicity umask to bet applied to newly-created files and directories, instead of the user's default mask.

Note: For logging to work if **-e** is not specified, **`sftp-server`** must be able to access `/dev/log`. Use of **`sftp-server`** in a **chroot** configuration therefore requires that **syslogd** establish a logging socket inside the **chroot** directory.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_DEBUG_TIMESTAMP
If this variable is specified to YES, it will contain the timestamp in the debug information. If it is specified to CPU, the CPU time will be used as the timestamp.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SFTP_SERVER_CONVERT
Contains file extensions which are allowed to perform the text file conversion on zOS **sftp-server**. It is only used internally and is not for external specification.

_ZOS_SMF_FD
Set to the file descriptor number used for interprocess communication during SMF-related processing. This environment variable is only used internally and is not for external specification.

Related information

sftp, **ssh**, **sshd**, **sshd_config**, **zos_sshd_config**

Author

Markus Friedl

ssh — OpenSSH client (remote login program)

Format

ssh [**–1246AaCfgKkMNnqsTtVvXxYy**] [**–b** *bind_address*] [**–c** *cipher_spec*] [**–D** [*bind-address:*] *port*] [**–E** log_file] [**–e** *escape_char*] [**–F** *configfile*] [–I *pkcs11*] [**–i** *identity_file*] [**–L** [*bind-address:*]*port:host:hostport*] [**–l** *login_name*] [**–m** *mac_spec*] [**-O** *ctl_cmd*] [**–o** *option*] [**–p** *port*] [**-Q** *protocol_feature*] [**–R** [*bind-address:*] *port:host:hostport*] [**-S** *ctl_path*] [**-W** *host:port*] [**-w** *local_tun* [*:remote_tun*]] [*user@*] *hostname* [*command*]

Description

ssh (SSH client) is a program for logging into a remote machine and for executing commands on a remote machine. It is an alternative to **rlogin** and **rsh** and provides secure encrypted communications between two untrusted hosts over an insecure network. X11 connections and arbitrary TCP ports can also be forwarded over the secure channel.

ssh connects and logs into the specified host name (with optional user name). If *command* is specified, instead of a login shell being executed, *command* is executed on the remote host. Users must prove their identity to the remote machine using one of several methods, depending on the protocol version used.

Tip: To avoid problems when running as a user that shares a UID, run **ssh** with the **-F** option to specify a user-specific **ssh_config** file. The file should set the IdentityFile, User, and UserKnownHostsFile keywords to the proper user-specific values. You should also specify a user-specific **zos_user_ssh_config** file using the _ZOS_USER_SSH_CONFIG environment variable.

OpenSSH can be set up to use ICSF to implement certain **ssh** ciphers and MAC algorithms. This extension enables **ssh** to use hardware support when applicable. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

OpenSSH can be set up to run in FIPS mode. This extension enables **ssh** to comply with FIPS 140-2 mode when applicable. See "Setting up OpenSSH to run in FIPS mode" on page 58 for more information. OpenSSH can be set up to use ICSF to implement certain **ssh** Key Exchange algorithms. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

Options

–1 Forces **ssh** to try protocol version 1 only. If both **–1** and **–2** are specified, **ssh** uses the option that appears last on the command line.

–2 Forces **ssh** to try protocol version 2 only. If both **–1** and **–2** are specified, **ssh** uses the option that appears last on the command line.

–4 Forces **ssh** to use IPv4 addresses only. If both **–4** and **–6** are specified, **ssh** uses the option that appears last on the command line.

–6 Forces **ssh** to use IPv6 addresses only. If both **–4** and **–6** are specified, **ssh** uses the option that appears last on the command line.

–a Disables forwarding of the authentication agent connection.

–A Enables forwarding of the authentication agent connection. This can also be specified on a per-host basis in a **ssh_config** configuration file.

Guideline: Enable agent forwarding with caution. Users with the ability to bypass file permissions on the remote host (for the agent's UNIX-domain socket) can access the local agent through the forwarded connection. Attackers cannot obtain key material from the agent. However, they can perform operations on the keys that enable them to authenticate using the identities loaded into the agent.

Restriction: This option is not supported if running in FIPS mode.

–b *bind_address*

Use *bind_address* on the local machine as the source address of the connection. This option is useful only on systems with more than one address.

Rule: The *bind_address* must be the same address family (IPv4 or IPv6) as the remote host name specified on the **ssh** command line.

–c *cipher_spec*

Selects the cipher to use for encrypting the session.

For protocol 1 specifications:

3des 3des (Triple-DES) is an encrypt-decrypt-encrypt triple with three different keys. It is the default.

blowfish

Blowfish is a secure fast block cipher.

des Specifying des is strongly discouraged due to cryptographic weakness. It is supported only in **ssh** for interoperability with legacy protocol 1 implementations that do not support the 3DES cipher.

For protocol version 2 specifications, ciphers can be specified in order of preference in a comma-separated list. Valid ciphers include:

3des-cbc
Triple-DES (3DES) algorithm

aes128-cbc
Advanced Encryption Standard (AES) CBC mode with 128-bit key

aes128-ctr
Advanced Encryption Standard (AES) CTR mode with 128-bit key

aes192-cbc
Advanced Encryption Standard (AES) CBC mode with 192-bit key

aes192-ctr
Advanced Encryption Standard (AES) CTR mode with 192-bit key

aes256-cbc
Advanced Encryption Standard (AES) CBC mode with 256-bit key

aes256-ctr
Advanced Encryption Standard (AES) CTR mode with 256-bit key

arcfour
Arcfour algorithm

arcfour128
Arcfour algorithm with 128-bit key

arcfour256
Arcfour algorithm with 256-bit key

aes128-gcm@openssh.com
Advanced Encryption Standard (AES) GCM mode with 128-bit key.

aes256-gcm@openssh.com
Advanced Encryption Standard (AES) GCM mode with 256-bit key.

blowfish-cbc
Blowfish algorithm

cast128-cbc
CAST algorithm

rijndael-cbc@lysator.liu.se
Same as Advanced Encryption Standard (AES) CBC mode with 256-bit key

The cipher is typically one long unbroken line; in the following example the cipher is not shown as one unbroken line due to space limitations. See the ciphers keyword in ssh_config for default list.

The ciphers list might need to be modified based on the ciphers source used. For more information, see the CiphersSource keyword in the z/OS-specific OpenSSH client configuration files **zos_ssh_config** or **zos_user_ssh_config**.

–C Requests compression of all data (including stdin, stdout, stderr, and data for forwarded X11 and TCP connections). The compression level can be controlled by the CompressionLevel option for protocol version 1. The default value can be set on a per-host basis in the **ssh_config** configuration file; for more information about the Compression and CompressionLevel options, see ssh_config.

–D [*bind_address:***]***port*
Specifies a local dynamic application-level port forwarding. This type of dynamic port forwarding works by allocating a socket to listen to port on the local side, optionally bound to the specified *bind_address*. Whenever a connection is made to this port, it is forwarded over the secure channel and the application protocol is used to determine where to connect from the remote machine. Currently, the SOCKS4 and SOCKS5 protocol are supported and **ssh** will act as a SOCKS server. Only a superuser can forward privileged ports. Dynamic port forwardings can also be specified in the **ssh_config** configuration file.

IPv6 addresses can be specified with an alternative syntax: [*bind_address*/]*port* or by enclosing the address in square brackets. Only the superuser can forward privileged ports. By default, the local port is bound in accordance with the GatewayPorts setting. However, an explicit *bind_address* can be used to bind the connection to a specific address. The *bind_address* of "localhost" indicates that the listening port is to be bound for local use only, while an empty address or '*' indicates that the port should be available from all interfaces.

Appendix B, “OpenSSH - port forwarding examples,” on page 519 has examples of port forwarding.

–E *log_file*
Append debug logs to `log_file` instead of standard error.

–e *escape_char*
Sets the escape character for sessions with a pty (the default is " ~"). The escape character is only recognized at the beginning of a line. The escape character followed by a dot ('.') closes the connection, followed by Control-Z suspends the connection, and followed by itself sends the escape character once. Setting the character to "none" disables any escape characters and makes the session fully transparent.

–f Requests **ssh** to go to the background before command execution. This is useful if **ssh** is going to ask for passwords, password phrases, or passphrases, but the user wants it in the background. This implies **–n**. The recommended way to start X11 programs at a remote site is **ssh –f** *host xterm*.

If the ExitOnForwardFailure configuration option is set to “yes”, then a client started with **-f** will wait for all remote port forwards to be successfully established before placing itself in the background.

Restriction: This option is not supported if running in FIPS mode, or Key Exchange algorithms are implemented using ICSF.

–F *configfile*
Specifies an alternative per-user **ssh_config** configuration file. If an **ssh_config** configuration file is given on the command line, the system-wide **ssh_config** configuration file (`/etc/ssh/ssh_config`) will be ignored. The default for the per-user **ssh_config** configuration file is `~/.ssh/config`. This option has no effect on the z/OS-specific configuration files.

–g Allows remote hosts to connect to local forwarded ports.

–i *identity_file*

Selects a file from which the identity (private key) for RSA, DSA or ECDSA authentication is read. The default is `~/.ssh/identity` for protocol version 1. For protocol version 2 , the default is `~/.ssh/id_rsa`, `~/.ssh/id_dsa` and `~/.ssh/id_ecdsa`. Identity files can also be specified on a per-host basis in the **ssh_config** configuration file. It is possible to have multiple **–i** options (and multiple identities specified in the **ssh_config** configuration file).

For a given protocol, identity files are tried in the order they are specified. If key ring certificates have been separately specified, then they will always be tried before identity files. The certificates are used in the order they were specified, followed by the identity files in the order they were specified. The key ring certificates could be specified either via a command-line option by specifying one or more IdentityKeyRingLabel options on the **-o** option, or by specifying the IdentityKeyRingLabel keyword in the **zos_user_ssh_config** file (the z/OS-specific per-user client configuration file).

However, if an identity is loaded in an agent, regardless of whether it originated from a key ring certificate or from a file, then that identity will be tried first.

To sum it up, the order that identities are tried are as follows:

1. Identities in the agent.
2. The key ring certificates on the command-line option
3. Key ring certificates specified in a **zos_user_ssh_config** file
4. Identity files on the command-line option, and then
5. Identity files specified in an **ssh_config** configuration file.

Restriction: This option is not supported if running in FIPS mode.

–I pkcs11

(**–I** is the uppercase **– i**). Not supported on z/OS UNIX. Specifies which smart card device to use. Specify the PKCS#11 shared library **ssh** should use to communicate with a PKCS#11 token providing the user's private RSA key.

-k Disables forwarding (delegation) of GSS-API credentials to the server.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. The only mechanism currently supported on z/OS UNIX is Kerberos V5 .For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txthttp://www.ietf.org/rfc/rfc2743.txt.

-K Enables GSS-API authentication and forwarding (delegation) of GSS-API credentials to the server. If running in **FIPSMODE**, this option is not supported even if its value is specified.

–l *login_name*

Specifies the user to log in as on the remote machine. This option can also be specified on a per-host basis in the **ssh_config** configuration file.

–L **[***bind-address:***]***port***:***host***:***hostport*

Specifies that *port* on the local (client) host is to be forwarded to the given host and port on the remote side. This works by allocating a socket to listen to *port* on the local side, optionally bound to the specified *bind_address*. When a connection is made to this port, it is forwarded over the secure channel and a connection is made to *host port hostport* from the remote machine. Port forwardings can also be specified in the **ssh_config** configuration file. Only a superuser can forward privileged ports.

IPv6 addresses can be specified with an alternative syntax: [*bind_address*/]*port*/*host*/*hostport* or by enclosing the address in square brackets.

By default, the local port is bound in accordance with the GatewayPorts setting. However, an explicit *bind_address* can be used to bind the connection to a specific address. The *bind_address* of "localhost" indicates that the listening port be bound for local use only, while an empty address or '*' indicates that the port should be available from all interfaces.

Appendix B, “OpenSSH - port forwarding examples,” on page 519 has examples of port forwarding.

–m *mac_spec*

For protocol version 2, a comma-separated list of MAC (message authentication code) algorithms can be specified in order of preference. **ssh_config** contains a description of MACs.

The MAC algorithms list might need to be modified based on the MAC algorithm source used. For more information, see the MACsSource keyword in the z/OS-specific OpenSSH client configuration files, **zos_ssh_config** or **zos_user_ssh_config**.

-M Places the **ssh** client into master mode for connection sharing. Multiple **-M** options puts **ssh** into master mode with confirmation required before slave connections are accepted. **ssh_config** contains a description of ControlMaster.

–n Redirects stdin from /dev/null (prevents reading stdin). This option must be used when **ssh** is run in the background. A common trick is to use this to run X11 programs on a remote machine.

For example:

```
ssh –n shadows.cs.hut.fi emacs &
```

Result: An emacs session is started on shadows.cs.hut.fi and the X11 connection is automatically forwarded over an encrypted channel. The **ssh** program is put in the background. This does not work if **ssh** needs to ask for a password, password phrase, or passphrase; see the **–f** option.

–N Specifies that a remote command not be executed. This is useful for just forwarding ports (protocol version 2 only). This option overrides the **-t** option.

–o *option*

Can be used to give options in the format used in the **ssh_config** and **zos_user_ssh_config** configuration files. This is useful for specifying options for which there is no separate command-line flag. For full details of the available options and their values, see ssh_config and zos_user_ssh_config. The z/OS-specific per-user OpenSSH client configuration options can be specified on **-o**, but the z/OS specific system-wide options (see zos_ssh_config) cannot.

For example:

```
ssh -oHostbasedAuthentication=no Billy@us.pok.ibm.com
```

-O *ctl_cmd*

Controls the master process of a multiplexed connection. When the **-O** option is specified, the *ctl_cmd* argument is interpreted and passed to the master process. Valid commands are "check" (check that the master process is running) and "exit" (request the master to exit).

–p *port*

Port to connect to on the remote host. This can be specified on a per-host basis in the **ssh_config** configuration file.

–q Quiet mode. Suppresses most warning and diagnostic messages.

–Q *protocol_feature*

Queries **ssh** for the algorithms supported for the specified version 2 *protocol_feature*. The following is a list of features that can be queried: ”cipher” (supported symmetric ciphers), “MAC” (supported message integrity codes), “KEX” (key exchange algorithms), “key” (key types). Protocol features are treated case insensitively.

–R [*bind_address:***]***port***:***host***:***hostport*

Specifies that the given port on the remote (server) host is to be forwarded to host and port on the local side. A socket is allocated to listen to *port* on the remote side; when a connection is made, it is forwarded over the secure channel and a connection is made to *host port hostport* from the local machine. Port forwardings can also be specified in the **ssh_config** configuration file. Privileged ports can be forwarded only when logging in as superuser on the remote machine. IPv6 addresses can be specified by enclosing the address in square brackets or using an alternative syntax: [*bind_address/*]*port/host/hostport*.

By default, the listening socket on the server is bound to the loopback interface only. The default can be overridden by specifying a *bind_address*. An empty *bind_address*, or the address '*', indicates that the remote socket should listen on all interfaces. Specifying a remote *bind_address* will only succeed if the server's GatewayPorts option is enabled as described in GatewayPorts.

If the port argument is “0”, the listen port will be dynamically allocated on the server and reported to the client at run time. When used together with **-O** forward, the allocated port will be printed to the standard output.

–s Can be used to request invocation of a subsystem on the remote system. Subsystems are a feature of SSH protocol version 2, which facilitates the use of **ssh** as a secure transport for other applications such as **sftp**. The subsystem is specified as the remote command.

For example:

```
ssh -s host subsystem_name
```

User-defined subsystems (those that are not built-in) are only supported when both the OpenSSH client and server are running on a z/OS system. See “Limitations” on page 108 for more information.

-S *ctl_path*

Specifies the location of a control socket for connection sharing on the string `none` to disable connection sharing. For more information, see the descriptions of the **ssh_config** keywords ControlMaster and ControlPath.

–t Forces pty allocation. This option can be used to execute arbitrary screen-based programs on a remote program, which can be very useful, for example, when implementing menu services. Multiple **–t** options force pty allocation, even if **ssh** has no local tty. Both single and multiple uses of **–t** will be overridden by either the **–T** or **–N** options.

–T Disables pty allocation. This option overrides the **–t** option.

–v Verbose mode. Causes **ssh** to print debugging messages about its progress. This is helpful in debugging connection, authentication, and configuration problems. Multiple **–v** options increase the verbosity. You can specify up to three **-v** options.

–V Displays the current OpenSSH and OpenSSL version information and exits.

-w *local_tun*[*:remote_tun*]
Not supported on z/OS UNIX. Requests tunnel device forwarding with the specified devices between the client (*local_tun*) and the server (*remote_tun*).

The devices can be specified by numerical ID or the keyword "any", which uses the next available tunnel device. If *remote_tun* is not specified, it defaults to "any". See also the descriptions of the **ssh_config** options Tunnel and TunnelDevice. If the Tunnel option is unset, it is set to the default tunnel mode, which is "point-to-point".

-W *host:port*
Requests that standard input and output on the client be forwarded to host on port over the secure channel. Implies **-N**, **-T**, ExitOnForwardFailure and ClearAllForwardings. Works with Protocol version 2 only.

Note: On z/OS UNIX, the forwarded connection to the remote host and port will not be translated.

–x Disables X11 forwarding.

–X Enables X11 forwarding. This can also be specified on a per-host basis in the **ssh_config** configuration file.

X11 forwarding should be enabled with caution. Users with the ability to bypass file permissions on the remote host (for the user's X authorization database) can access the local X11 display through the forwarded connection. An attacker may then be able to perform activities such as keystroke monitoring.

For this reason, X11 forwarding is subjected to X11 SECURITY extension restrictions by default. See the description of the **ssh -Y** option and the **ssh_config** option ForwardX11Trusted for more information.

–y Send log information to the UNIX syslog (syslogd). By default, this information is sent to stderr.

–Y Enables trusted X11 forwarding. Trusted X11 forwardings are not subjected to the X11 SECURITY extension controls.

ssh can additionally obtain **ssh_config** configuration data from a per-user configuration file and a system-wide **ssh_config** configuration file. For file format and configuration options, see ssh_config. **ssh** can also obtain z/OS-specific configuration data from a system-wide **zos_ssh_config** configuration file and per-user **zos_user_ssh_config** configuration file. For file format and configuration options, see zos_ssh_config and zos_user_ssh_config.

Host key checking

In host key checking, **ssh** automatically maintains and checks a database containing identification for all hosts it has ever been used with. Host keys are stored in ~/.ssh/known_hosts in the user's home directory. Additionally, the /etc/ssh/ssh_known_hosts file is automatically checked for known hosts. Any new hosts can be automatically added to the user's file. If a host's identification changes, **ssh** warns about this and disables password authentication to prevent server spoofing or man-in-the-middle attacks, which could otherwise be used to circumvent the encryption. The **ssh_config** keyword StrictHostKeyChecking can be used to control logins to machines whose host key is not known or has changed. The keyword is described in StrictHostKeyChecking.

Because of the difficulty of comparing host keys just by looking at hex strings, there is also support to compare host keys visually, using random art. By setting the VisualHostKey option to "yes", a small ASCII graphic gets displayed on every login to a server, no matter if the session itself is interactive or not. By learning the pattern a known server produces, a user can easily find out that the host key has changed when a completely different pattern is displayed. Because these patterns are not unambiguous however, a pattern that looks similar to the pattern remembered only gives a good probability that the host key is the same, not guaranteed proof.

To get a listing of the fingerprints along with their random art for all known hosts, the following command line can be used:

```
$ ssh-keygen -lv -f ~/.ssh/known_hosts
```

If the fingerprint is unknown, an alternative method of verification is available: SSH fingerprints verified by DNS. An additional resource record (RR), SSHFP, is added to a zonefile and the connecting client is able to match the fingerprint with that of the key presented. SSHFP DNS records are not currently supported by z/OS UNIX.

Authentication

The OpenSSH SSH client supports SSH protocol version 1 and protocol version 2. Protocol version 2 is the default. These settings can be altered using the **ssh_config** Protocol option (described in Protocol), or enforced using the -1 and -2 options. Both protocols support similar authentication methods, but protocol version 2 is preferred because it provides additional mechanisms for confidentiality (the traffic is encrypted using, for example, AES, 3DES, Blowfish, CAST128, or Arcfour) and integrity (for example, hmac-md5, hmac-sha1, hmac-sha2-256, hmac-sha2-512, umac-64, umac-128, hmac-ripemd160). Protocol version 1 lacks a strong mechanism for ensuring the integrity of the connection.

The methods available for authentication are:

- Host-based authentication (disabled by default). See "Host-based authentication" on page 105.
- Public key authentication. See "Public key authentication" on page 105.
- Challenge-response authentication (not supported on z/OS UNIX). See "Challenge-response authentication" on page 106.
- Password authentication. See "Password authentication" on page 106.
- GSSAPI-based authentication. See section on GSSAPI/Kerberos..

Authentication methods are tried in the order listed previously, though protocol version 2 has a configuration option to change the default order: the **sshd_config** keyword PreferredAuthentications. The keyword is described in PreferredAuthentications.

Host-based authentication

In host-based authentication, if the machine the user logs in from is listed in /etc/hosts.equiv or /etc/shosts.equiv on the remote machine, and the user names are the same on both sides, or if the files ~/.rhosts or ~/.shosts exist in the user's home directory on the remote machine and contain a line containing the name of the client machine and the name of the user on that machine, the user is considered for login. Additionally, the server must be able to verify the client's host key for the login to be permitted. (See the description of ~/.ssh/known_hosts and /etc/ssh/ssh_known_hosts.) This authentication method closes security holes due to IP spoofing, DNS spoofing, and routing spoofing.

For more information about host-based authentication, refer to the **ssh_config** keyword HostbasedAuthentication.

Guideline: The /etc/hosts.equiv, ~/.rhosts, and **rlogin**/**rsh** protocol in general, are inherently insecure and the administrator should disable them if security is desired.

Public key authentication

In public key authentication, the scheme is based on public key cryptography, using cryptosystems where encryption and decryption are done using separate keys, and it is not feasible to derive the decryption key from the encryption key. Each user creates a public/private key pair for authentication purposes. The server knows the public key, and only the user knows the private key. **ssh** implements public key authentication protocol automatically, using one of the following algorithms: RSA, DSA or ECDSA. Protocol version 1 is restricted to using only RSA keys, but protocol version 2 can use any.

The ~/.ssh/authorized_keys file lists the public keys that are permitted for logging in. When the user logs in, **ssh** tells the server which key pair it would like to use for authentication. The client proves that it has access to the private key and the server checks that the corresponding public key is authorized to accept the account.

One method of creating a key pair is by running **ssh-keygen**. This action stores the private key in ~/.ssh/identity (protocol version 1), ~/.ssh/id_dsa (protocol version 2 DSA), ~/.ssh/id_ecdsa (protocol version 2 ECDSA), or ~/.ssh/id_rsa (protocol version 2 RSA) and stores the public key in ~/.ssh/identity.pub (protocol version 1), ~/.ssh/id_dsa.pub protocol version 2 DSA), ~/.ssh/id_ecdsa.pub protocol version 2 ECDSA), or ~/.ssh/id_rsa.pub (protocol version 2 RSA) in the user's home directory. The user then copies the public key to the ~/.ssh/authorized_keys file in the home directory on the remote machine. The authorized_keys file corresponds to the conventional ~/.rhosts file, and has one key per line, though the lines can be very long. After this, the user can log in without giving the password.

Another method of creating a key pair is by using digital certificates associated with a SAF key ring, either real or virtual. See “Steps for setting up user authentication when using key rings to store keys” on page 76 for more information about using SAF key rings to manage your keys.

A variation on public key authentication is available in the form of certificate authentication: instead of a set of public/private keys, signed certificates are used. This has the advantage that a single trusted certification authority can be used in place of many public/private keys. See “Certificates” on page 126 for more information.

The most convenient way to use public key or certificate authentication might be with an authentication agent. See ssh-agent for more information.

Challenge-response authentication

In challenge-response authentication, the server sends an arbitrary challenge text and prompts for a response. Protocol version 2 allows multiple challenges and responses; protocol version 1 is restricted to just one challenge and response. Examples of challenge-response authentication include BSD Authentication and PAM (on some non-OpenBSD systems).

Challenge-response authentication is not supported on z/OS UNIX.

Password authentication

Finally, if other authentication methods fail, **ssh** prompts the user for a password and password phrase. The password and password phrase are sent to the remote host for checking; however, because all communications are encrypted, the password and password phrase cannot be seen by anyone listening on the network.

Login session and remote execution

When the user's identity has been accepted by the server, the server either executes the given command or logs into the machine and gives the user a normal shell on the remote machine. All communication with the remote command or shell is automatically encrypted.

If a pseudo terminal (pty) has been allocated (normal login session), the user can use the escape characters in “Escape characters.”

If no pty has been allocated, the session is transparent (escape characters are not recognized) and can be used to reliably transfer binary data. Setting the escape character to “none” will also make the session transparent even if a tty is used.

The session terminates when the command or shell on the remote machine exits and all X11 and TCP/IP connections have been closed. The exit status of the remote program is returned as the exit status of **ssh**.

Escape characters

When a pty has been requested, **ssh** supports a number of functions through the use of an escape character.

A single tilde character can be sent as "~~" or by following the tilde by a character other than those described later in this section. The escape character must always follow a newline to be interpreted as a special character. The escape character can be changed in configuration files using the EscapeChar configuration option or on the command line by the **–e** option.

The supported escape characters (assuming the default "~") are:

~. Disconnect.

~^Z Background **ssh**.

~& Background **ssh** at logout when waiting for forwarded connections or X11 sessions to terminate.

Restriction: This option is not supported if running in FIPS mode, or Key Exchange algorithms are implemented using ICSF.

~# List forwarded connections.

~? Display a list of escape characters.

~B Send a BREAK to the remote system.

Restriction: The ~B escape character is useful only for protocol version 2 and if the peer supports it.

~C Open command line. Use this option to do the following tasks:

- Add port forwardings using the **-L**, **-D**, and **-R** options (see -L option, -D option, and -R option).
- Cancel existing remote forwardings using the **-KR** or **-KD** option (for example, **-KR***[bind_address:]port*).
- Execute a local command if the **ssh_config** keyword PermitLocalCommand enables the feature (for example, *!command*).
- Get basic help using the **-h** option.

~R Request rekeying of the connection.

Restriction: The ~R escape character is useful only for protocol version 2 and if the peer supports it.

~V Decrease the verbosity (LogLevel) when errors are being written to stderr.

~v Increase the verbosity (LogLevel) when errors are being written to stderr.

X11 forwarding

If the ForwardX11 keyword is set to "yes" (or, see the description of the **-X**, **-x**, and **-Y** options described in “Options” on page 97) and X11 is in use (the DISPLAY environment variable is set), then the connection to the X11 display is automatically forwarded to the remote side. As a result, any X11 program that is started from the shell (or command) goes through the encrypted channel and the connection to the real X server is made from the local machine. The user should not manually set DISPLAY. Forwarding of X11 connections can be configured on the command line or in configuration files. For more information about OpenSSH client configuration files, see ssh_config.

The DISPLAY value set by **ssh** points to the server machine, but with a display number greater than zero. This is normal and happens because **ssh** creates a proxy X server on the server machine for forwarding the connections over the encrypted channel. In other words, the **ssh** server masquerades as an X server.

ssh also automatically sets up Xauthority data on the server machine. For this purpose, it generates a random authorization cookie, stores it in Xauthority on the server, and verifies that any forwarded connections carry this cookie and replace it with the real cookie when the connection is opened. The real authentication cookie is never sent to the server machine (and no cookies are sent without encryption).

If the ForwardAgent variable is set to "yes" (or, see the description of the **-A** and **-a** options) and the user is using an authentication agent, the connection to the agent is automatically forwarded to the remote side.

TCP forwarding

Forwarding of arbitrary TCP connections over the secure channel can be specified either on the command line or in a configuration file. One possible application of

TCP forwarding is a secure connection to a mail server; another is going through firewalls. For more information, see Appendix B, “OpenSSH - port forwarding examples,” on page 519.

Running OpenSSH in other locales

Rule: All files used by OpenSSH (such as key files and configuration files) must be in the IBM-1047 code set, with the exception of the **rc** files (`/etc/ssh/sshrc` and `~/.ssh/rc`). The **rc** files are parsed by /bin/sh and should be in the code set of the current locale. Do not use the `/etc/ssh/sshrc` file if there is a possibility of the users on the system running in different locales.

Limitations

User-defined subsystems are only supported when both the OpenSSH client and server are running on z/OS. This is due to a limitation in the SECSH protocol with regards to EBCDIC platforms; for more information about the IETF SECSH RFCs and internet drafts, see Appendix C, “RFCs and Internet drafts,” on page 523. User-defined subsystems are specified by using the **sshd_config** Subsystem keyword. Only the built-in **sftp** subsystem is supported for transfers between all platforms.

Restrictions: Some restrictions apply.

- OpenSSH does not run in multibyte locales.
- If using password authentication, the SSH client cannot be run from OMVS (which is a 3270 session).

Examples

When passing shell commands on the SSH invocation line, the backslash escape character is needed to handle the characteristics of specifying a sequential data set or member of a partitioned data set (PDS).

- Copying from the z/OS UNIX file system to a PDS:

```
ssh user@ibm.com "cp ssh.log \"//'USER.SSH.LOG(LOG1)'\" "
```

- Copying from the z/OS UNIX file system to a sequential data set:

```
ssh user@ibm.com "cp ssh.log \"//'USER.SSH.LOG2'\" "
```

Files

~/.rhosts

This file is used for host-based authentication. On some machines, this file may need to be world-readable if the user's home directory is on an NFS partition, because **sshd** reads it as a superuser. Additionally, this file must be owned by the user and must not have write permissions for anyone else. The recommended permission for most machines is read/write for the user and not accessible by others.

~/.shosts

This file is used in exactly the same way as `~/.rhosts`, but allows host-based authentication without permitting login with **rlogin** or **rsh**.

~/.ssh/

This directory is the default location for all user-specific configuration and authentication information. There is no general requirement to keep the entire contents of this directory secret, but the recommended permissions are read/write/execute for the user, and not accessible by others.

~/.ssh/authorized_keys
Lists the public keys (RSA/DSA/ECDSA) that can be used for logging in as this user. For the format of this file, see "Format of the authorized_keys file" on page 136. The content of this file is not highly sensitive, but the recommended permissions are read/write for the user, and not accessible by others.

If this file, the `~/.ssh/` directory, or the user's home directory are writable by other users, then the file could be modified or replaced by unauthorized users. In this case, **sshd** will not allow it to be used unless the value for the **sshd_config** keyword StrictModes has been set to "no".

~/.ssh/config
The per-user **ssh_config** configuration file. The file format and configuration options are described in ssh_config. Because of the potential for abuse, this file must have strict permissions: read/write for the user, and not writable by others.

~/.ssh/environment
Contains additional definitions for environment variables. For more information, see "Environment variables" on page 110.

~/.ssh/identity, ~/.ssh/id_dsa, ~/.ssh/id_rsa, ~.ssh/id_ecdsa
Contains the private key for authentication. These files contain sensitive data and should be readable by the user but not accessible by others (read/write/execute). Note that **ssh** ignores a private key file if it is accessible by others. It is possible to specify a passphrase when generating the key; the passphrase will be used to encrypt the sensitive part of this file using 3DES.

~/.ssh/identity.pub, ~/.ssh/id_dsa.pub, ~/.ssh/id_rsa.pub, ~/.ssh/id_ecdsa.pub
Contains the public key for authentication. These files are not sensitive and can (but need not) be readable by anyone. The contents of the `~/.ssh/identity.pub` file must be added to `~/.ssh/authorized_keys` on all machines where the user wants to log in using protocol RSA authentication. The contents of the `~/.ssh/id_dsa.pub` , `~/.ssh/id_ecdsa`, and `~/.ssh/id_rsa.pub` file must be added to `~/.ssh/authorized_keys` on all machines where the user wants to log in using protocol version 2 DSA/ECDSA/RSA authentication. These files are never used automatically and are not necessary; they are only provided for the convenience of the user.

~/.ssh/known_hosts
Contains a list of host keys for all hosts that the user has logged into that are not already in the system-wide list of known host keys, `/etc/ssh/ssh_known_hosts`, which is described in "ssh_known_hosts file format" on page 139. This file should be writable only by the owner and the owner must be the user. It can be, but need not be, world-readable.

~/.ssh/rc
Commands in this file are executed by **ssh** when the user logs in, just before the user's shell (or command) is started. For more information about the format, see "Files" on page 141.

~/.ssh/zos_user_ssh_config
The z/OS-specific per-user client configuration file. The file format and configuration options are described in zos_user_ssh_config. Because of the potential for abuse, this file must have strict permissions: read/write for the user, and not writable by others.

/etc/hosts.equiv
This file is for host-based authentication. It should only be writable by a superuser. For more information about the format, see "Files" on page 141.

/etc/ssh/shosts.equiv
This file is used in exactly the same way as `/etc/hosts.equiv` but allows host-based authentication without permitting login with **rlogin** or **rsh**.

/etc/ssh/ssh_config
System-wide **ssh_config** configuration file. For file format and configuration information, see ssh_config.

/etc/ssh/ssh_host_key, /etc/ssh/ssh_host_dsa_key, /etc/ssh/ssh_host_rsa_key, /etc/ssh/ssh_host_ecdsa_key
These three files contain the private parts of the host keys and are used for host-based authentication. If protocol version 1 is used, **ssh** must be setuid 0 because the host key is readable only by a superuser. For protocol version 2, **ssh** uses **ssh_keysign** to access the host keys. This eliminates the requirement that **ssh** be setuid 0 when the host-based authentication is used. By default, **ssh** is not setuid 0.

/etc/ssh/ssh_known_hosts
System-wide list of known host keys. This file must be prepared by the system administrator to contain the public host keys of all machines in the organization, and it must be world-readable. For more information about the format, see "ssh_known_hosts file format" on page 139.

The canonical system name (as returned by name servers) is used by **sshd** to verify the client host when logging in; other names are needed because **ssh** does not convert the user-supplied name to a canonical name before checking the key, because someone with access to the name servers would then be able to fool host authentication.

/etc/ssh/sshrc
Commands in this file are executed by **ssh** when the user logs in, just before the user's shell (or command) is started. For more information about the format, see "Files" on page 141.

/etc/ssh/zos_ssh_config
z/OS-specific system-wide client configuration file. For file format and configuration information, see zos_ssh_config.

Environment variables

ssh typically sets or uses the following environment variables:

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_DEBUG_TIMESTAMP
If this variable is specified to YES, it will contain the timestamp in the debug information. If it is specified to CPU, the CPU time will be used as the timestamp.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SMF_FD
Set to the file descriptor number used for interprocess communication

during SMF-related processing. This environment variable is only used internally and is not for external specification.

_ZOS_USER_SSH_CONFIG
Specifies the path name of the z/OS-specific per-user OpenSSH client configuration file. The system-wide default is `/etc/ssh/zos_ssh_config` and the user's default is `~/.ssh/zos_user_ssh_config`. If this variable is specified, it replaces the user's default file but not the system-wide default file. See zos_ssh_config and zos_user_ssh_config for the available keywords. The recommended permissions of the specified file are read/write for the user and not writable by others.

DISPLAY
Indicates the location of the X11 server. It is automatically set by **ssh** to point to a value of the form *hostname*:*n* where *hostname* indicates the host where the shell runs, and *n* is an integer greater than or equal to 1. **ssh** uses this special value to forward X11 connections over the secure channel. The user should normally not set DISPLAY explicitly, as that will render the X11 connection insecure (and require the user to manually copy any required authorization cookies).

HOME
Set to the path for the user's home directory.

LOGNAME
Synonym for USER.

MAIL Set to the path of the user's mailbox.

PATH Set to the default PATH, as compiled into **ssh**.

SSH_ASKPASS
If **ssh** needs a passphrase, it reads the passphrase from the current terminal if it was run from a terminal. If **ssh** does not have a terminal associated with it, but DISPLAY and SSH_ASKPASS are set, it executes the program specified by SSH_ASKPASS and opens an X11 window to read the passphrase. This is particularly useful when calling **ssh** from an .Xsession or related script. It is necessary to redirect the input from `/dev/null` to make this work.

SSH_AUTH_SOCK
Identifies the path of a UNIX-domain socket used to communicate with the agent.

SSH_CONNECTION
Identifies the client and server ends of the connection. The variable contains four space-separated values: client ip-address, client port number, server ip-address and server port number.

SSH_ORIGINAL_COMMAND
Contains the original command line if a forced command is executed. It can be used to extract the original arguments.

SSH_TTY
Set to the name of the tty (path to the device) associated with the current shell or command. If the current session has no tty, this variable is not set.

TZ Set to indicate the present time zone if it was set when the daemon was started (the daemon passes the value on to new connections).

USER Set to the name of the user logging in.

Additionally, **ssh** reads `~/.ssh/environment` and adds lines of the format **VARNAME=***value* to the environment if the file exists and if users are allowed to change their environment. For more information, see PermitUserEnvironment.

Exit values

ssh exits with the exit status of the remote command or with 255 if an error occurred.

Related information

scp, **sftp**, **ssh-add**, **ssh-agent**, **ssh_config**, **ssh-keygen**, **ssh-keysign**, **sshd**, **zos_ssh_config**, **zos_user_ssh_config**

Authors

OpenSSH is a derivative of the original and free ssh 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus Friedl contributed the support for SSH protocol versions 1.5 and 2.0.

ssh-add — Add RSA or DSA identities to the authentication agent

Format

ssh-add [**–cDdkLlXx**] [**–t** *life*] [*file* ...]

ssh-add –s *pkcs11*

ssh-add –e *pkcs11*

Description

ssh-add adds private key identities to the authentication agent, **ssh-agent**. When run without arguments and when neither of the key ring environment variables is set, it adds the files `~/.ssh/id_rsa`, `~/.ssh/id_dsa`, `~/.ssh/id_ecdsa`, and `~/.ssh/identity`. Alternative file names can be given on the command line, or identities can be gathered from the user's key ring (real or virtual). To obtain them from SAF key rings, use either the _ZOS_SSH_KEY_RING or _ZOS_SSH_KEY_RING_LABEL environment variables. For more information about them, see “Environment variables” on page 114.

If loading a private key from a file, **`ssh-add`** will also try to load corresponding certificate information from the filename obtained by appending `-cert.pub` to the name of the private key file. See “Certificates” on page 126 for more information on using SSH style certificates.

If any file requires a passphrase, **`ssh-add`** asks for the passphrase from the user. The passphrase is read from the user's tty. **`ssh-add`** retries the last passphrase if multiple identity files are given.

Tip: Users sharing a UNIX UID should always run **ssh-add** with arguments to specify the identities to be added or removed. If any file requires a passphrase, **ssh-add** asks for the passphrase from the user. The passphrase is read from the user's tty. **ssh-add** retries the last passphrase if multiple identity files are given.

Requirement: The authentication agent must be running and the SSH_AUTH_SOCK environment variable must contain the name of its socket for **ssh-add** to work.

Options

–c Specifies that added identities are subject to confirmation by the SSH_ASKPASS program before being used for authentication. You can press Enter or type 'yes' to confirm use of the identities. The SSH_ASKPASS program is described in “Environment variables” on page 114.

–d Removes the identity from the agent. When run without specifying an identity to remove, it removes `~/.ssh/id_rsa`, `~/.ssh/id_dsa`, `~/.ssh/id_ecdsa`, and `~/.ssh/identity` and their corresponding certificates. If the default identities are not present, **ssh-add** ends with return code 1.

When the identity is specified, **ssh-add** needs to load the public key of the identity first in order to remove it. It looks for the public key in the path name of the identity. If the key is not found, the error message `Bad key file` is given.

–D Deletes all identities from the agent.

-e *pkcs11*
Not supported in z/OS UNIX. Removes keys provided by PKCS#11 shared library *pkcs11*.

-k When loading keys into or deleting keys from the agent, process plain private keys only and skip certificates.

–l Lists fingerprints of all identities currently represented by the agent.

–L Lists public key parameters of all identities currently represented by the agent.

-s *pkcs11*
Not supported in z/OS UNIX. Adds keys provided by the PKCS#11 shared library *pkcs11*.

–t *life* Sets a maximum lifetime when adding identities to an agent. The lifetime can be specified in seconds or in a time format specified in **sshd_config**.

–x Locks the agent with a password.

–X Unlocks the agent.

Files

~/.ssh/identity
Contains the protocol version 1 RSA authentication identity of the user.

~/.ssh/id_dsa
Contains the protocol version 2 DSA authentication identity of the user.

~/.ssh/id_ecdsa
Contains the protocol version 2 ECDSA authentication identity of the user.

~/.ssh/id_rsa
Contains the protocol version 2 RSA authentication identity of the user.

Identity files should not be readable by anyone but the user. **ssh-add** ignores identity files if they are accessible by others.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SSH_KEY_RING
Specifies the key ring owner, followed by that user's SAF key ring name to be used as input, rather than the default or specified file names. The owner and key ring name must be separated by a '/'. All RSA and DSA identities that are in this key ring will be added to the authentication agent. The key ring can be either real or virtual.

For example:

```
KeyRingOwner/KeyRingName
```

If both _ZOS_SSH_KEY_RING and _ZOS_SSH_KEY_RING_LABEL are set, then only _ZOS_SSH_KEY_RING_LABEL is used.

_ZOS_SSH_KEY_RING_LABEL
Specifies the key ring owner, followed by that user's SAF key ring and certificate label within the key ring containing the input key, rather than the default or specified file names. The owner and key ring name must be separated by a '/'. One or more blanks separate the key ring name from the certificate label. Labels can contain embedded blanks. When setting the variable on a shell command line, the value must be enclosed in double quotes to preserve the blanks. The key ring can be either real or virtual.

For example:

```
KeyRingOwner/KeyRingName CertLabel
```

If both _ZOS_SSH_KEY_RING and _ZOS_SSH_KEY_RING_LABEL are set, then only _ZOS_SSH_KEY_RING_LABEL is used.

DISPLAY, SSH_ASKPASS
If **ssh-add** needs a passphrase, it will read the passphrase from the current terminal if it was run from a terminal. If **ssh-add** does not have a terminal associated with it, but DISPLAY and SSH_ASKPASS are set, it will execute the program specified by SSH_ASKPASS and open an X11 window to read the passphrase. This is particularly useful when calling **ssh-add** from an .Xsession or a script. It is necessary to redirect the input from `/dev/null` to make this work.

For example:

```
ssh-add < /dev/null
```

SSH_AUTH_SOCK
Identifies the path of a UNIX-domain socket used to communicate with the agent.

Exit values

0 Successful completion

1 An error occurred. The specified command failed.

2 An error occurred. **ssh-add** is unable to contact the authentication agent.

Related information

ssh, **ssh-agent**, **ssh-keygen**, **sshd**

Authors

OpenSSH is a derivative of the original and free ssh 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus Friedl contributed the support for SSH protocol versions 1.5 and 2.0.

ssh-agent — Authentication agent

Format

ssh-agent [**–c** | **–s**] [**–d**] [**–a** *bind_address*] [**–t** *life*] [*command_string* [*args ...*]]

ssh-agent [**–c** | **–s**] **–k**

Description

ssh-agent is a program to hold private keys used for public key authentication (RSA, DSA, ECDSA). The idea is that **ssh-agent** is started in the beginning of an X-session or a login session and all other windows or programs are started as clients to the **ssh-agent** program. Through the use of environment variables, the agent can be located and automatically used for authentication when logging in to other machines using **ssh**.

The agent initially does not have any private keys. Keys are added using **ssh-add**. When executed without arguments, **ssh-add** adds the files `~/.ssh/id_rsa`, `~/.ssh/id_dsa`, `~/.ssh/idecdsa`, and `~/.ssh/identity`. If the identity has a passphrase, **ssh-add** asks for the passphrase (using a small X11 application if running under X11 or from the terminal if running without X11). It then sends the identity to the agent. Several identities can be stored in the agent; the agent can automatically use any of these identities. **ssh-add –l** displays the identities currently held by the agent. Identities stored in the agent will take precedence over an identity specified through **ssh**'s **–i** option or IdentityFile keyword. Refer to the **-i** *identity_file* description in ssh for a summary of the order that identities are tried during public key authentication.

The concept is that the agent run is in the user's local machine. Authentication data need not be stored on any other machine and authentication passphrases never go over the network. However, the connection to the agent is forwarded over SSH remote logins and the user can thus use the privileges given by the identities anywhere in the network in a secure way.

There are two main ways to set up an agent. Either the agent starts a new subcommand into which some environment variables are exported or the agent prints the needed shell commands (either **sh** or **tcsh** syntax can be generated) which can be run with **eval** in the calling shell. Later, **ssh** looks at these variables and uses them to establish an agent. The agent will never send a private key over its request channel. Instead, operations that require a private key will be performed by the agent and the result will be returned to the requester. This way, private keys are not exposed to clients using the agent. For example:

For the **sh** syntax:

```
1. ssh-agent $SHELL
```

2. `eval 'ssh-agent -s'`

For **tcsh** syntax:

1. `ssh-agent $SHELL`
2. `eval 'ssh-agent -c'`

A UNIX-domain socket is created and the name of this socket is stored in the SSH_AUTH_SOCK environment variable. The socket is owned by the current user and is thereby accessible to processes running under the same user ID and superusers.

The SSH_AGENT_PID environment variable holds the agent's process ID. The agent exits automatically when the command given on the command line terminates.

Options

–a *bind_address*
Binds the agent to the UNIX-domain socket *bind_address*. The default is `$TMPDIR/ssh-XXXXXXXX/agent.<ppid>`. If the TMPDIR environment variable is not set, `/tmp` is used as a default.

–c
Generates C-shell (**tcsh**) commands on stdout. This is the default if SHELL looks like it is a csh style of shell.

–d
Debug mode. When this option is specified, **ssh-agent** will not fork.

–k
Kills the current agent given by the SSH_AGENT_PID environment variable). This is only necessary when **ssh-agent** is run with **eval** in the calling shell. If the agent started a new subshell then exiting the subshell will also kill the agent.

–s
Generates Bourne shell (**sh**) commands on stdout. This is the default if SHELL does not look like it is a csh style of shell.

–t *life*
Sets a default value for the maximum lifetime of identities added to the agent. The lifetime can be specified in seconds or in a time format specified in **sshd**. A lifetime specified for an identity with **ssh-add** overrides this value. Without this option, the default maximum lifetime is forever.

If a *command_string* is given, this is executed as a subprocess of the agent. When the command ends, so does the agent.

Files

~/.ssh/identity
Contains the protocol version 1 RSA authentication identity of the user.

~/.ssh/id_dsa
Contains the protocol version 2 DSA authentication identity of the user.

~/.ssh/id_ecdsa
Contains the protocol version 2 ECDSA authentication identity of the user.

~/.ssh/id_rsa
Contains the protocol version 2 RSA authentication identity of the user.

$TMPDIR/ssh-XXXXXXXXXX/agent.<ppid>
UNIX-domain sockets used to contain the connection to the authentication agent. **ppid** is the process ID of the agent's parent process. The last eight

characters of “XXXXXXXXXX ” will match ppid if the ppid is eight characters. Otherwise, “XXXXXXXXXX” is a system-generated string. These sockets should be readable only by the owner. The sockets should be automatically removed when the agent exits. If the TMPDIR environment variable is not set, the /tmp directory is used.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

SHELL
Contains the full path name of the current shell.

SSH_AGENT_PID
Holds the process ID of the agent.

SSH_AUTH_SOCK
Holds the name of the socket through which the agent is accessible.

Exit values

0	Successful completion
> 0	Failure

Related information

ssh, **ssh-add**, **ssh-keygen**, **sshd**

Authors

OpenSSH is a derivative of the original and free **ssh** 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus Friedl contributed the support for SSH protocol versions 1.5 and 2.0.

ssh-askpass — X11-based passphrase dialog for OpenSSH

Description

ssh-askpass is an X11-based passphrase dialog for use with OpenSSH. It is intended to be called from the **ssh-add** program and not invoked directly.

The user interface has a series of LED-like areas which light up one-by-one with each passphrase character entered, beginning from the left-hand edge of the dialog. When they reach the right hand edge, they go dark one-by-one again. This gives the user feedback that passphrase characters have been entered, but does not provide onlookers with a cue as to the length of the passphrase.

Pressing the OK button accepts the passphrase (even if it is empty), which is written to standard output and the dialog exits with a status of zero (success). Pressing the Cancel button discards the passphrase and the dialog exits with nonzero status.

The following keystrokes are accepted:

[Backspace] or [Delete]
Erases previous character

[Control+U] or [Control+X]
Erases entire passphrase

[Enter], [Control+M], or [Control+J]
Accepts passphrase (OK)

[Escape]
Discards passphrase (Cancel)

Files

/usr/lib/X11/app-defaults
The definition and files for **x11-ssh-askpass** are available at http://www.jmknoble.net/software/x11-ssh-askpass/.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

Exit values

0	Successful completion
> 0	Bad passphrase entered or an error occurred

Related information

ssh, **ssh-add**, **sshd**

Authors

Jamie Zawinski, Jim Knoble

ssh-keygen — Authentication key generation, management, and conversion

Format

ssh-keygen [**-q**] [**-b** *bits*] [**-t** *type*] [**-N** *new_passphrase*] [**-C** *comment*] [**-f** *output_keyfile*]

ssh-keygen –p [**–P** *old_passphrase*] [**-N** *new_passphrase*] [**–f** *keyfile*]

ssh-keygen –i [**-m** *key_format*] [**–f** *input_keyfile*]

ssh-keygen –e [**-m** *key_format*] [**–f** *input_keyfile*]

ssh-keygen –y [**-m** *key_format*] [**–f** *input_keyfile*]

ssh-keygen –c [**–P** *passphrase*] [**–C** *comment*] [**–f** *keyfile*]

ssh-keygen –l [**–f** *input_keyfile*]

ssh-keygen –B [**–f** *input_keyfile*]

ssh-keygen –D *pkcs11*

ssh-keygen –F *hostname* [**–f** *known_hosts_file*] [**–l**]

ssh-keygen –H [**–f** *known_hosts_file*]

ssh-keygen –R *hostname* [**––f** *known_hosts_file*]

ssh-keygen –r *hostname* [**–f** *input_keyfile*] [**–g**]

ssh-keygen –G *output_file* [**–v**] [**–b** *bits*] [**–M** *memory*] [**–S** *start_point*]

ssh-keygen –T *output_file* [**–f** *input_file*] [**–v**] [**–a** *num_trials*] [**-J** *num_lines*] [**-j** *start-line*] [**-K** *checkpt*] [**–W** *generator*]

ssh-keygen -s *ca_key* **-I** *certificate_identity* [**-h**] [**-n** *principals*] [-O *option*] [**-V** *validity_interval*] [**-z** *serial_number*] file ...

ssh-keygen -L [**-f** *input_keyfile*]

ssh-keygen -A

ssh-keygen -k -f *krl_file* [**-u**] [**-s** *ca_public*] [**-z** *version_number*] file ...

ssh-keygen -Q -f *krl_file* file ...

Description

ssh-keygen generates, manages, and converts authentication keys for **ssh**. It can create RSA keys for use by SSH protocol version 1 and RSA, DSA, or ECDSA keys for use by SSH protocol version 2. The type of key to be generated is specified with the **–t** option. If invoked without any arguments, **ssh-keygen** generates an RSA key for use in SSH protocol 2 connections.

ssh-keygen supports the extraction and conversion of keys that are stored in digital certificates associated with SAF key rings.

ssh-keygen is also used to generate groups for use in Diffie-Hellman Group Exchange (DH-GEX). It is a key agreement method that allows two parties to derive a shared secret key securely over an open (unprotected) network. For more details, check the IETF Internet draft "Diffie-Hellman Group Exchange for the SSH Transport Layer Protocol" at http://www.ietf.org/rfc/rfc4253.txt. For additional information, see "Moduli generation" on page 125.

If not using SAF key rings, each user who wants to use SSH with RSA, DSA, or ECDSA authentication runs **ssh-keygen** once to create the authentication key in `~/.ssh/identity`, `~/.ssh/id_dsa`, `~/.ssh/id_ecdsa`, or `~/.ssh/id_rsa`. The system administrator might also use **ssh-keygen** to generate host keys.

ssh-keygen can also be used to generate and update key revocation lists, and to test whether given keys have been revoked by one. See "Key revocation lists" on page 126 for details.

This program generates the key and asks for a file in which to store the private key. The public key is stored in a file with the same name but with ".pub" appended. The program also asks for a passphrase. A passphrase is similar to a password, except it can be a phrase with a series of words, punctuation, numbers, white space, or any string of characters you want. Unless it is empty, the passphrase must be greater than 4 characters long. However, good passphrases are 10 to 30 characters long, are not simple sentences or otherwise guessable (English prose has only 1 or 2 bits of entropy per character and provides very bad passphrases), and contain a mix of uppercase and lowercase letters, numbers, and non-alphanumeric characters. The passphrase length must also be less than 1024 characters, or it will be truncated. The passphrase can be changed later using the **–p** option.

You cannot recover a lost passphrase. If the passphrase is lost or forgotten, a new key must be generated and copied to the corresponding public key to other machines.

For RSA1 keys, there is also a comment field in the key file that is only for convenience to the user to help identify the key. The comment can tell what the key is for or whatever is useful. The comment is initialized to "user@host" when the key is created, but can be changed using the **–c** option.

When a change is made to the key (such as a comment or passphrase), the change is applied to the key file only. For the loaded keys in the SSH agent, one has to unload and reload the changed keys.

When attempting to change a key, **ssh-keygen** first tries to load the key without a passphrase if one is not specified. If that fails, it will prompt for the passphrase.

Tip: To avoid problems when running as a user that shares a UID, the **-f** option can be used to specify the location of the file to process.

Options

-a *num_trials*
Specifies the number of primality tests or trials to perform when screening DH-GEX candidates using the **-T** command. The minimum number of trials is 4.

-A For each of the key types (**rsa1**, **rsa**, **dsa** and **ecdsa**) for which host keys do not exist, generate the host keys with the default key file path, an empty passphrase, default bits for the key type, and default comment.

–b *bits* Specifies the number of bits in the key to create. For RSA keys, the minimum size is 768 bits, the maximum size is 16384 bits, and the default is 2048 bits.

Note: When the -G option is on, the minimum size is 512 bits.
Generally, 2048 bits is considered sufficient. DSA keys must be exactly 1024 bits as specified by FIPS 186-2. For ECDSA keys, the **-b** flag determines the key length by selecting from one of three elliptic curve sizes: 256, 384 or 521 bits. Attempting to use bit lengths other than these three values for ECDSA keys will fail.

–B Shows the bubble babble digest of specified private or public key file. Bubble Babble is a text format for fingerprint. For example: `1024 xekib-ridyd-mybuh-fpun-bybir-nagak-netoc-nogib-zacev-sotim-luxex user@host.pok.ibm.com`.

–c Requests changing the comment in the private and public key files. This operation is only supported for RSA1 keys. The program will prompt for the file containing the private keys, for the passphrase if the key has one, and for the new comment, when **–P**, **–C**, and **–f** are not specified. It updates both public and private keys. This option is mutually exclusive with the **–p** option. Comments are truncated after 1023 characters. In addition, the comment length is limited by the terminal interface. For long comments up to 1023 characters, use the **–C** option.

–C *comment*
Provides the new comment. The comment is truncated after 1023 characters.

–D *pkcs11*
Not supported in z/OS Unix. Download the RSA public keys provided by the PKCS#11 shared library *pkcs11*. When used in combination with **-s**, this option indicates that a CA key resides in a PKCS#11 token (see "Certificates" on page 126 for details).

–e Reads a private or public OpenSSH key file and prints a public key in RFC 4716 SSH Public Key File Format to stdout. This option allows exporting public keys for use by several commercial SSH implementations.

If using a SAF key ring on the local system, but not on a remote system, this option can be used with the _ZOS_SSH_KEY_RING_LABEL environment variable to export your public key from the key ring. The public key can then be copied to the remote system and imported with **ssh-keygen -i**.

Restriction: This option applies to protocol version 2 only.

–f *filename*
If **–F**, **–H**, or **–R** is specified, *filename* specifies the file name of the `known_hosts` file. For other options, *filename* specifies the file name of the key file. The *filename* is limited to 1023 characters including the 4 characters for ".pub" for the public keys.

For some of the options allowing [**-f** *input_keyfile*], the _ZOS_SSH_KEY_RING_LABEL environment variable can be used to specify a key ring and certificate label to be used, overriding the **-f** option. For more information about how the environment variable is used, see _ZOS_SSH_KEY_RING_LABEL.

–F *hostname*
Searches for the specified *hostname* in a `known_hosts` file, listing any occurrences found. Use this option to find hashed host names or addresses. It can also be used in conjunction with the **–H** option to print found keys in a hashed format If **-f** is not specified, `~/.ssh/known_hosts` is used.

–g Uses generic DNS resource record format when printing fingerprint resource records using the **-r** command.

–G *output_file*
Generates candidate primes for DH-GEX.

Rule: These primes must be screened for safety (using the **-T** option) before use.

–h When signing a key, create a host certificate instead of a user certificate. See "Certificates" on page 126 for details.

–H Hashes a `known_hosts` file. This option replaces all host names and addresses with hashed representations within the specified file; the original contents are moved to a file with a .old suffix. These hashes can be used normally by **ssh** and **sshd**, but they do not reveal identifying information if the file's contents are disclosed. This option will not modify existing hashed host names and is therefore safe to use on files that mix hashed and non-hashed names. If **-f** is not specified, `~/.ssh/known_hosts` is used.

–i Reads an unencrypted private (or public) key file in SSH protocol version 2 format and prints an OpenSSH compatible private (or public) key to stdout. **ssh-keygen** also reads the RFC 4716 SECSH Public Key File Format. This option allows importing keys from several commercial SSH implementations.

–I ***certificate_identity***
Specify the key identity when signing a public key. See “Certificates” on page 126 for details.

–j ***start-line***
Start screening at the specified line number while performing DH candidate screening using the **-T** option.

–J ***num_lines***
Exit after screening the specified number of lines while performing DH candidate screening using the **-T** option.

–k
Generate a KRL file. In this mode, **`ssh-keygen`** will generate a KRL file at the location specified by way of the **-f** flag that revokes every key or certificate presented on the command line. Keys/certificates to be revoked may be specified by public key file or using the format described in “Key revocation lists” on page 126.

–K ***checkpt***
Write the last line processed to the file *checkpt* while performing DH candidate screening using the **-T** option. This will be used to skip lines in the input file that have already been processed if the job is restarted. This option allows importing keys from other software, including several commercial SSH implementations. The default import format is “RFC4716”.

–l
Shows the fingerprint of specified public key file. Private protocol version 1 RSA1 keys are also supported. For RSA and DSA keys, **ssh-keygen** tries to find the matching public key file and prints its fingerprint. For example: `1024 7d:74:a5:4b:7b:10:5d:62:4b:9f:f3:1c:14:32:b8:74 user@host.pok.ibm.com`. If combined with **-v**, an ASCII art representation of the key is supplied with the fingerprint.

–L
Prints the contents of a certificate.

–m ***key_format***
Specify a key format for the **-i** (import) or **-e** (export) conversion options. The supported key formats are: “RFC4716” (RFC 4716/SSH2 public or private key), “PKCS8” (PEM PKCS8 public key) or “PEM” (PEM public key). The default conversion format is “RFC4716”.

–M *memory*
Specifies the amount of memory (in megabytes) to use when generating candidate moduli for DH-GEX. The number of specified megabytes must be an integer value greater than 7 and less than 128.

–n ***principals***
Specify one or more principals (user or host names) to be included in a certificate when signing a key. Multiple principals may be specified, separated by commas. See “Certificates” on page 126 for details.

–N *new_passphrase*
Provides the new passphrase. When **–t** *type* or **–d** options are used, the **–P** value will be used for passphrase regardless if **–N** is specified. If **–P** is not specified with **–t** *type* or **–d**, the **–N** value will be used for the passphrase.

Rule: Do not specify passphrases on the command line because this method allows the passphrase to be visible (for example, when the **ps** utility is used).

–O*option*
Specify a certificate option when signing a key. This option may be

specified multiple times. See "Certificates" on page 126 for details. The options that are valid for user certificates are as follows:

clear Clear all enabled permissions. This is useful for clearing the default set of permissions so permissions may be added individually.

force-command=command
Forces the execution of command instead of any shell or command specified by the user when the certificate is used for authentication.

no-agent-forwarding
Disable ssh-agent(1) forwarding (permitted by default).

no-port-forwarding
Disable port forwarding (permitted by default).

no-pty Disable PTY allocation (permitted by default).

no-user-rc
Disable execution of `~/.ssh/rc` by sshd(8) (permitted by default).

no-x11-forwarding
Disable X11 forwarding (permitted by default).

permit-agent-forwarding
Allows ssh-agent(1) forwarding.

permit-port-forwarding
Allows port forwarding.

permit-pty
Allows PTY allocation.

permit-user-rc
Allows execution of `~/.ssh/rc` by sshd(8).

permit-x11-forwarding
Allows X11 forwarding.

source-address=address_list
Restrict the source addresses from which the certificate is considered valid. The *address_list* is a comma separated list of one or more address/netmask pairs in CIDR format.

At present, no options are valid for host keys.

–p Requests changing the passphrase of a private key file instead of creating a new private key. The program will prompt for the file containing the private key, for the old passphrase, and twice for the new passphrase.

–P *passphrase*
Provides the old passphrase. When the **–t** *type* or **–d** options are used, the **–P** value is used for the passphrase regardless if **–N** is specified. When the **–t** *type* or **–d** options are used, it is recommended that **–N** *new_passphrase* be used instead of **–P** *passphrase*.

Rule: Do not specify passphrases on the command line because this method allows the passphrase to be visible (for example, when the **ps** utility is used).

–q Suppresses messages. Useful when called from a script.

–Q Test whether keys have been revoked in a Key Revocation List.

–r *hostname*

Prints the SSHFP fingerprint resource record named *hostname* for the specified public key file. If **-f** is not specified, the default files `/etc/ssh/ssh_host_rsa_key` and `/etc/ssh/ssh_host_dsa_key` are used in sequence.

–R *hostname*

Removes all keys belonging to *hostname* from a `known_hosts` file. Use this option to delete hashed hosts (see the **-H** option). If **-f** is not specified, `~/.ssh/known_hosts` is used.

–s *ca_key*

Certify (sign) a public key using the specified CA key. See “Certificates” on page 126 for details.

When generating a key revocation list, **-s** specifies a path to a CA public key file used to revoke certificates directly by key ID or serial number. See “Key revocation lists” on page 126 for details

–S *start*

Specifies the start point in hexadecimal format when generating candidate moduli for DH-GEX. The specified start point must be a valid hexadecimal value.

–t *type* Specifies the type of the key to create. The possible values are "rsa1" for protocol version 1 and "rsa", "dsa", or "ecdsa" for protocol version 2. The program will prompt for the file name to contain the private keys and passphrase, if **–P** or **–N**, and **–f** is not specified.

–T *output_file*

Tests Diffie-Hellman Group Exchange candidate primes (generated using the **-G** option) for safety.

–u Update a key revocation list (KRL). When specified with **-k**, keys listed by way of the command line are added to the existing KRL rather than a new KRL being created.

–U *reader*

Not supported in z/OS UNIX. Uploads an existing RSA private key into the smart card in reader.

–v Verbose mode. Causes **ssh-keygen** to print debugging messages about its progress. The messages are helpful for debugging moduli generation. Multiple **–v** options increase the verbosity. You can specify up to three **-v** options.

–V *validity_interval*

Specify a validity interval when signing a certificate. A validity interval may consist of a single time, indicating that the certificate is valid beginning now and expiring at that time, or may consist of two times separated by a colon to indicate an explicit time interval. The start time may be specified as a date in YYYYMMDD format, a time in YYYYMMDDHHMMSS format or a relative time (to the current time) consisting of a minus sign followed by a relative time in the format described in the TIME FORMATS section of sshd_config(5). The end time may be specified as a YYYYMMDD date, a YYYYMMDDHHMMSS time or a relative time starting with a plus character.

For example: “+52w1d” (valid from now to 52 weeks and one day from now), “-4w:+4w” (valid from four weeks ago to four weeks from now), "20100101123000:20110101123000" (valid from 12:30 PM, January 1st, 2010 to 12:30 PM, January 1st, 2011), "-1d:20110101" (valid from yesterday to midnight, January 1st, 2011).

–W *generator*
Specifies the desired generator when testing candidate module for DH-GEX. Valid generator values are 2, 3, or 5.

–x Same as **–e**. It is recommended that **–e** be used instead of **–x**.

–X Same as **–i**. It is recommended that **–i** be used instead of **–X**.

–y Reads a private OpenSSH format file and prints an OpenSSH public key to stdout.

–z ***serial_number***
Specifies a serial number to be embedded in the certificate to distinguish this certificate from others from the same CA. The default serial number is zero.

When generating a key revocation list (KRL), the **-z** flag is used to specify a KRL version number.

Moduli generation

You can use **ssh-keygen** to generate groups for the Diffie-Hellman Group Exchange (DH-GEX) protocol. DH-GEX is a key agreement method that allows two parties to derive a shared secret key securely over an open (unprotected) network.

Generating these groups is a two-step process. First, candidate primes are generated using a fast, but memory-intensive process. These candidate primes are then tested for suitability, which is a CPU-intensive process.

Use the **-G** option to generate the primes. You can specify the length of the primes using the **-b** option.

For example:

```
ssh-keygen -G moduli-2048.candidates -b 2048
```

By default, the search for primes begins at a random point in the desired length range. You can override this using the **-S** option, which specifies a different start point (in hex).

After a set of candidates has been generated, the candidates must be tested for suitability using the **-T** option. In this mode, **ssh-keygen** reads the candidates from standard input (or a file specified using the **-f** option).

For example:

```
ssh-keygen -T moduli-2048 -f moduli-2048.candidates
```

By default, each candidate is subject to 100 primality tests. You can override the default by using the **-a** option. The DH generator value is automatically chosen for the prime under consideration. If you want a specific generator, you can request it using the **-W** option. Valid generator values are 2, 3 and 5.

You can install screened DH groups in `/etc/ssh/moduli`.

Requirement: The `/etc/ssh/moduli` file must contain moduli of a range of bit lengths, and both ends of a connection must share common moduli.

Certificates

ssh-keygen supports signing of keys to produce certificates that may be used for user or host authentication. Certificates consist of a public key, some identity information, zero or more principal (user or host) names and a set of options that are signed by a Certification Authority (CA) key. Clients or servers may then trust only the CA key and verify its signature on a certificate rather than trusting many user/host keys.

Note: OpenSSH certificates are a different, and much simpler, format to the X.509 certificates used in SSL / TLS. Unlike individual user/host keys, which may be stored in a SAF key ring, SSH certificates may not be stored in SAF key ring.

ssh-keygen supports two types of certificates: user and host. User certificates authenticate users to servers, whereas host certificates authenticate server hosts to users. To generate a user certificate, do the following:

```
ssh-keygen -s /path/to/ca_key -I key_id /path/to/user_key.pub
```

The resultant certificate will be placed in /path/to/user_key-cert.pub. A host certificate requires the **-h** option:

```
ssh-keygen -s /path/to/ca_key -I key_id -h /path/to/host_key.pub
```

The host certificate will be output to /path/to/host_key-cert.pub.

In all cases, *key_id* is a "key identifier" that is logged by the server when the certificate is used for authentication.

Certificates may be limited to be valid for a set of principal (user/host) names. By default, generated certificates are valid for all users or hosts. To generate a certificate for a specified set of principals:

```
ssh-keygen -s ca_key -I key_id -n user1,user2 user_key.pub
ssh-keygen -s ca_key -I key_id -h -n host.domain user_key.pub
```

Additional limitations on the validity and use of user certificates may be specified through certificate options. A certificate option may disable features of the SSH session, may be valid only when presented from particular source addresses or may force the use of a specific command. For a list of valid certificate options, see **-O** in “Options” on page 120.

Finally, certificates may be defined with a validity lifetime. The **-V** option allows specification of certificate start and end times. A certificate that is presented at a time outside this range will not be considered valid. By default, certificates are valid from UNIX Epoch to the distant future.

For certificates to be used for user or host authentication, the CA public key must be trusted by **sshd** or **ssh**.

Key revocation lists

ssh-keygen is able to manage OpenSSH format key revocation lists (KRLs). These binary files specify keys or certificates to be revoked using a compact format, taking as little a one bit per certificate if they are being revoked by serial number.

KRLs may be generated using the **-k** flag. This option reads one or more files from the command line and generates a new KRL. The files may either contain a KRL specification (see below) or public keys, listed one per line. Plain public keys are revoked by listing their hash or contents in the KRL and certificates revoked by serial number or key ID (if the serial is zero or not available).

Revoking keys using a KRL specification offers explicit control over the types of record used to revoke keys and may be used to directly revoke certificates by serial number or key ID without having the complete original certificate on hand. A KRL specification consists of lines containing one of the following directives followed by a colon and some directive-specific information:

serial: *serial_number[-serial_number]*
Revokes a certificate with the specified serial number. Serial numbers are 64-bit values, not including zero and may be expressed in decimal, hex or octal. If two serial numbers are specified separated by a hyphen, then the range of serial numbers including and between each is revoked. The CA key must have been specified on the **ssh-keygen** command line using the **-s** option.

id:*key_id*
Revokes a certificate with the specified key ID string. The CA key must have been specified on the **ssh-keygen** command line using the **-s** option.

key: *public_key*
Revokes the specified key. If a certificate is listed, then it is revoked as a plain public key.

sha1: *public_key*
Revokes the specified key by its SHA1 hash.

KRLs may be updated using the **-u** flag in addition to **-k**. When this option is specified, keys listed by way of the command line are merged into the KRL, adding to those already there.

It is also possible, given a KRL, to test whether it revokes a particular key (or keys). The **-Q** flag will query an existing KRL, testing each key specified on the command line. If any key listed on the command line has been revoked (or an error encountered), then **ssh-keygen** will exit with a non-zero exit status. A zero exit status will only be returned if no key was revoked.

Files

/etc/ssh/moduli
Contains Diffie-Hellman groups used for DH-GEX. The file format is described in moduli.

~/.ssh/identity
Contains the protocol version 1 RSA authentication identity of the user. This file should not be readable by anyone but the user. It is possible to specify a passphrase when generating the key; that passphrase will be used to encrypt the private part of this file using 3DES. This file is not automatically accessed by **ssh-keygen**, but it is offered as the default file for the private key. **ssh** reads this file when a login attempt is made.

~/.ssh/identity.pub
Contains the protocol version 1 RSA public key for authentication. The contents of this file should be added to the `~/.ssh/authorized_keys` file on all machines where the user wants to log in using RSA authentication. You do not need to keep the contents of this file secret.

~/.ssh/id_dsa
Contains the protocol version 2 DSA authentication identity of the user.

This file should not be readable by anyone but the user. It is possible to specify a passphrase when generating the key; that passphrase will be used to encrypt the private part of this file using 128-bit AES. This file is not automatically accessed by **ssh-keygen**, but it is offered as the default file for the private key. **ssh** reads this file when a login attempt is made.

~/.ssh/id_ecdsa
Contains the protocol version 2 ECDSA authentication identity of the user. This file should not be readable by anyone but the user. It is possible to specify a passphrase when generating the key; that passphrase will be used to encrypt the private part of this file using 128-bit AES. This file is not automatically accessed by **ssh-keygen**, but it is offered as the default file for the private key. **ssh** reads this file when a login attempt is made.

~/.ssh/id_dsa.pub
Contains the protocol version 2 DSA public key for authentication. The contents of this file should be added to the `~/.ssh/authorized_keys` file on all machines where the user wants to log in using DSA authentication. You do not need to keep the contents of this file a secret.

~/.ssh/id_ecdsa.pub
Contains the protocol version 2 ECDSA public key for authentication. The contents of this file should be added to the `~/.ssh/authorized_keys` file on all machines where the user wants to log in using ECDSA authentication. You do not need to keep the contents of this file a secret.

~/.ssh/id_rsa
Contains the protocol version 2 RSA authentication identity of the user. This file should not be readable by anyone but the user. It is possible to specify a passphrase when generating the key; that passphrase will be used to encrypt the private part of this file using 3DES. This file is not automatically accessed by **ssh-keygen**, but it is offered as the default file for the private key. **ssh** reads this file when a login attempt is made.

~/.ssh/id_rsa.pub
Contains the protocol version 2 RSA public key for authentication. The contents of this file should be added to `~/.ssh/authorized_keys` on all machines where the user wants to log in using RSA authentication. You do not need to keep the contents of this file secret.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SSH_KEY_RING_LABEL
Specifies the key ring owner, followed by that user's SAF key ring and certificate label within the key ring containing the input key, rather than the file specified as **-f** *input_keyfile*, on some **ssh-keygen** options. The key ring owner and key ring name must be separated by a '/'. One or more blanks separate the key ring name from the certificate label. Labels can contain embedded blanks. When setting the variable on a shell command line, the value must be enclosed in double quotes to preserve the blanks.

For example:

```
KeyRingOwner/KeyRingName CertLabel
```

The key ring can be either real or virtual.

This variable is used on the following options: **-e**, **-l**, **-r**, **-y**, and **-B**. Other options that use the **-f** *input_keyfile* will ignore this variable.

Exit values

0	Successful completion
> 0	Failure

Related information

ssh, **ssh-add**, **ssh-agent**, **sshd**

Authors

OpenSSH is a derivative of the original and free ssh 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus Friedl contributed the support for SSH protocol versions 1.5 and 2.0.

ssh-keyscan — Gather ssh public keys

Format

ssh-keyscan [**–46Hv**] [**–f** *file*] [**–p** *port*] [**–T** *timeout*] [**–t** *type*] [*host* | *addrlist namelist*] [...]

Description

ssh-keyscan is a command for gathering the public host keys for a number of hosts. It aids in building and verifying `ssh_known_hosts` files. **ssh-keyscan** provides a minimal interface suitable for use by shell and Perl scripts.

ssh-keyscan uses non-blocking socket I/O to contact as many hosts as possible in parallel, so it is very efficient. For successful host key collection, you do not need login access to the machines that are being scanned, nor does the scanning process involve any encryption.

If a machine being scanned is down or is not running **sshd**, the public key information cannot be collected for that machine. The return value is not altered and a warning message might be displayed.

For example:

```
ssh-keyscan hostname1 hostname2
hostname1: exception!
(hostname2's rsa1 key displayed here)
```

Options

–4 Forces **ssh-keyscan** to use IPv4 addresses only. If both **–4** and **–6** are specified, **ssh-keyscan** uses the option that appears last on the command line.

–6 Forces **ssh-keyscan** to use IPv6 addresses only. If both **–4** and **–6** are specified, **ssh-keyscan** uses the option that appears last on the command line.

–f *file* Reads *hosts* or *addrlist namelist* pairs from this file, one per line. If **–** is supplied instead of a file name, **ssh-keyscan** reads *hosts* or *addrlist namelist* pairs from the standard input.

–H Hashes all host names and addresses in the output. Hashed names can be used normally by **ssh** and **sshd**, but they do not reveal identifying information if the host's contents are disclosed.

Note: Only one hashed hostname can appear on a single line and no wildcard operators can be applied.

–p *port*
Port to connect to on the remote host.

–t *type* Specifies the type of the key to fetch from the scanned hosts. The possible values are "rsa1" for protocol version 1 and "rsa", "dsa", or "ecdsa" for protocol version 2. If the **-t** option is not specified, **ssh-keyscan** searches only for SSH protocol version 2 “rsa” and “ecdsa” keys by default.

–T *timeout*
Sets the timeout for connection attempts. If timeout seconds have elapsed since a connection was initiated to a host or since the last time anything was read from that host, then the connection is closed and the host in question considered unavailable. The default is 5 seconds.

–v Verbose mode. Causes **ssh-keyscan** to print debugging messages about its progress. Multiple **-v** options increase the verbosity. You can specify up to three **-v** options.

File formats

Input format
Each line of the input file shall consist of either *hosts* or *addrlist namelist* pairs. *Hosts* is either a single or comma-delimited list of hosts. *Addrlist* is a single or comma-separated list of IP addresses and *namelist* is either a single or comma-delimited list of hosts. *Addrlist namelist* pairs are separated by white space.

Example: Examples of input file lines:

```
1.2.3.4
name.my.domain
1.2.3.4,1.2.4.4
1.2.3.4,1.2.4.4 name.my.domain,name,n.my.domain,n
name.my.domain,1.2.3.4,name,n,1.2.4.4,n.my.domain
```

Output format for rsa1 keys
host-or-namelist bits exponent modulus

Output format for rsa, dsa and ecdsa keys
host-or-namelist keytype base64-encoded-key where keytype is either *ssh-rsa* for an RSA key, *ssh-dss* for a DSA key, and ecdsa-sha2-nistp256, ecdsasha2- nistp384, or ecdsa-sha2-nistp521 for ECDSA keys.

Files

/etc/ssh/ssh_known_hosts
System-wide list of known host keys. This file should be prepared by the system administrator to contain the public host keys of all machines in the organization. See “ssh_known_hosts file format” on page 139 for further details of the format of this file. This file must be writeable only by the owner and only be world-readable.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

Exit values

0 Successful completion

> 0 An error occurred

Usage note

ssh-keyscan generates `Connection closed by remote host` messages on the consoles of all the machines it scans if the server is older than version 2.9. The connection is closed because it opens a connection to the **ssh** port, reads the public key, and drops the connection as soon as it gets the key.

Related information

ssh, **sshd**

Authors

David Mazieres wrote the initial version, and Wayne Davison added support for protocol version 2.

ssh-keysign — ssh helper program for host-based authentication

Format

ssh-keysign

Description

ssh-keysign is used by **ssh** to access the local host keys and generate the digital signature that is required during host-based authentication with SSH protocol version 2. **ssh-keysign** is not intended to be invoked by the user, but from **ssh**. See ssh and sshd for more information about host-based authentication.

ssh-keysign is disabled by default. It can only be enabled in the global client configuration file `/etc/ssh/ssh_config` by setting EnableSSHKeysign to "yes".

Files

/etc/ssh/ssh_config
Controls whether **ssh-keysign** is enabled. EnableSSHKeysign must be set to “yes” in this file.

/etc/ssh/ssh_host_dsa_key, /etc/ssh/ssh_host_rsa_key, /etc/ssh/ssh_host/ecdsa_key
These files contain the private parts of the host keys used to generate the digital signature. They should be owned by a superuser, readable only by a superuser, and not accessible by others.

Restriction: Because they are readable only by UID 0, **ssh-keysign** must be setuid 0 if host-based authentication is used.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

Exit values

0	Successful completion
> 0	An error occurred

Related information

ssh, **ssh-keygen**, **ssh_config**, **sshd**

Authors

Markus Friedl

sshd — OpenSSH daemon

Format

sshd [**-46dDeiqTt**] [**–b** *bits*] [**-C** *connection_spec*] [**-c** *host_certificate_file*] [**-E** *log_file*] [**–f** *config_file*] [**–g** *login_grace_time*] [**–h** *host_key_file*] [**–k** *key_gen_time*] [**–o** *option*] [**–p** *port*] [**–u** *len*]

Description

sshd (OpenSSH daemon) is the daemon program for **ssh**. Together, these programs are an alternative to **rlogin** and **rsh** and provide encrypted communications between two untrusted hosts over an insecure network.

sshd listens for connections from clients. It is typically started when z/OS UNIX is initialized. (See Chapter 5, “For system administrators,” on page 21 for more information about starting **sshd**.) It forks a new daemon for each incoming connection. The forked daemons handle key exchange, encryption, authentication, command execution, and data exchange. This implementation of **sshd** supports both SSH protocol versions 1 and 2 simultaneously. The default **sshd** configuration only runs protocol version 2

OpenSSH can be configured to collect SMF login failure records for **sshd** as well as server transfer completion records that are associated with "internal-sftp". See “Steps for setting up the system to collect OpenSSH SMF records” on page 50 for more information. See Chapter 12, “SMF Type 119 records for OpenSSH,” on page 201 for more information about the SMF login failure records (subtype 98) and server transfer completion records (subtype 96).

OpenSSH can be set up to use ICSF to implement certain **sshd** ciphers and MAC algorithms. This extension enables **sshd** to use hardware support when applicable. See “Setting up OpenSSH to use ICSF cryptographic operations” on page 52 for more information.

OpenSSH can be set up to run in FIPS mode. This extension enables **sshd** to comply with FIPS 140-2 mode when applicable. See “Setting up OpenSSH to run in FIPS mode” on page 58 for more information. OpenSSH can be set up to use ICSF to implement certain **ssh** Key Exchange algorithms. See “Setting up OpenSSH to use ICSF cryptographic operations” on page 52 for more information.

Options

sshd can be configured using command-line options or a **sshd_config** configuration file (the default is **/etc/ssh/sshd_config**); command-line options override values specified in the configuration file. **sshd** can also obtain z/OS-specific configuration data from a system-wide **/etc/ssh/sshd_config** configuration file.

sshd rereads its configuration files, including z/OS-specific files, when it receives a hang up signal, SIGHUP, by executing itself with the name and options it was started with; for example, `/usr/sbin/sshd`.

For more information about the configuration files, see sshd_config and zos_sshd_config.

–4 Forces **sshd** to use IPv4 addresses only. If both **–4** and **–6** are specified, **sshd** uses the option that appears last on the command line.

–6 Forces **sshd** to use IPv6 addresses only. If both **–4** and **–6** are specified, **sshd** uses the option that appears last on the command line.

–b *bits* Specifies the number of bits in the ephemeral protocol version 1 server key (default 1024).

–c *host_certificate_file*
Specifies a path to a certificate file to identify **sshd** during key exchange. The certificate file must match a host key file specified using the **-h** option or the HostKey configuration directive.

–C *connection-spec*
Specify the connection parameters to use for the **-T** extended test mode. If provided, any Match directives in the configuration file that would apply to the specified user, host, and address will be set before the configuration is written to standard output. The connection parameters are supplied as keyword=value pairs. The keywords are “user”, “host”, “laddr”, “lport”, and “addr”. All are required and may be supplied in any order, either with multiple **-C** options or as a comma-separated list.

–d Debug mode. The server sends verbose debug output to the system log (if **sshd** is invoked with **–i**) or stderr, and does not put itself in the background. The server also will not fork and will only process one connection. This option is only intended for debugging for the server. Multiple **–d** options increase the debugging level. You can specify up to three **-v** options.

–D **sshd** does not fork and does not become a daemon. This allows for easy monitoring of **sshd**.

–e **sshd** sends the output to standard error instead of the system log. This option is only useful when **sshd** is not running as a daemon (for example, when **sshd** is started with the **–D** option).

–E ***log_file***
: Append debug logs to *log_file* instead of the UNIX system log (syslogd).

–f *config_file*
: Specifies the name of the **sshd_config** configuration file. The default is `/etc/ssh/sshd_config`. **sshd** will not start if there is no **sshd_config** configuration file. This option has no effect on the z/OS-specific configuration file.

–g *login_grace_time*
: Gives the grace time for clients to authenticate themselves (default 120 seconds). If the client fails to authenticate the user within this many seconds, the server disconnects and exits. A value of zero indicates no limit.

–h *host_key_file*
: Specifies a file from which a host key is read.

If **sshd** is not run as UID(0), a host key must often be provided by another method because the default host key files are normally not readable by anyone but a superuser. Host keys can be provided by either using this option or by specifying a host key with either the HostKey or HostKeyRingLabel configuration options. For full details of the options and their values, see sshd_config and zos_sshd_config.

The default host key file is `/etc/ssh/ssh_host_key` for protocol version 1. For protocol version 2, the default host key files are `/etc/ssh/ssh_host_rsa_key` , `/etc/ssh/ssh_host_dsa_key`, and `/etc/ssh/ssh_host_ecdsa_key`. It is possible to have multiple host keys for the different protocol versions and host key algorithms.

Restriction: This option is not supported if running in FIPS mode.

–i
: Specifies that **sshd** is being run from **inetd**. **sshd** is normally not run from **inetd** because it needs to generate the server key before it can respond to the client and this might decrease performance. Clients would have to wait too long if the key was regenerated every time. However, with small key sizes (such as 512), using **sshd** from **inetd** might be feasible.

–k *key_gen_time*
: Specifies how often the ephemeral protocol version 1 server key is regenerated (default 3600 seconds or one hour). The motivation for regenerating the key fairly often is that the key is not stored anywhere, and after about an hour, it becomes impossible to recover the key for decrypting intercepted communications even if the machine is cracked into or physically seized. A value of zero indicates that the key will never be regenerated. The key will only be regenerated if it has been used.

–o *option*
: Can be used to give options in the format used in the **sshd_config** and **zos_sshd_config** configuration files. This is useful for specifying options for which there is no separate command-line flag. For full details of the options and their values, see sshd_config and zos_sshd_config.

–p *port*
: Specifies the port on which the server listens for connections (default 22). Multiple port options are permitted. Ports specified in the **sshd_config** configuration file with the Port option are ignored when a command-line

port is specified. Ports specified using the ListenAddress option override command-line ports. More information about those options can be found in Port and ListenAddress.

–q Quiet mode. Nothing is sent to the system log. Typically, the beginning, authentication, and termination of each connection is logged.

–t Test mode. Only checks the validity of the **sshd_config** configuration file and sanity of the keys. This option is useful for updating **sshd** reliably because configuration options might change.

–T Extended test mode. Check the validity of the configuration file, output the effective configuration to stdout and then exit. Optionally, Match rules may be applied by specifying the connection parameters using one or more **-C** options.

–u *len* This option is used to specify the size of the field in the utmpx structure that holds the remote host name. If the resolved host name is longer than *len*, the dotted decimal value will be used instead. This allows hosts with very long host names that overflow this field to still be uniquely identified. Specifying **–u0** indicates that only dotted decimal addresses should be put into the utmpx file. **–u0** can also be used to prevent **sshd** from making DNS requests unless the authentication mechanism or configuration requires it. Authentication mechanisms that might require DNS include RhostsRSAAuthentication, HostbasedAuthentication, and using a *from="pattern-list"* option in a key file. Configuration options that require DNS include using a *user@host* pattern in AllowUsers or DenyUsers.

Authentication

The OpenSSH SSH daemon supports SSH protocols versions 1 and 2. Protocol version 2 is supported by default, though this can be changed by using the Protocol keyword in **sshd_config**. (The keyword is described in Protocol.) Protocol version 2 supports both RSA and DSA keys; protocol version 1 only supports RSA keys. For both protocols, each host has a host-specific key used to identify the host.

Forward security for protocol version 1 is provided through an additional server key that is generated when the server starts. This key is typically regenerated every hour if it has been used, and is never stored on disk. Whenever a client connects, the daemon responds with its public host and server keys. The client compares the RSA host key against its own database to verify that it has not changed. The client then generates a 256-bit random number. It encrypts this random number using both the host key and the server key, and sends the encrypted number to the server. Both sides then use this random number as a session key which is used to encrypt all further communications in the session. The rest of the session is encrypted using a conventional cipher, currently Blowfish or 3DES, with 3DES being used by default. The client selects the encryption algorithm to use from those offered by the server.

For protocol version 2, forward security is provided through a Diffie-Hellman key agreement. This key agreement results in a shared session key. The rest of the session is encrypted using a symmetric cipher. The client selects the encryption algorithm to use from those offered by the server. For a list of ciphers, see Ciphers. Additionally, session integrity is provided through a cryptographic message authentication code. For a list of MACs keywords, see MACs.

Finally, the server and the client enter an authentication dialog. The client tries to authenticate itself using host-based authentication (which is disabled by default), public key authentication, challenge-response authentication (which is not supported on z/OS UNIX), or password authentication.

If the client successfully authenticates itself, a dialog for preparing the session is entered. At this time the client can request tasks such as allocating a pty, forwarding X11 connections, forwarding TCP connections, or forwarding the authentication agent connection over the secure channel.

After this, the client either requests a shell or execution of a command. The sides then enter session mode. In this mode, either side can send data at any time, and such data is forwarded to and from the shell or command on the server side, and the user terminal on the client side.

When the user program terminates and all forwarded X11 and other connections have been closed, the server sends command exit status to the client, and both sides exit.

Login process

When a user successfully logs in and privilege separation is disabled, **sshd** goes through the following series of steps. If privilege is enabled, then Step 4 is done first, and then Steps 1, 2, 3, 5, 6, 7, 8, and 9 in that order. As a result, the `/etc/motd`, `/etc/nologin` and `~/.hushlogin` path names are relative to the user's new root directory.

1. If the login is on a tty and no command has been specified, prints last login time and `/etc/motd` (unless prevented in the configuration file or by `~/.hushlogin`; see “Files” on page 141 for details).
2. If the login is on a tty, records login time to the utmpx database.
3. If the user is not a superuser, checks `/etc/nologin`; if it exists, prints contents and quits.
4. Changes to run with normal user privileges. The changes include processing the **sshd_config** ChrootDirectory keyword. As a result, path name processing after this point is relative to the user's new root directory. The keyword is described in ChrootDirectory.
5. Sets up basic environment.
6. Reads the `~/.ssh/environment` file if it exists and if users are allowed to change their environment. See the keyword PermitUserEnvironment.
7. Changes to the user's home directory.
8. If the `~/.ssh/rc` file exists, runs it; or, if `/etc/ssh/sshrc` exists, runs it; otherwise runs the xauth program. The rc files are given the X11 authentication protocol and cookie in standard input. This method of reading only the first startup file found differs from that of the z/OS shells.
9. Runs the user's shell or command.

Format of the authorized_keys file

The AuthorizedKeysFile keyword specifies the file containing public keys for public key authentication. If none is specified, the default is `~/.ssh/authorized_keys` and `~/.ssh.authorized_keys2`.

Each line of the file contains one key specification (empty lines and lines starting with # are ignored as comments).

- Protocol version 1 public keys consist of the following space-separated fields: options, bits, exponent, modulus, comment. The bits, exponent, modulus, and comment fields give the RSA key for protocol version 1.
- Protocol version 2 public keys that are not in key rings consist of options, keytype, base64-encoded key, comment. The options field is optional; its presence is determined by whether the line starts with a number (the options field never starts with a number).

  Protocol version 2 public keys that are in a key ring only consist of options, one of which must be the *zos-key-ring-label* option.

  For protocol version 2, the keytype is "ssh-dss", "ssh-rsa", “ecdsa-sha2-nistp256”, “ecdsa-sha2- nistp384”, or “ecdsa-sha2-nistp521”.

Lines in this file are typically several hundred bytes long (because of the size of the public key encoding) up to a limit of 8 kilobytes, which permits DSA keys up to 8 kilobits and RSA keys up to 16 kilobits. To avoid typing them, copy the `identity.pub`, `id_dsa.pub`, `id_ecdsa.pub`, or `id_rsa.pub` file and edit it.

sshd enforces a minimum RSA key modulus size for protocol version 1 and protocol version 2 keys of 768 bits.

The options field (if present) consists of comma-separated option specifications. No spaces are permitted, except within double quotes. The following option specifications are supported (note that option keywords are not case sensitive):

cert-authority

Specifies that the listed key is a certification authority (CA) that is trusted to validate signed certificates for user authentication.

Certificates may encode access restrictions similar to these key options. If both certificate restrictions and key options are present, the most restrictive union of the two is applied.

command="command"

Specifies that the command is executed whenever this key is used for authentication. The command supplied by the user (if any) is ignored. The command is on a pseudo terminal (pty) if the client requests a pty; otherwise it is run without a tty. If an 8-bit clean channel is required, do not request a pty or should specify no-pty. A quote can be included in the command by quoting it with a backslash. This option can be useful to restrict certain public keys to perform just a specific operation. An example might be a key that permits remote backups but nothing else. The client can specify any combination of TCP and X11 forwarding unless they are explicitly prohibited. The command originally supplied by the client is available in the SSH_ORIGINAL_COMMAND environment variable. This option applies to shell, command, or subsystem execution.

Note: This command may be superseded by either a sshd_config(5) ForceCommand directive or a command embedded in a certificate.

environment="NAME=value"

Specifies that the string is to be added to the environment when logging in using this key. Environment variables set this way override other default environment values. See “Environment variables” on page 110 in **ssh** for more information. Multiple options of this type are permitted. Environment processing is disabled by default and is controlled by means of the PermitUserEnvironment option. This option is automatically disabled if UseLogin is enabled.

See PermitUserEnvironment for information about environment variable processing and precedence rules. The **sshd_config** keyword UseLogin is documented in UseLogin.

from="pattern-list"

Specifies that in addition to public key authentication, the canonical name of the remote host must be present in the comma-separated list of patterns. The purpose of this option is to increase security; public key authentication by itself does not trust the network or name servers or anything but the key. However, if the key is stolen, this additional option makes using a stolen key more difficult because name servers and routers would have to be compromised in addition to just the key.

The purpose of this option is to optionally increase security: public key authentication by itself does not trust the network or name servers or anything (but the key); however, if somebody somehow steals the key, the key permits an intruder to log in from anywhere in the world. This additional option makes using a stolen key more difficult (name servers and/or routers would have to be compromised in addition to just the key).

See "Patterns" on page 163 for more information about patterns.

no-agent-forwarding

Prevents authentication agent forwarding when this key is used for authentication.

no-port-forwarding

Prevents TCP forwarding when this key is used for authentication. Any port forward requests by the client will return an error. This option can be used in conjunction with the command option.

no-pty Prevents tty allocation (a request to allocate a pty will fail).

no-user-rc

Disables execution of the `~/.ssh/rc` file.

no-X11-forwarding

Prevents X11 forwarding when this key is used for authentication. Any X11 forward requests by the client will return an error.

permitopen="host:port"

Limits local **ssh –L** port forwarding such that it can only connect to the specified host and port. IPv6 addresses can be specified with an alternate syntax: *host*/*port*. Use commas to separate multiple permitopen options. No pattern matching is performed on the specified host names, they must be literal domains or addresses. A port specification of "*" matches any port.

Appendix B, "OpenSSH - port forwarding examples," on page 519 has examples of port forwarding.

principals="principals"

On a cert-authority line, specifies allowed principals for certificate authentication as a comma separated list. At least one name from the list must appear in the certificate's list of principals for the certificate to be accepted. This option is ignored for keys that are not marked as trusted certificate signers using the cert-authority option.

tunnel="n"

This option is ignored on z/OS UNIX. Forces a tunnel device on the server. Without this option, the next available device is used if the client requests a tunnel.

zos-key-ring-label="*KeyRingOwner/KeyRingName label*"

Specifies the key ring owner, key ring name, and the certificate label within the key ring on the OpenSSH server that contains the user's public key. One or more blanks separate the key ring (real or virtual) name from the certificate label. Certificate labels can contain embedded blanks. The option value must be enclosed in double quotes. Key fields following the options (on the same line) are ignored.

Requirements: These requirements must be met.

- The certificate must be copied from the client system and added to the user's key ring on the OpenSSH server.
- If the user is not storing the authorized keys in a key ring, then the public key must be extracted from the certificate and added to the user's authorized keys on the OpenSSH server.

If a key ring is being used on the server side (for example, SSHAuthKeysRing), it was created in the user authentication setup described in "Steps for setting up user authentication when using key rings to store keys" on page 76.

An example of an `authorized_keys` file:

```
# Comments allowed at start of line
ssh-rsa AAAAB3Nza...LiPk== user@example.net
from="*.sales.example.net,!pc.sales.example.net" ssh-rsa AAAAB2...19Q== john@example.net
command="dump /home",no-pty,no-port-forwarding ssh-dss AAAAC3...51R== example.net
permitopen="192.0.2.1:80",permitopen="192.0.2.2:25" ssh-dss AAAAB5...21S==
ssh-rsa AAAA...==jane@example.net
zos-key-ring-label="KeyRingOwner/SSHAuthKeysRing uniq-ssh-rsa"
from="*.example.com",zos-key-ring-label="KeyRingOwner/SSHAuthKeysRing uniq-ssh-dsa"
```

ssh_known_hosts file format

The `/etc/ssh/ssh_known` hosts and `~/.ssh/known_hosts` files contain the host public keys for all known hosts. The use of the global file is optional; if it is used, it must be prepared by the administrator. The per-user file is maintained automatically. Each time the user connects from an unknown host, the key of that unknown host is added to the per-user file

Each line in these files contains the following fields, and the fields are separated by spaces:

For RSA1 from the identity.pub file:
hostnames, bits, exponent, modulus, comment.

For RSA, DSA, or ECDSA from the id_rsa.pub, id_dsa.pub, or id_ecdsa.pub files:
hostnames, marker (optional), key-type, public-key, comment

For RSA or DSA from the key ring:
hostnames, zos-key-ring-label="KeyRingOwner/KeyRingName label"

zos-key-ring-label specifies the key ring owner, key ring name of the name of the `known_hosts` SAF key ring, and the certificate label of the certificate within the key ring on the OpenSSH client that contains the host public key. One or more blanks separate the key ring (real or virtual) name from the certificate label. Certificate labels can contain embedded blanks. The option value must be enclosed in double quotes. Any fields following *zos-key-ring-label* on the same line are ignored. The *zos-key-ring-label* specification keyword is not case sensitive.

Requirement: The certificate must be copied from the server system and added to the known hosts file or key ring on the OpenSSH client.

If a key ring is being used on the client side, for example, SSHKnownHostRing, the key ring was created in the server authentication setup as described in “Steps for setting up server authentication when keys are stored in key rings” on page 29.

Hostnames is a comma-separated list of patterns (`*` and `?` act as wildcards). Each pattern is matched against the canonical host name when authenticating a client or against the user-supplied name when authenticating a server. A pattern can also be preceded by `!` to indicate negation. If the host name matches a negated pattern, it is not accepted by that line even if it matched another pattern on the line. A hostname or address can optionally be enclosed within '[' and ']' brackets, then followed by ':' and a nonstandard port number.

The marker is optional, but if it is present then it must be one of “@cert-authority”, to indicate that the line contains a certification authority (CA) key, or “@revoked”, to indicate that the key contained on the line is revoked and must not ever be accepted. Only one marker should be used on a key line. See “Certificates” on page 126 for more information on SSH-style certificates.

Alternatively, hostnames can be stored in a hashed form which hides host names and addresses if the file's contents are disclosed. Hashed hostnames start with a '`|`' character. Only one hashed hostname can appear on a single line and none of the above negation or wildcard operators can be applied.

Bits, exponent, and modulus are taken directly from the RSA host key. They can generally be obtained from the `/etc/ssh/ssh_host_key.pub` file. The optional comment field continues to the end of the line.

Lines starting with # and empty lines are ignored as comments.

When performing host authentication, authentication is accepted if any matching line has the proper key, either one that matches exactly or, if the server has presented a certificate for authentication, the key of the certification authority that signed the certificate. For a key to be trusted as a certification authority, it must use the ``@cert-authority'' marker described previously.

The known hosts file also provides a facility to mark keys as revoked, for example when it is known that the associated private key has been stolen. Revoked keys are specified by including the ``@revoked'' marker at the beginning of the key line, and are never accepted for authentication or as certification authorities, but instead will produce a warning from **ssh** when they are encountered.

It is thus permissible (but not recommended) to have several lines or different host keys for the same names. This will happen when short forms of host names from different domains are put in the file. It is possible that the files contain conflicting information. Authentication is accepted if valid information can be found from either file.

The lines in these files are typically hundreds of characters long and should be generated by a script, ssh-keyscan, or by taking `/etc/ssh/ssh_host_key.pub` and adding the host names at the front. **ssh-keygen(1)** also offers some basic automated editing for `~/.ssh/known_hosts`, including removing hosts matching a host name and converting all host names to their hashed representations.

An example of a `ssh_known_hosts` file:

```
# Comments allowed at start of line
closenet,...,192.0.2.53 1024 37 159...93 closenet.example.net
cvs.example.net,192.0.2.10 ssh-rsa AAAA1234.....=
# A hashed hostname
|1|JfKTdBh7.....= ssh-rsa AAAA1234.....=
# An example specification of a known host key from a key ring
mvs* zos-key-ring-label="KeyRingOwner/SSHKnownHostsRing mvs1-ssh-rsa"
```

Running OpenSSH in other locales

Rule: All files used by OpenSSH (such as key files and configuration files) must be in the IBM-1047 code set, with the exception of the **rc** files (`/etc/ssh/sshrc` and `~/.ssh/rc`). The **rc** files are parsed by `/bin/sh` and should be in the code set of the current locale. Do not use the `/etc/ssh/sshrc` file if there is a possibility of the users on the system running in different locales.

Restrictions: Some restrictions apply.

- OpenSSH does not run in multibyte locales.
- The OpenSSH daemon (**sshd**) must be run in the POSIX C locale (which is the default).

For more information about globalization, see Chapter 7, “Globalization on z/OS systems,” on page 63.

Limitations

The maximum length of the ephemeral server key is INT_MAX.

Files

~/.hushlogin
This file is used to suppress printing the last login time and `/etc/motd`, if the **sshd_config** keywords PrintLastLog and PrintMotd, respectively, are enabled. It does not suppress printing of the banner specified by the **sshd_config** keyword Banner.

~/.rhosts
This file is used for host-based authentication. On some machines, this file might need to be world-readable if the user's home directory is on an NFS partition, because **sshd** reads it as a superuser. Additionally, this file must be owned by the user and must not have write permissions for anyone else. The recommended permission for most machines is read/write for the user and not accessible by others

~/.shosts
This file is used in exactly the same way as `~/.rhosts`, but allows host-based authentication without permitting login with **rlogin** or **rsh**.

~/.ssh/
This directory is the default location for all user-specific configuration and authentication information. There is no general requirement to keep the entire contents of this directory secret, but the recommended permissions are read/write/execute for the user, and not accessible by others.

~/.ssh/authorized_keys
Lists the public keys (RSA/DSA/ECDSA) that can be used for logging in as this user. For the format of this file, see “Format of the authorized_keys

file" on page 136. The content of this file is not highly sensitive, but the recommended permissions are read/write for the user, and not accessible by others.

If this file, the `~/.ssh/` directory, or the user's home directory are writable by other users, then the file could be modified or replaced by unauthorized users. In this case, **sshd** will not allow it to be used unless the value for the **sshd_config** keyword StrictModes has been set to "no".

~/.ssh/environment

If this file exists, it is read into the environment at login. It can only contain empty lines, comment lines (starting with #), and assignment lines of the form *name=value*. The file must be writable only by the user; it need not be readable by anyone else. Environment processing is disabled by default and is controlled by means of the PermitUserEnvironment option, which is described in PermitUserEnvironment.

~/.ssh/known_hosts

Contains a list of host keys for all hosts the user has logged into that are not already in the system-wide list of known host keys, `/etc/ssh/ssh_known_hosts`. See "ssh_known_hosts file format" on page 139 for further details of the format of this file. This file must be writable only by the owner and can, but need not be, world-readable.

~/.ssh/rc

If this file exists, it is run with /bin/sh after reading the environment files, but before starting the user's shell or command. It must not produce any output on stdout; stderr must be used instead. If X forwarding is in use, it will receive the "proto cookie" pair in its standard input (and DISPLAY in its environment). The script must call xauth, because **sshd** will not run xauth automatically to add X11 cookies. If you have not configured your system for X11 forwarding, see "Steps for configuring the system for X11 forwarding" on page 47.

The primary purpose of this file is to run any initialization routines which might be needed before the user's home directory becomes accessible; AFS™ is a particular example of such an environment.

This file will probably contain some initialization code, followed by lines similar to this example:

```
if read proto cookie && [ -n "$DISPLAY" ]; then
     if [ `echo $DISPLAY | cut -c1-10` = 'localhost:' ]; then
           # X11UseLocalhost=yes
           echo add unix:`echo $DISPLAY |
              cut -c11-` $proto $cookie
     else
           # X11UseLocalhost=no
           echo add $DISPLAY $proto $cookie
     fi | xauth -q -
fi
```

If this file does not exist, `/etc/ssh/sshrc` is run, and if that does not exist either, xauth is used to add the cookie.

This file should be writable only by the user.

/etc/hosts.allow, /etc/hosts.deny

Not supported on z/OS UNIX. Access controls that should be enforced by tcp-wrappers are defined in this file.

/etc/hosts.equiv

This file is for host-based authentication. In the simplest form, this file contains host names, one per line. Users on those hosts are permitted to log in without a password, provided they have the same user name on both machines. The host name can also be followed by a user name; such users are permitted to log in as any user on this machine except superuser.

If the client host/user is successfully matched in this file, login is automatically permitted, provided the client and server user names are the same. Additionally, successful public key authentication is typically required. This file must be writable only by a superuser. It is recommended that it be world-readable.

Guideline: Do not use user names in `/etc/hosts.equiv`. Be aware that the named users can log in as any user, including bin, daemon, adm, and other accounts that own critical binaries and directories. The only valid use for user names is in negative entries.

/etc/nologin

If this file exists, **sshd** refuses to let anyone except a superuser log in. The contents of the file are displayed to anyone trying to log in and non-superuser connections are refused. The file must be world-readable.

/etc/motd

Contains the message of the day. See the **sshd_config** keyword PrintMotd for more information.

/etc/ssh/moduli

Contains Diffie-Hellman groups used for the Diffie-Hellman Group Exchange. The file format is described in moduli.

/etc/ssh/sshd_config

Contains configuration data for **sshd**. The file format and configuration options are described in sshd_config.

/etc/ssh/ssh_host_key, /etc/ssh/ssh_host_dsa_key, /etc/ssh/ssh_host_ecdsa_key, /etc/ssh/ssh_host_rsa_key

These three files contain the private parts of the host keys. They must only be owned and readable by a superuser. **sshd** does not start if these files are group-accessible or world-accessible.

/etc/ssh/ssh_host_key.pub, /etc/ssh/ssh_host_dsa_key.pub, /etc/ssh/ssh_host_ecdsa_key.pub, /etc/ssh/ssh_host_rsa_key.pub

These three files contain the public parts of the host keys. These files are only provided for the convenience of the user so their contents can be copied to known hosts files. They are created using **ssh-keygen**. This file must be writable only by a superuser and can, but need not be, world-readable. Their contents must match the respective private parts.

/etc/ssh/shosts.equiv

This file is used in exactly the same way as `/etc/hosts.equiv`, but allows host-based authentication without permitting login with **rlogin** or **rsh**.

/etc/ssh/ssh_known_hosts

System-wide list of known host keys. This file should be prepared by the system administrator to contain the public host keys of all machines in the organization. See “ssh_known_hosts file format” on page 139 for further details of the format of this file. This file must be writeable only by the owner and only be world-readable.

/etc/ssh/sshrc
Similar to `~/.ssh/rc`, it can be used to specify machine-specific login-time initialization globally. This file should be writable only by a superuser and world-readable.

/etc/ssh/zos_sshd_config
Contains z/OS-specific configuration data for **sshd**. The file format and configuration options are described in zos_sshd_config.

/var/empty
chroot directory used by **sshd** during privilege separation in the pre-authentication phase. The directory must not contain any files. It must also be owned by a superuser and not be group-writable or world-writable.

/var/run/sshd.mm.XXXXXXXX
Temporary files created by **sshd** for compression with privilege separation.

/var/run/sshd.pid
Contains the process ID of the **sshd** listening for connections (if there are several daemons running concurrently for different ports, this contains the process ID of the one started last). The contents of this file are not sensitive. It can be world-readable. This file is not created if the server is running in debug mode.

Environment variables

_ZOS_OPENSSH_DEBUG
Contains z/OS-specific debug information. This environment variable is only used internally and is not for external specification.

| **_ZOS_OPENSSH_DEBUG_TIMESTAMP**
| If this variable is specified to YES, it will contain the timestamp in the
| debug information. If it is specified to CPU, the CPU time will be used as
| the timestamp.

_ZOS_OPENSSH_MSGCAT
Identifies the OpenSSH message catalog to be used when sending OpenSSH error messages.

_ZOS_SMF_FD
Set to the file descriptor number used for interprocess communication during SMF-related processing. This environment variable is only used internally and is not for external specification.

_ZOS_SSHD_CONFIG
Specifies the path name of the user-defined **zos_sshd_config** configuration file. The default is `/etc/ssh/zos_sshd_config`. For a list of available keywords, see zos_sshd_config. The recommended permissions of the specified file are read/write for the user and not accessible by others.

Related information

moduli, **scp**, **sftp**, **sftp-server**, **ssh**, **ssh-add**, **ssh-agent**, **ssh-keygen**, **sshd_config**, **zos_sshd_config**

Authors

OpenSSH is a derivative of the original and free ssh 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus

Friedl contributed the support for SSH protocol versions 1.5 and 2.0. Niels Provos and Markus Friedl contributed support for privilege separation.

Chapter 10. OpenSSH files

OpenSSH client configuration files

ssh_config — OpenSSH client configuration files

Description

ssh obtains configuration data from these sources in the following order:

1. Command line options
2. User's configuration file (`~/.ssh/config`)
3. System-wide configuration file (`/etc/ssh/ssh_config`)

For each parameter, the first obtained value is used. The **ssh_config** configuration files contain sections separated by “Host” specifications and that section is only applied for hosts that match one of the patterns given in the specification. The matched host name is the one given on the command line.

Guideline: Because the first obtained value for each parameter is used, you should put host-specific declarations near the beginning of the file, and put the general defaults at the end.

File format

The **ssh_config** configuration file views empty lines and lines starting with # as comments.

Configuration options can be specified using two different formats.

- The first format is the keyword argument pair separated by white space.
- The second format is the keyword argument pair separated with exactly one "=" and optional white space. This format is useful to avoid the need to quote white space when specifying configuration options using the **scp**, **sftp** and **ssh -o** options. Arguments can optionally be enclosed in double quotes (") in order to represent arguments containing spaces.

  For example:

  ```
  keyword argument
  keyword=argument
  ```

Keywords are not case sensitive and arguments are case sensitive. Following are the possible keywords:

AddressFamily
Specifies which address family to use when connecting. Valid arguments are "any", "inet" (for IPv4 only) or "inet6" (for IPv6 only).

AFSTokenPassing
Not supported on z/OS UNIX. Specifies whether to pass AFS tokens to remote host. The argument to this keyword must be "yes" or "no".

Restriction: The AFSTokenPassing option applies to protocol version 1 only.

BatchMode
If set to "yes", passphrase/password querying is disabled. This option is

useful in scripts and other batch jobs where no user is present to supply the password. The argument must be set to "yes" or "no". The default is "no".

Rule: An SSH agent, Kerberos authentication (if available), or trusted host authentication must be used for authentication to succeed in batch mode.

BindAddress
Uses the specified address on the local machine as the source address of the connection. This option is only useful on systems with more than one address and does not work if UsePrivilegedPort is set to "yes".

ChallengeResponseAuthentication
Not supported on z/OS UNIX. Specifies whether to use challenge-response authentication. The argument must be set to "yes" or "no". The default is "yes".

CheckHostIP
If this flag is set to "yes", **ssh** checks the host IP address in the known_hosts file. Regardless of this setting, **ssh** always checks the known hosts files for the user-specified host name. Enabling this option means that both the user-specified host name and IP address should be in a known hosts file. If not, a warning is issued to inform the user that the missing entry is being written to the `~/.ssh/known_hosts` file. This flag allows **ssh** to detect if a host key changed due to DNS spoofing. If the option is set to "no", the check is not executed. The default is "yes".

Cipher
Specifies the cipher to use for encrypting the session in protocol version 1. Currently, Blowfish, Triple DES (3DES), and DES are supported. The DES cipher is only supported in the **ssh** client for interoperability with legacy protocol version 1 implementations that do not support the 3DES cipher. Its use is strongly discouraged due to cryptographic weaknesses. The default is 3DES.

Ciphers
Specifies the ciphers to use for encrypting the session in protocol version 2 in the order of preference. Multiple ciphers must be separated by commas. Valid ciphers include:

3des-cbc
Triple DES algorithm (3DES)

aes128-cbc
Advanced Encryption Standard (AES) CBC mode with 128-bit key

aes128-ctr
Advanced Encryption Standard (AES) CTR mode with 128-bit key

aes192-cbc
Advanced Encryption Standard (AES) CBC mode with 192-bit key

aes192-ctr
Advanced Encryption Standard (AES) CTR mode with 192-bit key

aes256-cbc
Advanced Encryption Standard (AES) CBC mode with 256-bit key

aes256-ctr
Advanced Encryption Standard (AES) CTR mode with 256-bit key

| **aes128-gcm@openssh.com**
| Advanced Encryption Standard (AES) GCM mode with 128-bit key

aes256-gcm@openssh.com
Advanced Encryption Standard (AES) GCM mode with 256-bit key

arcfour
Arcfour algorithm

arcfour128
Arcfour algorithm with 128-bit key

arcfour256
Arcfour algorithm with 256-bit key

blowfish-cbc
Blowfish algorithm

cast128-cbc
CAST algorithm

rijndael-cbc@lysator.liu.se
Same as Advanced Encryption Standard (AES) CBC mode with 256-bit key

The ciphers list is typically one long unbroken line; however due to space limitations, the default ciphers list is not shown as one unbroken line. The default is:

```
aes128-ctr,aes192-ctr,aes256-ctr,arcfour256,arcfour128,
aes128-gcm@openssh.com,aes256-gcm@openssh.com,
aes128-cbc,3des-cbc,blowfish-cbc,cast128-cbc,aes192-cbc,
aes256-cbc,arcfour
```

For example:

```
ssh  -o"Ciphers aes128-cbc,blowfish-cbc"   Billy@us.pok.ibm.com
```

FIPS mode requires that CTR algorithms use non-repeated IV for the same AES key. OpenSSH manages the IV by itself. The IV is stored in a array which is 16 bytes will not be repeated until encrypt 2^128 times, about 2^132 bytes in a connection. It cannot be repeated in actual use. The **RekeyLimit** option can be used to renegotiate new keys automatically to avoid the repetition.

Restriction: If running in FIPS mode, the following options are not supported:

```
aes128-gcm@openssh.com,
aes256-gcm@openssh.com,
arcfour,
arcfour128,
arcfour256,
blowfish-cbc,
cast128-cbc
```

The ciphers list might need to be modified based on the ciphers source used. For more information, see the CiphersSource keyword in the z/OS-specific OpenSSH client configuration files **zos_ssh_config** or **zos_user_ssh_config**.

ClearAllForwardings
Specifies that all local, remote, and dynamic port forwardings specified in the configuration files or on the command line be cleared. This option is primarily useful from the **ssh** command line to clear port forwardings set in configuration files and is automatically set by **scp** and **sftp**. The argument must be set to "yes" or "no". The default is "no".

Compression

Specifies whether to use compression. The argument must be set to "yes" or "no". The default is "no".

CompressionLevel

Specifies the compression level to use if compression is enabled. The argument must be an integer from 1 (fast) to 9 (slow, best). The default level is 6, which is good for most applications.

Restriction: This option applies to protocol version 1 only.

ConnectionAttempts

Specifies the number of tries (one per second) to make before exiting. The argument must be an integer. This might be useful in scripts if the connection sometimes fails. The default is 1.

ConnectTimeout

Specifies the timeout (in seconds) used when connecting to the SSH server, instead of using the default system's TCP timeout. This value is used only when the target is down or is unreachable, not when it refuses the connection.

ControlMaster

Enables the sharing of multiple sessions over a single network connection. When set to "yes", **ssh** listens for connections on a control socket specified using the ControlPath argument. Additional sessions can connect to this socket using the same ControlPath with ControlMaster set to "no" (the default). These sessions will try to reuse the master instance's network connection rather than initiating new ones, but will fall back to connecting normally if the control socket does not exist, or is not listening.

Setting ControlMaster to "ask" causes **ssh** to listen for control connections, but requires confirmation using the SSH_ASKPASS program before they are accepted (see ssh-add for details). If the ControlPath cannot be opened, **ssh** continues without connecting to a master instance.

X11 and **ssh-agent** forwarding are supported over these multiplexed connections. However, the display and agent forwarded will be the one belonging to the master connection; that is, it is not possible to forward multiple displays or agents.

Two additional options allow for opportunistic multiplexing: try to use a master connection but fall back to creating a new one if one does not exist. These options are "auto" and "autoask". The latter requires confirmation such as the "ask" option.

Master and slave connections must have the same **FIPSMODE** setting.

ControlPath

Specifies the path to the control socket used for connection sharing as described in the ControlMaster option or the string "none" to disable connection sharing. In the path, *%L* is substituted by the first component of the local host name, *%l* is substituted by the local host name (including any domain name), *%h* is substituted by the target host name, *%n* will be substituted by the original target host name specified on the command line, *%p* the port, *%r* by the remote login username, and *%u* by the username of the user running **ssh**. To ensure that shared connections are uniquely identified, any ControlPath used for opportunistic connection sharing should include at least *%h*, *%p*, and *%r*.

Restriction: The maximum path length is 107 bytes.

ControlPersist

When used in conjunction with ControlMaster, specifies that the master connection should remain open in the background (waiting for future client connections) after the initial client connection has been closed. If set to “no”, then the master connection will not be placed into the background, and will close as soon as the initial client connection is closed. If set to “yes”, then the master connection will remain in the background indefinitely (until killed or closed via a mechanism such as the `ssh` “-O exit” option). If set to a time in seconds, or a time in any of the formats documented in sshd_config, then the backgrounded master connection will automatically terminate after it has remained idle (with no client connections) for the specified time.

DynamicForward

Specifies that a TCP port on the local machine be forwarded over the secure channel and the application protocol is then used to determine where to connect to from the remote machine. The argument must be a port number. The argument must be either *[bind_address:]port* or *[bind_address/]port*. IPv6 addresses can be specified by enclosing addresses in square brackets or by using the *[bind_address/]port* syntax. By default, the local port is bound in accordance with the GatewayPorts setting. However, an explicit bind_address can be used to bind the connection to a specific address. The bind_address of "localhost" indicates that the listening port are to be bound for local use only, while an empty address or * indicates that the port should be available from all interfaces.

Currently, the SOCKS4 and SOCKS5 protocols are supported and **ssh** will act as a SOCKS server. Multiple forwardings can be specified and additional forwarding can be given on the command line. Only the superuser can forward privileged ports.

ExitOnForwardFailure

Specifies whether **ssh** is to terminate the connection if it cannot set up all requested dynamic, tunnel, local, and remote port forwardings. The argument must be "yes" or "no". The default is "no".

EnableSSHKeysign

Setting this option to "yes" in the global client configuration file `/etc/ssh/ssh_config` enables the use of the helper program **ssh-keysign** during HostbasedAuthentication. (See ssh-keysign for more information about **ssh-keysign**.) The argument must be "yes" or "no". The default is "no".

Rule: Put the EnableSSHKeysign option in the non-host-specific section.

If running in **FIPSMODE**, this option is not supported even though its value is set to “yes”.

EscapeChar

Sets the escape character (default of ~). The escape character can also be set on the command line. The argument can be a single character, ^ followed by a letter or "none" to disable the escape character entirely (making the connection transparent for binary data).

If running in **FIPSMODE**, this option is not supported even though its value is set to “yes”.

ForwardAgent

Specifies whether the connection to the authentication agent (if any) is to be forwarded to the remote machine. The argument must be set to "yes" or "no". The default is "no".

Enable agent forwarding with caution. Users with the ability to bypass file permissions on the remote host (for the agent's UNIX-domain socket) can access the local agent through the forwarded connection. Attackers cannot obtain key material from the agent; however, they can perform operations on the keys that enable them to authenticate using the identities loaded into the agent.

If running in **FIPSMODE**, this option is not supported even though its value is set to “yes”.

ForwardX11

Specifies whether X11 connections are to be automatically redirected over the secure channel and DISPLAY set. The argument must be set to "yes" or "no". The default is "no".

Enable X11 forwarding with caution. Users with the ability to bypass file permissions on the remote host (for the user's X11 authorization database) can access the local X11 display through the forwarded connection. An attacker may then be able to perform activities such as keystroke monitoring if the ForwardX11Trusted option is also enabled.

ForwardX11Timeout

Specify a timeout for untrusted X11 forwarding using the format described in “Time formats” on page 190. X11 connections received by **`ssh`** after this time will be refused. The default is to disable untrusted X11 forwarding after twenty minutes has elapsed.

ForwardX11Trusted

If this option is set to "yes", remote X11 clients will have full access to the original X11 display. If this option is set to "no", then remote X11 clients are considered untrusted and will be prevented from stealing or tampering with data belonging to trusted X11 clients. Furthermore, when set to "no", the xauth token (cookie) used for the session will be set to expire after 20 minutes. Remote clients will be refused access after this time. The default is "no".

See the X11 SECURITY extension specification for full details on the restrictions imposed on untrusted clients.

GatewayPorts

Specifies whether remote hosts are allowed to connect to local forwarded ports. By default, **ssh** binds local port forwardings to the loopback address. The binding prevents other remote hosts from connecting to forwarded ports. Use GatewayPorts to specify that **ssh** is to bind local port forwardings to the wildcard address, thus allowing remote hosts to connect to forwarded ports. The argument must be set to "yes" or "no". The default is "no".

GlobalKnownHostsFile

Specifies one or more files to use for the global host key database, separated by whitespace. The default is `/etc/ssh/ssh_known_hosts`, `/etc/ssh/ssh_known_hosts2`.

GSSAPIAuthentication

Specifies whether user authentication (such as Kerberos Authentication) based on GSS-API is allowed. The default is "no".

Restriction: The GSSAPIAuthentication option applies to protocol version 2 only.

If running in **FIPSMODE**, this option is not supported even if its value is specified.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPIClientIdentity

If set, specifies the GSSAPI client identity that ssh should use when connecting to the server. The default is unset, which means that the default identity will be used.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPIDelegateCredentials

Forwards (delegates) credentials to the server. The default is "no".

Restriction: This option applies to protocol version 2 only.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPIKeyExchange

Specifies whether key exchange based on GSSAPI may be used. When using GSSAPI key exchange, the server does not need to have a host key. The default is “no”.

Restriction: This option applies to protocol version 2 only.

If running in **FIPSMODE**, this option is not supported even though its value is set to “yes”.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPIRenewalForcesRekey

If set to “yes”, then renewal of the client's GSSAPI credentials will force the rekeying of the `ssh` connection. With a compatible server, this can delegate the renewed credentials to a session on the server. The default is “no”.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPIServerIdentity

If set, specifies the GSSAPI server identity that `ssh` should expect when connecting to the server. The default is unset, which means that the expected GSSAPI server identity will be determined from the target hostname.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPITrustDns

Set to “yes” to indicate that the DNS is trusted to securely canonicalize the name of the host being connected to. If “no”, the hostname entered on the command line will be passed untouched to the GSSAPI library. The default is “no”.

Restriction: This option only applies to protocol version 2 connections using GSSAPI.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

HashKnownHosts

If this option is set to "yes", indicates that **ssh** is to hash host names and addresses when they are added to `~/.ssh/known_hosts`. These hashed names can be used normally by **ssh** and **sshd**, but they do not reveal identifying information if the file's contents are disclosed. Existing names and addresses in known hosts files are not automatically converted, but can be manually hashed using **ssh-keygen**. The default is "no".

Host Restricts the following declarations (up to the next Host keyword) to be only for those hosts that match one of the patterns given after the keyword. If more than one pattern is provided, they should be separated by whitespace. A single `*` as a pattern can be used to provide global defaults for all hosts. The host is the hostname argument given on the command line (the name is not converted to a canonical host name before matching).

A pattern entry may be negated by prefixing it with an exclamation mark (“!”). If a negated entry is matched, then the Host entry is ignored, regardless of whether any other patterns on the line match. Negated matches are therefore useful to provide exceptions for wildcard matches.

See “Patterns” on page 163 for more information about patterns.

HostbasedAuthentication

Specifies whether to try rhosts-based authentication with public key authentication. The argument must be set to "yes" or "no". The default is "no".

Restriction: This option applies to protocol version 2 only.

The HostbasedAuthentication option is similar to RhostsRSAAuthentication.

If the local host (that is, the client system) keys are only stored in a SAF key ring, then a client using host-based authentication will not be able to access those keys because it uses **ssh-keysign** which only locates host keys in the default UNIX files. However, host-based authentication for clients on the local host can still be set up by an administrator on both the local and remote hosts, as follows:

1. Generate a new public/private key pair for the local host, storing them in the default UNIX files.
2. Extract the local host's public host key from the key pair just created. Copy it into the remote host's `/etc/ssh/ssh_known_hosts` file.

If running in **FIPSMODE**, this option is not supported even though its value is set to “yes”.

HostKeyAlgorithms

Specifies the protocol version 2 ; host key algorithms that the client wants to use in order of preference. The default for this option is the following:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com ,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com ,
ssh-rsa-cert-v01@openssh.com , ssh-dss-cert-v01@openssh.com,
ssh-rsa-cert-v00@openssh.com,ssh-dss-cert-v00@openssh.com, ecdsa-sha2-
nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
ssh-rsa,ssh-dss
```

If running in **FIPSMODE**, the following options are not supported:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ssh-dss-cert-v01@openssh.com,
ssh-rsa-cert-v00@openssh.com,
ssh-dss-cert-v00@openssh.com,
ecdsa-sha2-nistp256,
ecdsa-sha2-nistp384,
ecdsa-sha2-nistp521
```

HostKeyAlias

Specifies an alias that should be used instead of the real host name when looking up or saving host key in the host key database files. This option is useful for tunneling SSH connections or for multiple servers running on a single host.

HostName

Specifies the real host name to log into. You can use this option to specify nicknames or abbreviations for hosts. If the hostname contains the character sequence “ % h ” , then this will be replaced with the host name specified on the command line (this is useful for manipulating unqualified names). The default is the name given on the command line. Numeric IP addresses are also permitted both on the command line and in HostName specifications.

IdentitiesOnly
Specifies that **ssh** should only use the authentication identity files configured in the **ssh_config** files and key ring certificates configured in the **zos_user_ssh_config** file, even if the **ssh-agent** offers more identities. The argument to this keyword must be "yes" or "no". The default is "no".

Guideline: Use this option in situations where **ssh-agent** offers many different identities.

IdentityFile
Specifies a file from which the user's RSA, DSA, or ECDSA authentication identity is read. The default is `~/.ssh/identity` for protocol version 1. For protocol version 2, the default is `~/.ssh/id_rsa` , `~/.ssh/id_dsa`, and `~/.ssh/id_ecdsa`. Additionally, any identities configured with the IdentityKeyRingLabel or represented by the authentication agent are used for authentication. Refer to the **-i** *identity_file* description in the **ssh** command for a summary of the order that identities are tried during public key authentication.

The file name can use the tilde syntax to refer to a user's home directory or one of the following escape characters: *%d* (local user's home directory), *%u* (local user name), *%l* (local host name), *%h* (remote host name) or *%r* (remote user name).

It is possible to have multiple identity files specified in configuration files; all these identities will be tried in sequence. Multiple IdentityFile directives will add to the list of identities tried (this behaviour differs from that of other configuration directives).

IdentityFile may be used in conjunction with IdentitiesOnly to select which identities in an agent are offered during authentication.

If running in **FIPSMODE**, this option is not supported even if its value is specified.

IgnoreUnknown
Specifies a pattern-list of unknown options to be ignored if they are encountered in configuration parsing. This may be used to suppress errors if ssh_config contains options that are unrecognized by **ssh**. It is recommended that IgnoreUnknown be listed early in the configuration file as it will not be applied to unknown options that appear before it.

IPQoS This keyword is currently ignored in z/OS UNIX. Specifies the IPv4 type-of-service or DSCP class for connections. Accepted values are “af11”, “af12”, "af13", "af21", "af22", "af23", "af31", "af32", "af33", "af41", "af42", "af43", "cs0", "cs1", "cs2", "cs3", "cs4", "cs5", "cs6", "cs7", "ef", "lowdelay", "throughput", "reliability", or a numeric value. This option may take one or two arguments, separated by whitespace. If one argument is specified, it is used as the packet class unconditionally. If two values are specified, the first is automatically selected for interactive sessions and the second for non-interactive sessions. The default is "lowdelay" for interactive sessions and "throughput" for noninteractive sessions.

KbdInteractiveAuthentication

Not supported on z/OS UNIX. Specifies whether to use keyboard-interactive authentication. The argument to this keyword must be "yes" or "no".

KbdInteractiveDevices

Not supported on z/OS UNIX. Specifies the list of methods to use in keyboard-interactive authentication. Multiple method names must be comma-separated. The default is to use the server-specified list. The methods available vary depending on what the server supports. For an OpenSSH server, it might be zero or more instances of "bsdauth", "pam", and "skey".

KeepAlive

This keyword is supported for compatibility with versions of OpenSSH before 3.8.1p1. On systems using OpenSSH 3.8.1p1 or later, you should use the keyword TCPKeepAlive instead.

Specifies whether the system should send TCP keepalive messages to the other side. If they are sent, a lost network connection or stopping of one of the machines will be properly noticed. However, this means that OpenSSH connections will end if the route is down temporarily.

The default is "yes" (to send keepalives), and the client will notice if the network goes down or the remote host dies. This is important in scripts as well as to many users. To disable keepalives, set the value to "no".

KexAlgorithms

Specifies the available KEX (Key Exchange) algorithms. Multiple algorithms must be comma-separated. The default is as follows:

```
ecdh-sha2-nistp256,
ecdh-sha2-nistp384,
ecdh-sha2-nistp521,
diffie-hellman-group-exchange-sha256,
diffie-hellman-group-exchange-sha1,
diffie-hellman-group14-sha1,
diffie-hellman-group1-sha1
```

The Key Exchange algorithms list might need to be modified based on the Key Exchange algorithms source used. For more information, see the **KexAlgorithmsSource** keyword in the z/OS-specific OpenSSH client configuration files **zos_ssh_config** or **zos_user_ssh_config**. All KEX algorithms are supported in FIPS mode.

Restriction: This option applies to protocol version 2 only.

LocalCommand

Specifies a command to be executed on the local machine after successfully connecting to the server. The command string extends to the end of the line, and is executed with the user's shell.

The following escape character substitutions will be performed: %d (local user's home directory), %h (remote host name), %l (local host name), %n (host name as provided on the command line), %p (remote port), %r (remote user name) or %u (local user name).

The command is run synchronously and does not have access to the session of the **ssh** that spawned it. It should not be used for interactive commands. This option is ignored unless PermitLocalCommand has been enabled.

LocalForward

Specifies that a TCP port on the local machine is to be forwarded over the secure channel to the specified host and port from the remote machine. The first argument must be *[bind_address:]port* and the second must be *host:hostport*. IPv6 addresses can be specified by enclosing addresses in square brackets or by using an alternate syntax: *[bind_address/]port* and *host/hostport*. Multiple forwardings can be specified and additional forwardings can be given on the command line. Only the superuser can forward privileged ports. By default, the local port is bound in accordance with the GatewayPorts setting. However, an explicit *bind_address* can be used to bind the connection to a specific address. The *bind_address* of "localhost" indicates that the listening port is to be bound for local use only, while an empty address or * indicates that the port is to be available from all interfaces.

LogLevel

Gives the verbosity level that is used when logging messages from **ssh**. The possible values are: QUIET, FATAL, ERROR, INFO, VERBOSE, DEBUG, DEBUG1, DEBUG2, and DEBUG3. The default is INFO. DEBUG and DEBUG1 are equivalent. DEBUG2 and DEBUG3 each specify higher levels of verbose output.

MACs Specifies the MAC (message authentication code) algorithms in order of preference. The MAC algorithm is used for data integrity protection. Multiple algorithms must be comma-separated.

The MAC algorithms list is typically one long unbroken line; however due to space limitations, the default MAC algorithms list is not shown as one unbroken line. The default is:

```
hmac-md5-etm@openssh.com,hmac-sha1-etm@openssh.com,
umac-64-etm@openssh.com,umac-128-etm@openssh.com,
hmac-sha2-256-etm@openssh.com,hmac-sha2-512-etm@openssh.com,
hmac-ripemd160-etm@openssh.com,hmac-sha1-96-etm@openssh.com,
hmac-md5-96-etm@openssh.com, hmac-md5,hmac-sha1,
umac-64@openssh.com,umac-128@openssh.com, hmac-sha2-256,
hmac-sha2-512,hmac-ripemd160,hmac-sha1-96,hmac-md5-96
```

.

The algorithms that contain “-etm” calculate the MAC after encryption (encrypt-then-mac). The MAC algorithms list might need to be modified based on the MAC algorithms source used. For more information, see the MACsSource keyword in the z/OS-specific OpenSSH client configuration files **zos_ssh_config** or **zos_user_ssh_config**.

Restrictions: This option applies to protocol version 2 only. Also, if running in FIPS mode, the following options are not supported.

```
hmac-md5,
hmac-md5-96,
hmac-md5-etm@openssh.com,
hmac-md5-96-etm@openssh.com,
hmac-ripemd160,
hmac-ripemd160@openssh.com,
hmac-ripemd160-etm@openssh.com,
umac-64@openssh.com,
umac-64-etm@openssh.com,
umac-128-etm@openssh.com,
umac-128@openssh.com
```

NoHostauthenticationForLocalhost

This option can be used if the home directory is shared across machines (for example, if the home directory is NFS-mounted to multiple machines). In this case, localhost will refer to a different machine on each of the machines and the user will get many warnings about changed host keys. However, this option disables host authentication for localhost (to avoid these warnings). The argument must be set to "yes" or "no". The default is to check the host key for localhost.

NumberOfPasswordPrompts
Specifies the number of password prompts before giving up. The argument must be an integer. The default is 3.

Regardless of this value, the SSH daemon still regulates the total number of authentication attempts.

PasswordAuthentication
Specifies whether to use password authentication. The argument must be set to "yes" (default) or "no". Password authentication prompts the user for a password or password phrase that is sent to the remote host for checking.

PermitLocalCommand
Allows local command execution by means of the LocalCommand option or using the !command escape sequence in **ssh**. The argument must be "yes" or "no". The default is "no".

PKCS1Provider
Not supported in z/OS UNIX. Specifies which PKCS#11 provider to use. The argument to this keyword is the PKCS#11 shared library `ssh` should use to communicate with a PKCS#11 token providing the user's private RSA key.

Port Specifies the port number to connect to on the remote host. The default is 22.

PreferredAuthentications
Specifies the order in which the client should try protocol version 2 authentication methods. This allows a client to prefer one method (such as publickey) over another method (such as password). The default for this option is *gssapi-keyex,gssapi-with-mic,publickey,keyboard-interactive,password*.

keyboard-interactive is not supported on z/OS UNIX.

Protocol
Specifies the protocol versions **ssh** should support in order of preference. The possible values are 1 and 2. Multiple versions must be comma-separated. The default is 2. If 2,1 is specified, **ssh** tries version 2 and falls back to version 1 if version 2 is not available.

ProxyCommand
Specifies the command to use to connect to the server. The command string extends to the end of the line and is executed with the user's shell. In the command string, *%h* will be substituted by the host name to connect, *%p* by the port, and *%r* by the remote user name. The command can be basically anything and should read from its standard input and write to its standard output. It should eventually connect an **sshd** server running on some machine or execute **sshd –i**. Host key management will be done using the HostName of the host being connected (defaulting to the name typed by the user). The CheckHostIP keyword is not available for connects with a proxy command.

ProxyUseFdpass
Specifies that ProxyCommand will pass a connected file descriptor back to `ssh(1)` instead of continuing to execute and pass data. The default is “no”.

PubkeyAuthentication
Specifies whether to try public key authentication for protocol version 2. The argument must be set to "yes" (default) or "no".

RekeyLimit
Specifies the maximum amount of data that can be transmitted before the session key is renegotiated, optionally followed by a maximum amount of time that may pass before the session key is renegotiated. The first argument is the number of bytes, with an optional suffix of K, M, or G to indicate kilobytes, megabytes, or gigabytes, respectively. The default is between 1G and 4G, depending on the cipher. The optional second value is specified in seconds and may use any of the units documented in “Time formats” on page 190.

Restrictions: Some restrictions apply.
- This option applies to protocol version 2 only.
- The maximum value is UINT_MAX bytes and the minimum value is 16 bytes.

RemoteForward
Specifies that a TCP port on the remote machine is to be forwarded over the secure channel to the specified host and port from the local machine. The argument must be either *[bind_address:]port* or *[bind_address/]port*, and the second must be *host :hostport*. IPv6 addresses can be specified by enclosing addresses in square brackets or by using the *[bind_address/]port* syntax for the first argument and *host/hostport* in the second argument. Multiple forwardings can be specified and additional forwardings can be given on the command line.

If the *bind_address* is not specified, the default is to only bind to loopback addresses. If the *bind_address* is '*' or an empty string, then the forwarding is requested to listen on all interfaces. Specifying a remote *bind_address* succeeds only if the server's GatewayPorts option is enabled as described in GatewayPorts.

If the port argument is "0", the listen port will be dynamically allocated on the server and reported to the client at run time.

Restriction: Only the superuser can forward privileged ports.

RequestTTY
Specifies whether to request a pseudo-tty for the session. The argument may be one of: “no” (never request a TTY), “yes” (always request a TTY when standard input is a TTY), “force” (always request a TTY) or “auto” (request a TTY when opening a login session). This option mirrors the **-t** and **-T** flags for `ssh`.

RhostsAuthentication
Specifies whether to try rhosts-based authentication in protocol version 1. This declaration only affects the client side and does not affect security. Most servers do not permit RhostsAuthentication because it is not secure. This option was removed from OpenSSH3.7 and later releases and is no longer supported on z/OS Unix.

RhostsRSAAuthentication
Specifies whether to try rhosts-based authentication with RSA host

authentication in protocol version 1. This option requires **ssh** to be setuid 0. The argument must be set to "yes" or "no". The default is "no".

RSAAuthentication
Specifies whether to try RSA authentication. The argument to this keyword must be "yes" (default) or "no". RSA authentication will only be attempted if the identity file exists, or an authentication agent is running.

Restriction: This option applies to protocol version 1 only.

SendEnv
Specifies which environment variables from the local environment variables are to be sent to the server. Environment variables are specified by name, which can contain wildcard characters. However, the name cannot contain the equal (=) character. Multiple environment variables can be separated by white space or spread across multiple SendEnv options for a maximum of 256 environment variable specifications. The default is not to send any environment variables.

See “Patterns” on page 163 for more information about patterns.

The accepted environment variables are processed after authentication but before general environment variable setup and handling of the **sshd_config** keyword PermitUserEnvironment. Therefore, the values of accepted environment variables might be overwritten as a result of this subsequent processing.

Restriction: Environment variable passing is only supported in protocol version 2. The server must also support environment variable passing and the server must be configured to accept these environment variables. See the description of the **sshd_config** keyword AcceptEnv for information about configuring the server.

ServerAliveInterval
Sets a timeout interval in seconds after which if no data has been received from the server, **ssh** sends a message through the encrypted channel to request a response from the server. The default is 0, indicating that these messages are not sent to the server.

Restriction: This option applies to protocol version 2 only.

ServerAliveCountMax
Sets the number of server alive messages that can be sent without **ssh** receiving any messages back from the server. If this threshold is reached while server alive messages are being sent, **ssh** disconnects from the server, thus ending the session. The default value is 3.

Example: If ServerAliveInterval is set to 15, and ServerAliveCountMax is left at the default, if the server becomes unresponsive **ssh** will disconnect after approximately 45 seconds.

Note: The use of server alive messages is very different from TCPKeepAlive. The server alive messages are sent through the encrypted channel and therefore are not spoofable. The TCP keepalive option enabled by TCPKeepAlive is spoofable. The server alive mechanism is valuable when the client or server depend on knowing when a connection has become inactive.

Restriction: This option applies to protocol version 2 only.

SmartcardDevice
Not supported on z/OS UNIX. Specifies which smart card device to use.

The argument to this keyword is the device that **ssh** should use to communicate with a smart card used for storing the user's private RSA key. By default, no device is specified and smart card support is not activated.

StrictHostKeyChecking

If the argument is set to "yes", **ssh** will never automatically add host keys to the `~/.ssh/known_hosts` file and will refuse to connect to a host whose host key has changed. This provides maximum protection against trojan horse attacks, but can be troublesome when the `/etc/ssh/ssh_known_hosts` file is poorly maintained or connections to new hosts are frequently made. This option forces the user to manually add all new hosts. If the argument is set to "no", **ssh** will automatically add new host keys to the user known hosts files. If the flag is set to "ask", new host keys will be added to the user known host files only after the user has confirmed the action and **ssh** will refuse to connect to hosts whose host key has changed. The host keys of known hosts will be verified automatically in all cases. The argument must be set to "yes", "no", or "ask". The default is "ask".

TCPKeepAlive

Specifies whether the system should send TCP keepalive messages to the other side. If they are sent, a lost network connection or stopping of one of the machines will be properly noticed. However, this means that OpenSSH connections will end if the route is down temporarily. The default is "yes" (to send TCP keepalive messages), and the client will notice if the network goes down or the remote host dies. This is important in scripts as well as to many users. To disable TCP keepalive messages, set the value to "no".

Tunnel

Not supported on z/OS UNIX. Requests tunnel device forwarding between the client and the server. The argument must be "yes", "point-to-point" (layer 3), "ethernet" (layer 2), or "no". Specifying "yes" requests the default tunnel mode, which is "point-to-point". The default is "no".

TunnelDevice

Not supported on z/OS UNIX. Specifies the tunnel devices to open on the client (*local_tun*) and the server (*remote_tun*).

The argument must be *local_tun*[:*remote_tun*]. The devices can be specified by numerical ID or the keyword "any", which uses the next available tunnel device. If *remote_tun* is not specified, it defaults to "any". The default is "any:any".

UsePrivilegedPort

Specifies whether to use a privileged port for outgoing connections. The argument must be set to "yes" or "no". The default is "no".

The following rules apply:

- This option must be set to "yes" if RhostsRSAAuthentication authentications is needed with servers that only support protocol version 1.
- If UsePrivilegedPort is set to "yes", **ssh** must be setuid 0.

User Specifies the name that the user can use when logging on. This can be useful when a different user name is used on different machines. You do not have to remember to give the user name on the command line.

UserKnownHostsFile

Specifies one or more files to use for the user host key database separated by whitespace. The default is `~/.ssh/known_hosts, ~/.ssh/known_hosts2`.

VerifyHostKeyDNS

Specifies whether to verify the remote key using DNS and SSHFP (SSH fingerprint) resource records. If this option is set to "yes", the client will implicitly trust keys that match a secure fingerprint from DNS. Insecure fingerprints are handled as if this option was set to "ask". If this option is set to "ask", information about fingerprint match is displayed, but the user will still need to confirm new host keys according to the StrictHostKeyChecking option. The argument must be "yes", "no" or "ask". The default is "no".

Restriction: This option applies to protocol version 2 only.

z/OS UNIX does not support verified secure DNS SSHFP records, and therefore all key fingerprints obtained from DNS are assumed to be insecure.

VisualHostKey

If this flag is set to “yes”, an ASCII art representation of the remote host key fingerprint is printed in addition to the fingerprint string at login and for unknown host keys. If this flag is set to “no”, no fingerprint strings are printed at login and only the fingerprint string will be printed for unknown host keys. The default is “no”.

XAuthLocation

Specifies the full path name of the xauth program. The default is `/usr/X11R6/bin/xauth`. For more information, see “Steps for configuring the system for X11 forwarding” on page 47.

Patterns

A *pattern* consists of zero or more non-white space characters, '*' (a wildcard that matches zero or more characters), or '?' (a wildcard that matches exactly one character). For example, to specify a set of declarations for any host in the ".co.uk" set of domains, the following pattern could be used:

```
Host *.co.uk
```

The following pattern would match any host in the 192.168.0.[0-9] network range:

```
Host 192.168.0.?
```

A *pattern-list* is a comma-separated list of patterns. Patterns within pattern-lists can be negated by preceding them with an exclamation mark ('!'). For example, to allow a key to be used from anywhere within an organization except from the "dialup" pool, the following entry (in the `authorized_keys` file) could be used:

```
from="!*.dialup.example.com,*.example.com"
```

Limitations

Due to limitations in the SECSH protocol with regards to EBCDIC platforms, user-defined subsystems are only supported between z/OS and z/OS. (For information about the IETF SECSH RFCs and internet drafts, see Appendix C, “RFCs and Internet drafts,” on page 523.)

Files

~/.ssh/config

The per-user configuration file. For the format of this file, see “File format” on page 147. The file is used by the SSH client. Because of the potential for abuse, this file must have strict permissions: read/write for the user, and not writeable by others.

/etc/ssh/ssh_config

The system-wide configuration file. This file provides defaults for those values that are not specified in the user's configuration file and for those users who do not have a configuration file. This file must be world-readable.

Related information

scp, **sftp**, **ssh**

Authors

OpenSSH is a derivative of the original and free ssh 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus Friedl contributed the support for SSH protocol versions 1.5 and 2.0.

zos_ssh_config — z/OS-specific system-wide OpenSSH client configuration file

Description

z/OS obtains z/OS-specific system-wide OpenSSH client configuration data only from the `/etc/ssh/zos_ssh_config` configuration file. It contains sections separated by "Host" specifications, and that section is only applied for hosts that match one of the patterns given in the specification. The matched host name is the one given on the command line.

Restriction: z/OS-specific keywords cannot be specified in the **ssh_config** configuration files, such as the system-wide configuration file (`/etc/ssh/ssh_config`) or user-defined configuration file specified with the **ssh -F** option.

File format

The **zos_ssh_config** configuration file views empty lines and lines starting with # as comments. Configuration options can be specified using two different formats.

- The first format is the keyword argument pair separated by white space.
- The second format is the keyword argument pair separated with exactly one "=" and optional white space. Arguments can optionally be enclosed in double quotes (") in order to represent arguments containing spaces.

  For example:

  ```
  keyword argument
  keyword=argument
  ```

Keywords are not case sensitive while arguments are case sensitive. Following are the possible keywords:

ChannelConvert

Specifies one or more ssh channel types that will automatically be converted between ASCII and EBCDIC using the default code pages for the current locale. The argument must be a comma-separated list selected from the following list of channel types:

shell Interactive session

exec Remote program execution

subsystem

Remote subsystem program execution

direct-tcpip
TCP/IP forwarding

forwarded-tcpip
TCP/IP reverse forwarding

stdio-forward
ssh -W option (applies to client only)

The default is “shell,exec”, which is identical to the behavior of channel conversion in previous releases.

Note:

- “shell” conversion is enabled whether it is specified or not.
- This option only controls stdin/stdout conversion. stderr output (used with shell and exec channels) is always converted.
- The sftp protocol requires a binary connection. Do not specify “subsystem” conversion when using the **sftp** command or subsystem.
- The **scp** command requires a text (translated) connection. You must specify “exec” (which is enabled by default) when using the scp client or server.
- This option should not be used globally in **zos_ssh_config** since changing conversion options for channel types (for example, “subystem” or “exec”) could cause sftp, scp, and other exec connections to fail. The option may be used in **Host** blocks for selected connections.

Example 1: Executing a remote program, without translating its output:

```
> ssh -oChannelConvert=shell user@host cat remote.bin > local.bin
```

Example 2: Sending data to a remote socket program, tunneled through an ssh connection, translating the input and output:

```
> echo "hi" | ssh -W localhost:5000 -oChannelConvert=stdio-forward user@host
```

CiphersSource
Specifies the source used to implement the ciphers specified by the **ssh_config** keyword Ciphers. Valid arguments are "any", "OpenSSL" or "ICSF". The default is "OpenSSL". Specifying "OpenSSL" requests all ciphers to be implemented using the statically linked OpenSSL cryptographic library. Specifying "ICSF" requests all applicable ciphers to be implemented using Integrated Cryptographic Service Facility (ICSF). Ciphers that are not supported by ICSF will fail if used. Specifying "any" requests all applicable ciphers to be implemented using ICSF if available. Ciphers that are not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all ciphers are implemented using OpenSSL. For more information about the ICSF-supported ciphers and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations” on page 52. If FIPSMODE is set to “yes” and **CiphersSource** is set to “any”, the **CiphersSource** option will be set to “ICSF” automatically.

Restriction: This option only applies to protocol version 2.

ClientSMF
Specifies whether to collect client SMF records. The argument must be set to "TYPE119_U83", "TYPE119_U84" or "none". The default is "none". If set to "TYPE119_U83" or "TYPE119_U84" , SMF Type 119 client transfer completion records (subtype 97) are collected for the **sftp** and **scp** commands. SMF record exit IEFU83 receives control for "TYPE119_U83". SMF record exit IEFU84 receives control for "TYPE119_U84".

Restriction: Because this keyword can only be set in the z/OS-specific system-wide configuration file (`/etc/ssh/zos_ssh_config`), it cannot be specified using the **-o** option of **scp**, **sftp** or **ssh**.

The IEFU83 and IEFU84 exits are documented in *z/OS MVS Installation Exits*.

FIPSMODE
Specifies whether or not OpenSSH is running in FIPS mode. Valid arguments are `no` or `yes`. The default value is `no` which means OpenSSH is not running in any FIPS mode. Specifying `yes` means that OpenSSH is running in FIPS 140-2 mode. If this option is set to “yes”, it requires that **CiphersSource**, **MacsSource**, **KexAlgorithmsSource** are set to “ICSF” or “any”.

Restriction: This option only applies to protocol version 2.

Host Restricts the following declarations (up to the next Host keyword) to be only for those hosts that match one of the patterns given after the keyword. A single * as a pattern can be used to provide global defaults for all hosts. The host is the hostname argument given on the command line (the name is not converted to a canonical host name before matching).

See “Patterns” on page 163 in **ssh_config** for more information about patterns.

KexAlgorithmsSource
Specifies the source used to implement Key Exchange algorithms specified by the **`ssh_config`** keyword **KexAlgorithms**. Valid arguments are `any`, `OpenSSL` or `ICSF`. The default is `OpenSSL`. Specifying `OpenSSL` requests all Key Exchange algorithms to be implemented using the statically linked OpenSSL Cryptographic library. Specifying `ICSF` requests all applicable Key Exchange algorithms to be implemented using Integrated Cryptographic Service Facility (ICSF). Key Exchange algorithms that are not supported by ICSF will fail if used. Specifying `any` requests all applicable Key Exchange algorithms to be implemented using ICSF if available. Key Exchange algorithms not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all Key Exchange algorithms are implemented using OpenSSL. For more information about the ICSF-supported Key Exchange algorithms and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations” on page 52. If FIPSMODE is set to “yes” and **KexAlgorithmsSource** is set to “any”, the **KexAlgorithmsSource** option will be set to “ICSF” automatically.

Restriction: This option applies to protocol version 2 only.

MACsSource
Specifies the source used to implement the MAC algorithms specified by the **ssh_config** keyword MACs. Valid arguments are "any", "OpenSSL" or "ICSF". The default is "OpenSSL". Specifying "OpenSSL" requests all MAC algorithms to be implemented using the statically linked OpenSSL cryptographic library. Specifying "ICSF" requests all applicable MAC algorithms to be implemented using Integrated Cryptographic Service Facility (ICSF). MAC algorithms that are not supported by ICSF will fail if used. Specifying "any" requests all applicable MAC algorithms to be implemented using ICSF if available. MAC algorithms not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all MAC algorithms are implemented using OpenSSL. For more information about the ICSF-supported MAC algorithms and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations” on page 52

52. If FIPSMODE is set to “yes” and **MacsSource** is set to “any”, the **MacsSource** option will be set to “ICSF” automatically.

Restriction: This option only applies to protocol version 2.

zEDCCompression
Specifies whether zEnterprise Data Compression hardware will be allowed for ssh packet compression. The argument must be set to “yes” or “no”. The default is “no”. When set to “yes”, the zEDC zlib inflate/deflate threshold is lowered so that the initial ssh packets will allow hardware enabled compression for the connection. This option should not be enabled for interactive connections or others that primarily use small packets, as this could result in reduced performance as compared to the default software-based compression. Performance benefits are more likely to be realized with sftp or scp file transfer connections. This option has no effect unless the OpenSSH **Compression** option is enabled. See “ssh_config — OpenSSH client configuration files” on page 147 for more information on enabling ssh compression. For more information, see “zlib for zEnterprise Data Compression” in *z/OS MVS Programming: Callable Services for High-Level Languages*.

Files

/etc/ssh/zos_ssh_config
z/OS-specific system-wide client configuration file. This file must be world-readable but writable only by a superuser.

Related information

scp, **sftp**, **ssh**

zos_user_ssh_config — z/OS-specific per-user OpenSSH client configuration file

Description

z/OS obtains z/OS-specific per-user client configuration data in the following order:

1. User-specific client options from:
   a. The command-line specification using the **-o** option of the **scp**, **sftp**, or **ssh** command.
   b. The file specified with variable _ZOS_USER_SSH_CONFIG. The default is `~/.ssh/zos_user_ssh_config`.
2. System-wide client options from the file `/etc/ssh/zos_ssh_config`.

For each keyword that only supports one instance, the first obtained value is used. If the keyword supports multiple instances, all values are obtained from all sources and used as defined by the keyword.

Restriction: z/OS-specific keywords cannot be specified in the **ssh_config** configuration files, such as the system-wide configuration file (`/etc/ssh/ssh_config`) or user-defined configuration file specified with the **ssh -F** option.

The configuration file contains sections separated by "Host" specifications, and that section is only applied for hosts that match one of the patterns given in the specification. The matched host name is the one given on the command line.

File format

The **zos_user_ssh_config** configuration file views empty lines and lines starting with # as comments. Configuration options can be specified using two different formats.

- The first format is the keyword argument pair separated by white space.
- The second format is the keyword argument pair separated with exactly one "=" and optional white space. This format is useful to avoid the need to quote white space when specifying configuration options using the **scp**, **sftp** and **ssh -o** options. Arguments can optionally be enclosed in double quotes (") in order to represent arguments containing spaces.

  For example:

  ```
  keyword argument
  keyword=argument
  ```

Keywords are not case sensitive while arguments are case sensitive. Following are the possible keywords:

ChannelConvert

Specifies one or more ssh channel types that will automatically be converted between ASCII and EBCDIC using the default code pages for the current locale. The argument must be a comma-separated list selected from the following list of channel types:

shell Interactive session

exec Remote program execution

subsystem
Remote subsystem program execution

direct-tcpip
TCP/IP forwarding

forwarded-tcpip
TCP/IP reverse forwarding

stdio-forward
`ssh -W` option (applies to client only)

The default is “shell,exec”, which is identical to the behavior of channel conversion in previous releases.

Note:

- “shell” conversion is enabled whether it is specified or not.
- This option only controls stdin/stdout conversion. stderr output (used with shell and exec channels) is always converted.
- The sftp protocol requires a binary connection. Do not specify “subsystem” conversion when using the **sftp** command or subsystem.
- The **scp** command requires a text (translated) connection. You must specify “exec” (which is enabled by default) when using the scp client or server.
- This option should not be used globally in **zos_ssh_config** since changing conversion options for channel types (for example, “subystem” or “exec”) could cause sftp, scp, and other exec connections to fail. The option may be used in **Host** blocks for selected connections.

Example 1: Executing a remote program, without translating its output:

```
> ssh -oChannelConvert=shell user@host cat remote.bin > local.bin
```

Example 2: Sending data to a remote socket program, tunneled through an ssh connection, translating the input and output:

```
> echo "hi" | ssh -W localhost:5000 -oChannelConvert=stdio-forward user@host
```

CiphersSource

Specifies the source used to implement the ciphers specified by the **ssh_config** keyword Ciphers. Valid arguments are "any", "OpenSSL" or "ICSF". The default is "OpenSSL". Specifying "OpenSSL" requests all ciphers to be implemented using the statically linked OpenSSL cryptographic library. Specifying "ICSF" requests all applicable ciphers to be implemented using Integrated Cryptographic Service Facility (ICSF). Ciphers that are not supported by ICSF will fail if used. Specifying "any" requests all applicable ciphers to be implemented using ICSF if available. Ciphers that are not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all ciphers are implemented using OpenSSL. For more information about the ICSF-supported ciphers and the setup required to use ICSF, see "Setting up OpenSSH to use ICSF cryptographic operations" on page 52. If FIPSMODE is set to yes and **CiphersSource** is set to "any", the **CiphersSource** option will be set to "ICSF" automatically.

Restriction: This option applies to protocol version 2 only.

FIPSMODE

Specifies whether or not OpenSSH is running in FIPS mode. Valid arguments are `no` or `yes`. The default value is `no` which means OpenSSH is not running in any FIPS mode. Specifying `yes` means that OpenSSH is running in FIPS 140-2 mode. If this option is set to "yes", it requires that **CiphersSource**, **MacsSource**, and **KexAlgorithmsSource** are set to "ICSF" or "any".

Restriction: This option only applies to protocol version 2.

Host Restricts the following declarations (up to the next Host keyword) to be only for those hosts that match one of the patterns given after the keyword. A single * as a pattern can be used to provide global defaults for all hosts. The host is the hostname argument given on the command line (the name is not converted to a canonical host name before matching).

See "Patterns" on page 163 in **ssh_config** for more information about patterns.

IdentityKeyRingLabel

Specifies the key ring owner, key ring name and certificate label within the key ring from which the user's RSA or DSA authentication identity is read. The key ring can be real or virtual, and the certificate label can contain embedded blanks. The key ring and the certificate connected to the key ring were created in the user authentication setup, which is described in "Steps for setting up user authentication when using UNIX files to store keys" on page 75. One or more blanks separate the key ring name from the certificate label. The user's RSA or DSA authentication identity is read from all certificates before the identities associated with files specified with IdentityFile are checked. Refer to the **-i** *identity_file* description in ssh for a summary of the order that identities are tried during public key authentication.

The default is to use only the identity files and agent.

It is possible to have multiple identity files and key ring certificates in configuration files. If both identity files and key ring certificates are used, the key ring certificates are tried first. The maximum combined number of identity key files and key ring certificates that can be specified is 100.

The option value must be surrounded with double quotes when it appears in a configuration file, but double quotes are optional if the option appears on the **ssh** command line.

Example: An example of this option in the **zos_user_ssh_config** file for a key ring named SSHring that is owned by KeyRingOwnerID and a certificate labeled "my label with blanks" is as follows:

```
IdentityKeyRingLabel="KeyRingOwnerID/SSHring my label with blanks"
```

If the option is specified as a command-line option, you might need to include double quote characters that surround the argument value so that it is treated as a single command argument:

```
-o IdentityKeyRingLabel="KeyRingOwnerID/SSHring my label with blanks"
```

Restriction: To meet FIPS 140-2 mode standards, RSA/DSA key size must be 2048 or greater. OpenSSH limits the key size to be 1024 or greater in FIPS mode. Users should make sure to use the appropriate key size, if they want to meet FIPS 140-2 mode standards. The DSA 2048 key OpenSSH uses is not currently supported by RACF in FIPS mode.

KexAlgorithmsSource

Specifies the source used to implement Key Exchange algorithms specified by the **ssh_config** keyword **KexAlgorithms**. Valid arguments are any, OpenSSL or ICSF. The default is OpenSSL. Specifying OpenSSL requests all Key Exchange algorithms to be implemented using the statically linked OpenSSL Cryptographic library. Specifying ICSF requests all applicable Key Exchange algorithms to be implemented using Integrated Cryptographic Service Facility (ICSF). Key Exchange algorithms that are not supported by ICSF will fail if used. Specifying any requests all applicable Key Exchange algorithms to be implemented using ICSF if available. Key Exchange algorithms not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all Key Exchange algorithms are implemented using OpenSSL. For more information about the ICSF-supported Key Exchange algorithms and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations”. If FIPSMODE is set to “yes” and **KexAlgorithmsSource** is set to “any”, the **KexAlgorithmsSource** option will be set to “ICSF” automatically.

Restriction: This option applies to protocol version 2 only.

MACsSource

Specifies the source used to implement the MAC algorithms specified by the **ssh_config** keyword MACs. Valid arguments are "any", "OpenSSL" or "ICSF". The default is "OpenSSL". Specifying "OpenSSL" requests all MAC algorithms to be implemented using the statically linked OpenSSL cryptographic library. Specifying "ICSF" requests all applicable MAC algorithms to be implemented using Integrated Cryptographic Service Facility (ICSF). MAC algorithms that are not supported by ICSF will fail if used. Specifying "any" requests all applicable MAC algorithms to be implemented using ICSF if available. MAC algorithms that are not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all MAC algorithms are implemented using OpenSSL. For more information about the ICSF-supported MAC algorithms and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations” on page 52. If FIPSMODE is set to “yes” and **MacsSource** is set to “any”, the **MacsSource** option will be set to “ICSF” automatically.

Restriction: This option applies to protocol version 2 only.

zEDCCompression
Specifies whether zEnterprise Data Compression hardware will be allowed for ssh packet compression. The argument must be set to "yes" or "no". The default is "no". When set to "yes", the zEDC zlib inflate/deflate threshold is lowered so that the initial ssh packets will allow hardware enabled compression for the connection. This option should not be enabled for interactive connections or others that primarily use small packets, as this could result in reduced performance as compared to the default software-based compression. Performance benefits are more likely to be realized with sftp or scp file transfer connections. This option has no effect unless the OpenSSH **Compression** option is enabled. See "ssh_config — OpenSSH client configuration files" on page 147 for more information on enabling ssh compression. For more information, see "zlib for zEnterprise Data Compression" in *z/OS MVS Programming: Callable Services for High-Level Languages*.

Environment variable

_ZOS_USER_SSH_CONFIG
Specifies the path name of the z/OS-specific per-user OpenSSH client configuration file. The system-wide default is `/etc/ssh/zos_ssh_config` and the user's default is `~/.ssh/zos_user_ssh_config`. If this variable is specified, it replaces the user's default file but not the system-wide default file. The recommended permissions of the specified file are read/write for the user and not accessible by others.

Files

~/.ssh/zos_user_ssh_config
z/OS-specific per-user OpenSSH client configuration file. This file must be writable only by the user. It can be readable by others, but need not be.

Related information

scp, **sftp**, **ssh**

OpenSSH daemon configuration files

sshd_config — OpenSSH daemon configuration file

Description

sshd reads configuration data from the `/etc/ssh/sshd_config` file or the file specified with **-f** on the command line. "File format" describes the file format.

File format

The **sshd_config** configuration file views empty lines and lines starting with # as comments.

Configuration options can be specified using two different formats.

- The first format is the keyword argument pair separated by white space.
- The second format is the keyword argument pair separated with exactly one "=" and optional white space. This format is useful to avoid the need to quote white space when specifying configuration options using the **sshd –o** options. Arguments can optionally be enclosed in double quotes (") in order to represent arguments containing spaces.

For example:

```
keyword argument
keyword=argument
```

Keywords are not case sensitive and arguments are case sensitive. Following are possible keywords:

AcceptEnv
Specifies which environment variables sent by the client will be copied into the session's environment. See the description of the **ssh_config** keyword SendEnv for information about configuring clients. Variables are specified by name, which can contain the wildcard characters '*' and '?'. However, the name cannot contain the equal (=) character. Multiple environment variables can be separated by white spaces or spread across multiple AcceptEnv options for a maximum of 256 environment variable specifications. The default is not to accept any environment variables.

Guideline: Be careful when using the AcceptEnv option because some environment variables can be used to bypass restricted user environments.

The accepted environment variables are processed after authentication but before general environment variable setup and handling of the **sshd_config** keyword PermitUserEnvironment. Therefore, the values of accepted environment variables might be overwritten as a result of this subsequent processing.

Restriction: Environment variable passing is supported for protocol version 2 only.

AddressFamily
Specifies the address family to be used by **sshd**. Valid arguments are "any", "inet" (use IPv4 only), or "inet6" (use IPv6 only). The default is "any".

AFSTokenPassing
Not supported on z/OS UNIX. Specifies whether an AFS token can be forwarded to the server. The default is "no".

AllowAgentForwarding
Specifies whether ssh-agent(1) forwarding is permitted. The default is “yes”. Disabling agent forwarding does not improve general z/OS security unless users are also denied shell access, because they can install their own forwarders.

AllowGroups
This keyword can be followed by a list of group name patterns, separated by spaces. If specified, login is allowed only for users whose primary group or supplementary group list matches one of the patterns. Only group names are valid; a numerical group ID is not recognized. By default, login is allowed for all groups. The allow and deny options are processed in the following order to determine if the user should be disallowed from login: DenyUsers, AllowUsers, DenyGroups, and then AllowGroups. To be allowed to login, you must pass all the tests for the specified keywords.

That is, if you want *userx* who is in *groupy* and *groupz* to be allowed to login, and you plan to specify all four keywords, then:

- *userx* must not be in DenyUsers, and
- *userx* must be in AllowUsers, and
- both *groupy* and *groupz* must not be in DenyGroups, and
- either *groupy* or *groupz* must be in AllowGroups

Note: To be allowed to login, the user must have a group if AllowGroups or DenyGroups is specified.

See "Patterns" on page 163 in **ssh_config** for more information about patterns.

Refer to the **sshd_config** keyword Match for more information about matching z/OS user and group names.

Restriction: The maximum number of AllowGroups specifications is 256.

AllowTcpForwarding

Specifies whether TCP forwarding is permitted. The available options are "yes" or "all" to allow TCP forwarding, "no" to prevent all TCP forwarding, "local" to allow local (from the perspective of **ssh**) forwarding only or "remote" to allow remote forwarding only. Disabling TCP forwarding does not improve general z/OS security unless users are also denied shell access, because they can install their own forwarders. The default is "no".

AllowUsers

This keyword can be followed by a list of user name patterns, separated by spaces. If specified, login is allowed only for user names that match one of the patterns. Only user names are valid; a numerical user ID is not recognized. If the pattern takes the form *user@host*, then *user* and *host* are separately checked, restricting logins to particular users from particular hosts. The default is to allow login for all users. The allow and deny options are processed in the following order to determine if the user should be disallowed from login: DenyUsers, AllowUsers, DenyGroups, and then AllowGroups. To be allowed to login, you must pass all the tests for the specified keywords.

That is, if you want *userx* who is in *groupy* and *groupz* to be allowed to login, and you plan to specify all four keywords, then:

- *userx* must not be in DenyUsers, and
- *userx* must be in AllowUsers, and
- both *groupy* and *groupz* must not be in DenyGroups, and
- either *groupy* or *groupz* must be in AllowGroups

Note: To be allowed to login, the user must have a group if AllowGroups or DenyGroups is specified.

See "Patterns" on page 163 in **ssh_config** for more information about patterns.

Refer to the **sshd_config** keyword Match for more information about matching z/OS user and group names.

Restriction: The maximum number of AllowUsers specifications is 256.

AuthenticationMethods

Specifies the authentication methods that must be successfully completed for a user to be granted access. This option must be followed by one or more comma-separated lists of authentication method names. Successful authentication requires completion of every method in at least one of these lists.

For example, an argument of "publickey,password publickey,keyboardinteractive" would require the user to complete public key authentication, followed by either password or keyboard interactive authentication. Only methods that are next in one or more lists are offered at each stage, so for this example, it would not be possible to attempt password or keyboard interactive authentication before public key.

For keyboard interactive authentication it is also possible to restrict authentication to a specific device by appending a colon followed by the device identifier “bsdauth”, “pam”, or “skey”, depending on the server configuration. For example, “keyboard-interactive:bsdauth” would restrict keyboard interactive authentication to the bsdauth device. Keyboard interactive authentication is not supported on z/OS UNIX.

This option is only available for SSH protocol 2 and will yield a fatal error if enabled if protocol 1 is also enabled.

Note: Each authentication method listed should also be explicitly enabled in the configuration.
The default is not to require multiple authentication; successful completion of a single authentication method is sufficient.

AuthorizedKeysCommand

Specifies a program to be used to look up the user's public keys. The program must be owned by root and not writable by group or others. It will be invoked with a single argument of the username being authenticated, and should produce on standard output zero or more lines of authorized_keys output (see “Authentication” on page 135). If a key supplied by AuthorizedKeysCommand does not successfully authenticate and authorize the user, then public key authentication continues using the usual AuthorizedKeysFile files. By default, no AuthorizedKeysCommand is run.

If running in **FIPSMODE**, the plain text keys in **AuthorizedKeysFile** files will be ignored. Only zos-key-ring-label takes effect. The option revokes the public keys for the public key authentication.

AuthorizedKeysCommandUser

Specifies the user under whose account the AuthorizedKeysCommand is run. It is recommended to use a dedicated user that has no other role on the host than running authorized keys commands.

AuthorizedKeysFile

Specifies the file that contains the public keys that can be used for user authentication. AuthorizedKeysFile can contain tokens in the form *%T* which are substituted during connection setup. The following tokens are defined: %% is replaced by a literal %, *%h* is replaced by the home directory of the user being authenticated and *%u* is replaced by the username of that user. After expansion, AuthorizedKeysFile is taken to be an absolute path or one relative to the user's home directory (if no absolute path is given). Multiple file names may be listed, separated by whitespace. The default is `".ssh/authorized_keys, .ssh/authorized_keys2"` - (these files are anchored off the user's home directory).

If running in **FIPSMODE**, the plain text keys in **AuthorizedKeysFile** files will be ignored. Only zos-key-ring-label takes effect.

Restriction: The maximum path length is 1023 bytes.

AuthorizedPrincipalsFile

Specifies a file that lists principal names that are accepted for certificate authentication. When using certificates signed by a key listed in TrustedUserCAKeys, this file lists names, one of which must appear in the certificate for it to be accepted for authentication. Names are listed one per line preceded by key options (as described in “Format of the authorized_keys file” on page 136). Empty lines and comments starting with “#” are ignored.

AuthorizedPrincipalsFile may contain tokens of the form *%T* which are substituted during connection setup. The following tokens are defined: % % is replaced by a literal '%', *%h* is replaced by the home directory of the user being authenticated, and *%u* is replaced by the username of that user. After expansion, AuthorizedPrincipalsFile is taken to be an absolute path or one relative to the user's home directory.

The default is “none”, that is, not to use a principals file – in this case, the username of the user must appear in a certificate's principals list for it to be accepted.

Note: AuthorizedPrincipalsFile is only used when authentication proceeds using a CA listed in TrustedUserCAKeys and is not consulted for certification authorities trusted by way of `~/.ssh/authorized_keys`, though the principals=key option offers a similar facility (see “sshd — OpenSSH daemon” on page 132 for details).

If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

Banner

The contents of the specified file are sent to the remote user before authentication is allowed. If the argument is "none", then no banner is displayed. The default is no banner is displayed.

Restriction: This option applies to protocol version 2 only.

ChallengeResponseAuthentication

Not supported on z/OS UNIX. Specifies whether challenge-response authentication is allowed. The default is "no".

ChrootDirectory

Specifies a path to chroot to after authentication. This path, and all its components, must be root-owned directories that are not writable by any other user or group. This path also affects the files used during the login process. The default is not to chroot. For more information, see “Login process” on page 136 in the **sshd** section.

The path can contain the following tokens that are expanded at runtime once the connecting user has been authenticated: %% is replaced by a literal %, *%h* is replaced by the home directory of the user being authenticated, and *%u* is replaced by the username of that user.

The ChrootDirectory must contain the necessary files and directories to support the users' session. For interactive sessions, a shell (typically, sh) is required as well as basic /dev nodes such as null, zero, stdin, stdout, stderr, random and tty devices. For file transfer sessions using **sftp,** no additional configuration of the environment is necessary if the in-process **sftp** server is used (see Subsystem for details).

Rule: If the syslog daemon (**syslogd**) is used to debug the users' session, such as a file transfer session using **sftp**, then the ChrootDirectory must contain the datagram socket in use by **syslogd** (for example, `/dev/log`).

Restriction: The maximum path length is 1023 bytes.

Ciphers

Specifies the ciphers to use for encrypting the session in protocol version 2. Multiple ciphers must be comma-separated. Valid ciphers include:

3des-cbc
Triple-DES (3DES) algorithm

aes128-cbc
Advanced Encryption Standard (AES) CBC mode with 128-bit key

aes128-ctr
Advanced Encryption Standard (AES) CTR mode with 128-bit key

aes192-cbc
Advanced Encryption Standard (AES) CBC mode with 192-bit key

aes192-ctr
Advanced Encryption Standard (AES) CTR mode with 192-bit key

aes256-cbc
Advanced Encryption Standard (AES) CBC mode with 256-bit key

aes128-gcm@openssh.com
Advanced Encryption Standard (AES) GCM mode with 128-bit key

aes256-gcm@openssh.com
Advanced Encryption Standard (AES) GCM mode with 256-bit key

aes256-ctr
Advanced Encryption Standard (AES) CTR mode with 256-bit key

arcfour
Arcfour algorithm

arcfour128
Arcfour algorithm with 128-bit key

arcfour256
Arcfour algorithm with 256-bit key

blowfish-cbc
Blowfish algorithm

cast128-cbc
CAST algorithm

rijndael-cbc@lysator.liu.se
Same as Advanced Encryption Standard (AES) CBC mode with 256-bit key

The ciphers list is typically one long unbroken line; however due to space limitations, the default ciphers list is not shown as one unbroken line. The default is:

```
aes128-ctr,aes192-ctr,aes256-ctr,arcfour256,arcfour128,
aes128-gcm@openssh.com,aes256-gcm@openssh.com,aes128-cbc,
3des-cbc,blowfish-cbc,cast128-cbc,aes192-cbc, aes256-
cbc,arcfour
```

FIPS mode requires CTR algorithms that use non-repeated IV for the same AES key. z/OS OpenSSH manages the IV by itself. The IV is stored in an array that is 16 bytes long. It won't be repeated until encrypt 2^128 times, about 2^132 bytes in a connection. This most probably cannot be repeated in actual use. The **RekeyLimit** option can be used to renegotiate a new key automatically to avoid the repetition.

Restriction: If running in FIPS mode, the following options are not supported:

```
aes128-gcm@openssh.com,
aes256-gcm@openssh.com,
arcfour,
arcfour128,
arcfour256,
blowfish-cbc,
cast128-cbc
```

The ciphers list might need to be modified based on the ciphers source used. For more information, see the **zos_sshd_config** keyword CiphersSource.

ClientAliveInterval
Sets a timeout interval in seconds after which if no data has been received from the client, **sshd** sends a message through the encrypted channel to request a response from the client. The default is 0, indicating that these messages will not be sent to the client.

Restriction: This option applies to protocol version 2 only.

ClientAliveCountMax
Sets the number of client alive messages that can be sent without **sshd** receiving any messages back from the client. If this threshold is reached while client alive messages are being sent, **sshd** disconnects the client, thus terminating the session. It is important to note that the use of client alive messages is very different from TCPKeepAlive. Because the client alive messages are sent through the encrypted channel, they will not be spoofable. The TCP keepalive option enabled by TCPKeepAlive is spoofable. The client alive mechanism is valuable when the client or server depend on knowing when a connection has become inactive.

If ClientAliveInterval is set to 15 and ClientAliveCountMax is left at the default value of 3, unresponsive SSH clients are disconnected after approximately 45 seconds.

Restriction: This option applies to protocol version 2 only.

Compression
Specifies whether compression is allowed (full) or delayed until the user has authenticated successfully. The argument must be set to one of the following selections:

- "no" to disable all compression.
- "yes" to enable both full (zlib) and delayed (zlib@openssh.com) compression.
- "delayed" to enable delayed (zlib@openssh.com) compression only.

The default is "no".

If you use compression with privilege separation, make sure that the **sshd** daemon address space can memory map at least 656 pages. Either specify at least MAXMMAPAREA (656) in BPXPRMxx to provide a large enough system-wide value, or use a security product such as RACF to specify the MMAPAREAMAX limit for the user ID starting the **sshd** daemon. See *z/OS UNIX System Services Planning* for more information about MMAPAREAMAX.

DenyGroups
This keyword can be followed by a list of group name patterns, separated by spaces. Login is disallowed for users whose primary group or

supplementary group list matches one of the patterns. Only group names are valid; a numerical group ID is not recognized. The default is to allow login for all groups. The allow and deny options are processed in the following order to determine if the user should be disallowed from login: DenyUsers, AllowUsers, DenyGroups, and then AllowGroups. To be allowed to login, you must pass all the tests for the specified keywords.

That is, if you want *userx* who is in *groupy* and *groupz* to be allowed to login, and you plan to specify all four keywords, then:

- *userx* must not be in DenyUsers, and
- *userx* must be in AllowUsers, and
- both *groupy* and *groupz* must not be in DenyGroups, and
- either *groupy* or *groupz* must be in AllowGroups

Note: To be allowed to login, the user must have a group if AllowGroups or DenyGroups is specified.

See "Patterns" on page 163 in **ssh_config** for more information about patterns.

Refer to the **sshd_config** keyword Match for more information about matching z/OS user and group names.

Restriction: The maximum number of DenyGroups specifications is 256.

DenyUsers

This keyword can be followed by a list of user name patterns, separated by spaces. Login is disallowed for user names that match one of the patterns. Only user names are valid; a numerical user ID is not recognized. The default is to allow login for all users. If the pattern takes the form *user@host* then *user* and *host* are separately checked, restricting logins to particular users from particular hosts. The allow and deny options are processed in the following order to determine if the user should be disallowed from login: DenyUsers, AllowUsers, DenyGroups, and then AllowGroups. To be allowed to login, you must pass all the tests for the specified keywords.

That is, if you want *userx* who is in *groupy* and *groupz* to be allowed to login, and you plan to specify all four keywords, then:

- *userx* must not be in DenyUsers, and
- *userx* must be in AllowUsers, and
- both *groupy* and *groupz* must not be in DenyGroups, and
- either *groupy* or *groupz* must be in AllowGroups

Note: To be allowed to login, the user must have a group if AllowGroups or DenyGroups is specified.

See "Patterns" on page 163 in **ssh_config** for more information about patterns.

Refer to the **sshd_config** keyword Match for more information about matching z/OS user and group names.

Restriction: The maximum number of DenyUsers specifications is 256.

ForceCommand

Forces the execution of the command specified by ForceCommand, ignoring any command supplied by the client and `~/.ssh/rc` if present. The command is invoked by using the user's login shell with the **-c** option.

This applies to shell, command, or subsystem execution. It is most useful inside a Match block. The command originally supplied by the client is available in the SSH_ORIGINAL_COMMAND environment variable.

Specifying a command of "internal-sftp" forces the use of an in-process sftp server that requires no support files when used with ChrootDirectory.

Tip: sftp-server options can be specified with the "internal-sftp" command by separating the options with blank spaces.

GatewayPorts

Specifies whether remote hosts are allowed to connect to ports forwarded by the client. By default, **sshd** binds remote port forwardings to the loopback address. This prevents other remote hosts from connecting to forwarded ports. GatewayPorts can be used to specify that **sshd** is to allow remote port forwardings to bind to non-loopback addresses, thus allowing other hosts to connect. The argument can be set to one of the following selections:

- "no" to force remote port forwardings to be available to the local host only.
- "yes" to force remote port forwardings to bind to the wildcard address.
- "clientspecified" to allow the client to select the address to which the forwarding is bound.

The default is "no".

GSSAPIAuthentication

Specifies whether user authentication based on GSS-API is allowed. The default is "no".

If running in **FIPSMODE**, this option is not supported even if its value is specified.

Restriction: This option applies to protocol version 2 only.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt.

GSSAPICleanupCredentials

Specifies whether to automatically destroy the user's credentials cache on logout. The default is "yes".

Restriction: This option applies to protocol version 2 only.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt

GSSAPIKeyExchange

Specifies whether key exchange based on GSSAPI is allowed. GSSAPI key exchange does no rely on ssh keys to verify host identity. The default is “no”.

Restriction: This option applies to protocol version 2 only.

If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt

GSSAPIStoreCredentialsOnRekey

Controls whether the user's GSSAPI credentials should be updated following a successful connection rekeying. This option can be used to accepted renewed or updated credentials from a compatible client. The default is “no”.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt

GSSAPIStrictAcceptorCheck

Determines whether to be strict about the identity of the GSSAPI acceptor a client authenticates against. If “yes”, then the client must authenticate against the `host/default_hostname` service, using the current default hostname. If “no”, then the client may authenticate against any `host/some_hostname` service key stored in the machine's default store and available for use by the sshd server. This facility is provided to assist with operation on multi homed machines. The default is “yes”.

Restriction: This option applies to protocol version 2 only.

GSS-API stands for Generic Security Services Application Programming Interface. It is a generic API for handling client-server authentication. Because it provides security services to callers in a generic way, supportable with a range of underlying mechanisms and technologies, it allows for source-level portability of applications to different environments. For more details, check IETF standard RFC 2743 at http://www.ietf.org/rfc/rfc2743.txt

HostbasedAuthentication

Specifies whether rhosts or `/etc/hosts.equiv` authentication together with successful public key client host authentication is allowed (host-based authentication). The default is "no".

Restriction: This option applies to protocol version 2 only and is similar to RhostsRSAAuthentication.

HostbasedUsesNameFromPacketOnly

Specifies whether or not the server will attempt to perform a reverse name lookup when matching the name in the `~/.shosts`, `~/.rhosts`, and `/etc/hosts.equiv` files during HostbasedAuthentication. A setting of "yes" means that **sshd** uses the name supplied by the client instead of attempting to resolve the name from the TCP connection itself. The default is "no".

HostCertificate

Specifies a file containing a public host certificate. The certificate's public key must match a private host key already specified by HostKey. The default behaviour of `sshd` is not to load any certificates.

If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

HostKey

Specifies a file containing a private host key used by OpenSSH. The default host key is `/etc/ssh/ssh_host_key` for protocol version 1. For protocol version 2, the default host key is `/etc/ssh/ssh_host_rsa_key`, `/etc/ssh/ssh_host_dsa_key`, and `/etc/ssh/ssh_host_ecdsa_key`. **sshd** will refuse to use a file if it is group/world-accessible. RSA1 keys are used for protocol version 1 and DSA, RSA, or ECDSA are used for protocol version 2.

It is possible to have multiple host key files and key ring certificates (as configured by the HostKeyRingLabel option in the **zos_sshd_config** file) in configuration files. If both host key files and key ring certificates are listed, the key ring certificates will be tried first. Only the first key found of each key type (for example, RSA, DSA, ECDSA, or RSA1) is used.

The maximum combined number of host key files and key ring certificates that can be specified is 256.

If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

HostKeyAgent

Identifies the UNIX-domain socket used to communicate with an agent that has access to the private host keys. If “SSH_AUTH_SOCK” is specified, the location of the socket will be read from the SSH_AUTH_SOCK environment variable.

If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

IgnoreRhosts

Specifies that `.rhosts` and `.shosts` files will not be used in RhostsRSAAuthentication or HostbasedAuthentication.

The `/etc/hosts.equiv` and `/etc/ssh/shosts.equiv` files are still used. The default is "yes".

IgnoreUserKnownHosts

Specifies whether **sshd** should ignore the user's `~/.ssh/known_hosts` during RhostsRSAAuthentication or HostbasedAuthentication. The default is "no".

IPQoS This option is currently ignored in z/OS UNIX. Specifies the IPv4 type-ofservice or DSCP class for the connection. Accepted values are "af11", "af12", "af13", "af21", "af22", "af23", "af31", "af32", "af33", "af41", "af42", "af43", "cs0", "cs1", "cs2", "cs3", "cs4", "cs5", "cs6", "cs7", "ef", "lowdelay", "throughput", "reliability", or a numeric value. This option may take one or two arguments, separated by whitespace. If one argument is specified, it is used as the packet class unconditionally. If two values are specified, the first is automatically selected for interactive sessions and the second for non-interactive sessions. The default is "lowdelay" for interactive sessions and "throughput" for noninteractive sessions.

KbdInteractiveAuthentication

Not supported on z/OS UNIX. Specifies whether to use keyboard-interactive authentication. The argument to this keyword must be "yes" or "no".

KeepAlive

This keyword is supported for compatibility with versions of OpenSSH before 3.8.1p1. On systems using OpenSSH 3.8.1p1 or later, you should use the keyword TCPKeepAlive instead.

Specifies whether the system should send TCP keepalive messages to the other side. If they are sent, death of the connection or crash of one of the machines will be properly noticed. However, connections will die if the route is down temporarily. On the other hand, if keepalives are not sent, sessions may hang indefinitely on the server, leaving ghost users and consuming server resources.

The default is "yes" (to send keepalives), and the server will notice if the network goes down or the client host crashes. This avoids infinitely hanging sessions.

To disable keepalives, the value should be set to "no".

KerberosAuthentication

Not supported on z/OS UNIX. Specifies whether Kerberos authentication is allowed. The authentication can be in the form of a Kerberos ticket, or if PasswordAuthentication is "yes", the password provided by the user will be validated through the Kerberos KDC. To use this option, the server needs a Kerberos servtab which allows the verification of the KDC's identity. The default is "no".

KerberosGetAFSToken

Not supported on z/OS UNIX. If AFS is active and the user has a Kerberos 5 TGT, attempts to acquire an AFS token before accessing the user's home directory. The default is "no".

KerberosOrLocalPasswd

Not supported on z/OS UNIX. Validates the password by means of the security product's normal password checking if password authentication through Kerberos fails. The default is "yes".

KerberosTgtPassing

Not supported on z/OS UNIX. Specifies whether a Kerberos TGT is to be forwarded to the server. This will work only if the Kerberos server is actually an AFS kaserver. The default is "no".

KerberosTicketCleanup

Not supported on z/OS UNIX. Specifies whether to automatically erase the user's ticket cache file on logout. The default is "yes".

KexAlgorithms

Specifies the available KEX (Key Exchange) algorithms. Multiple algorithms must be comma-separated. The default is as follows:

```
ecdh-sha2-nistp256,
ecdh-sha2-nistp384,
ecdh-sha2-nistp521,
diffie-hellman-group-exchange-sha256,
diffie-hellman-group-exchange-sha1,
diffie-hellman-group14-sha1,
diffie-hellman-group1-sha1
```

The Key Exchange algorithms list might need to be modified based on the Exchange algorithms source used. For more information, see the **KexAlgorithmsSource** keyword in the z/OS-specific OpenSSH daemon configuration file zos_sshd_config. All KEX algorithms are supported in FIPS mode.

Note: This keyword will not be supported in a match block.

Restriction: This option applies to protocol version 2 only.

KeyRegenerationInterval
In protocol version 1, the ephemeral server key is automatically regenerated after this many seconds (if it has been used). Regeneration prevents the decrypting of captured sessions by later breaking into the machine and stealing the keys. The key is never stored anywhere. If the value is 0, the key is never regenerated. The default is 3600 (seconds).

ListenAddress
Specifies the local addresses **sshd** should listen on. The following forms can be used:

```
ListenAddress host|IPv4addr|IPv6_addr
ListenAddress host|IPv4_addr:port
ListenAddress [host|IPv6_addr]:port
```

If port is not specified, **sshd** listens on the address and all prior Port options specified. Multiple ListenAddress options are permitted. Additionally, any Port options must precede this option for non-port qualified addresses. The default is to listen on all local addresses.

LoginGraceTime
The server disconnects after this time if the user has not successfully logged in. If the value is 0, there is no time limit. The default is 120 (seconds).

LogLevel
Gives the verbosity level that is used when logging messages from **sshd**. The possible values are: QUIET, FATAL, ERROR, INFO, VERBOSE, DEBUG, DEBUG1, DEBUG2, and DEBUG3. The default is INFO. DEBUG and DEBUG1 are equivalent. DEBUG2 and DEBUG3 each specify higher levels of debugging output.

Guideline: Do not log with a DEBUG level because doing so violates the privacy of users.

For more information about these logging levels, also referred to as priority codes, see the syslog daemon chapter in *z/OS Communications Server: IP Configuration Reference*.

MACs Specifies the MAC (message authentication code) algorithms in order of preference. The MAC algorithm is used for data integrity protection. Multiple algorithms must be comma-separated.

The MAC algorithms list is typically one long unbroken line; however due to space limitations, the default MAC algorithms list is not shown as one unbroken line. The default is:

```
hmac-md5-etm@openssh.com,hmac-sha1-etm@openssh.com,
umac-64-etm@openssh.com,umac-128-etm@openssh.com,
hmac-sha2-256-etm@openssh.com,hmac-sha2-512-etm@openssh.com,
hmac-ripemd160-etm@openssh.com,hmac-sha1-96-etm@openssh.com,
hmac-md5-96-etm@openssh.com,
hmac-md5,hmac-sha1,umac-64@openssh.com,umac-128@openssh.com,
hmac-sha2-256,hmac-sha2-512,hmac-ripemd160,
hmac-ripemd16@openssh.com, hmac-sha1-96,hmac-md5-96
```

.

The algorithms that contain “-etm” calculate the MAC after encryption (encrypt-then-mac). The MAC algorithms list might need to be modified based on the MAC algorithms source used. For more information, see the **zos_sshd_config** keyword MACsSource.

Restrictions: This option applies to protocol version 2 only. Also, if running in FIPS mode, the following options are not supported:

```
hmac-md5,
hmac-md5-96,
hmac-md5-etm@openssh.com,
hmac-md5-96-etm@openssh.com,
hmac-ripemd160,
hmac-ripemd160@openssh.com
hmac-ripemd160-etm@openssh.com,
umac-64@openssh.com,
umac-64-etm@openssh.com,
umac-128-etm@openssh.com,
umac-128@openssh.com
```

Match Introduces a conditional block. If all of the criteria on the Match line are satisfied, the keywords on the following lines override those set in the global section of the config file, until either another Match line or the end of the file.

Rule: Global settings must be placed before the first Match block.

The arguments to Match are one or more criteria-pattern pairs. The available criteria are User, Group, Host, LocalAddress, LocalPort, and Address. The match patterns can consist of single entries or comma-separated lists and can use the wildcard and negation operators described in the **ssh_config** section “Patterns” on page 163.

Restrictions: Some restrictions apply.

- Only a subset of keywords can be used on the lines following a Match keyword. Those keywords are AcceptEnv, AllowAgentForwarding, AllowGroups, AllowTcpForwarding, AllowUsers, AuthenticationMethods, AuthorizedKeysCommand, AuthorizedKeysCommandUser, AuthorizedKeysFile, AuthorizedPrincipalsFile, Banner, ChrootDirectory, DenyGroups, DenyUsers, ForceCommand, GatewayPorts, GSSAPIAuthentication, HostbasedAuthentication, HostbasedUsesNameFromPacketOnly, KbdInteractiveAuthentication, KerberosAuthentication, MaxAuthTries, MaxSessions, PasswordAuthentication, PermitEmptyPasswords, PermitOpen, PermitRootLogin, PermitTunnel, PubkeyAuthentication, RekeyLimit, RhostsRSAAuthentication, RSAAuthentication, X11DisplayOffset, X11Forwarding, and X11UseLocalHost.

Guideline: User and group names are typically not case sensitive on z/OS systems. However, when matching user and group names for this keyword and for related keywords (such as the **sshd_config** keywords AllowGroups, AllowUsers, DenyGroups and DenyUsers), the user and group names must be in the same alphabetical case as is stored in the user database, group database and user ID alias table (for example, USERIDALIASTABLE).

Example:

```
AllowTcpForwarding no

Match Address 192.168.32.*,127.0.0.1
        AllowTcpForwarding yes
        GatewayPorts no

Match User bar,baz
        AllowTcpForwarding yes

Match Host t*
        AllowTcpForwarding yes
```

MaxAuthTries

Specifies the maximum number of authentication attempts permitted per connection. When the number of failures reaches half this value, additional failures are logged. The default is 6.

Password authentication failures are always logged.

MaxStartups

Specifies the maximum number of concurrent unauthenticated connections to the SSH daemon. Additional connections will be dropped until authentication succeeds or the LoginGraceTime expires for a connection. The default is 10:30:100.

Alternately, random early drop can be enabled by specifying the three colon separated values "start:rate:full" (for example, "10:30:100"). **sshd** will refuse connection attempts with a probability of "rate/100" (30%, in the example) if there are currently "start" (10) unauthenticated connections. The probability increases linearly and all connection attempts are refused if the number of unauthenticated connections reaches "full" (100).

PAMAuthenticationViaKbdInt

Not supported on z/OS UNIX. Specifies whether PAM challenge-response authentication is allowed. This option allows the use of most PAM challenge-response authentication modules, but it will allow password authentication regardless of whether PasswordAuthentication is enabled.

PasswordAuthentication

Specifies whether password authentication is allowed. The argument must be set to "yes" or "no". The default is "yes". Password authentication checks a user-supplied password or password phrase.

PermitEmptyPasswords

Specifies whether the server allows login to accounts with empty password strings when password authentication is allowed. The default is "no".

Guideline: Set this keyword to "no" for security reasons. However, empty passwords can be allowed by setting up a SURROGAT class. The MVS identity running **sshd** requires READ access to the SURROGAT class profile, BPX.SRV.*uuuuuuuu* (where *uuuuuuuu* is the MVS userid for each user who is permitted to log in with an empty password.) This allows any user to login to user ID *uuuuuuuu* without a password.

PermitOpen

| Specifies the destinations to which TCP port forwarding is permitted. The forwarding specification must be one of the following forms:

```
PermitOpen host:port
PermitOpen IPv4_addr:port
PermitOpen [IPv6_addr]:port
```

Multiple forwards can be specified by separating them with white space. An argument of "any" can be used to remove all restrictions and permit any forwarding requests. By default, all port forwarding requests are permitted.

PermitRootLogin
Specifies whether a superuser (root) can login using **ssh**. The argument must be "yes" (default), "without-password", "forced-commands-only", or "no".

If this option is set to "without-password", password authentication is disabled for superusers.

If this option is set to "forced-commands-only", superuser login with public key authentication will be allowed, but only if the Authorized Keys File "command=" option has been specified (which may be useful for taking remote backups even if superuser login is normally not allowed). All other authentication methods are disabled for superusers.

If this option is set to "no", a superuser is not allowed to login.

PermitTunnel
Not supported on z/OS UNIX. Specifies whether tunnel device forwarding is allowed. The argument must be "yes", "point-to-point" (layer 3), "ethernet" (layer 2), or "no". Specifying "yes" permits both "point-to-point" and "ethernet". The default is "no".

PermitUserEnvironment
Specifies whether the `~/.ssh/environment` and `environment=` options in `~/.ssh/authorized_keys` are processed by **sshd**. The default is "no". Enabling environment processing might enable users to bypass access restrictions in some configurations using mechanisms such as LD_PRELOAD.

The user's environment variables are processed after authentication and after the **sshd_config** keyword AcceptEnv is processed. As a result, the values of the user's environment variables might overwrite the results of the previous environment variable processing.

PidFile
Specifies the file that contains the process ID of the **sshd** daemon. The default is `/var/run/sshd.pid`.

Port Specifies the port number that **sshd** listens on. The default is 22. Multiple options of this type are permitted. See also ListenAddress.

PrintLastLog
Not supported on z/OS UNIX. Specifies whether **sshd** should print the date and time of the last user login when a user logs in interactively. The default is "no". This option only returns information if your system supports lastlog data, such as with a wtmp or wtmpx file.

PrintMotd
Specifies whether **sshd** should print `/etc/motd` when a user logs in interactively. (On some systems, the shell, `/etc/profile`, or equivalent also prints `/etc/motd`.) The default is "yes". For more information about the use of `/etc/motd` during the login process, see “Login process” on page 136.

Protocol
Specifies the protocol versions **sshd** should support. The possible values are "1" and "2". Multiple versions must be comma-separated. The default is "2".

PubkeyAuthentication

Specifies whether public key authentication is allowed. The default is "yes".

Restriction: This option applies to protocol version 2 only.

RekeyLimit

Specifies the maximum amount of data that may be transmitted before the session key is renegotiated, optionally followed a maximum amount of time that may pass before the session key is renegotiated. The first argument is specified in bytes and may have a suffix of “K”, “M”, or “G” to indicate Kilobytes, Megabytes, or Gigabytes, respectively. The default is between “1G” and “4G”, depending on the cipher. The optional second value is specified in seconds and may use any of the units documented in “Time formats” on page 190. The default value for RekeyLimit is “default none”, which means that rekeying is performed after the cipher's default amount of data has been sent or received and no time based rekeying is done. This option applies to protocol version 2 only.

RevokedKeys

Specifies revoked public keys. Keys listed in this file will be refused for public key authentication.

Note: If this file is not readable, then public key authentication will be refused for all users.

Keys may be specified as a text file, listing one public key per line, or as an OpenSSH key revocation list (KRL) as generated by ssh-keygen(1). For more information on KRLs, see “Key revocation lists” on page 126. If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

RhostsAuthentication

Specifies whether authentication using rhosts or `/etc/hosts.equiv` files is sufficient. Normally, this method should not be permitted, because it is insecure.

This option was removed from OpenSSH open source base distribution release 3.7 and is no longer supported on z/OS UNIX.

RhostsRSAAuthentication

Specifies whether rhosts or `/etc/hosts.equiv` authentication together with successful RSA host authentication is allowed. The default is "no".

Restriction: This option applies to protocol version 1 only.

RSAAuthentication

Specifies whether pure RSA authentication is allowed.

Restriction: This option applies to protocol version 1 only.

ServerKeyBits

Determines the number of bits in the ephemeral protocol version 1 server key. The minimum value is 512 and the default is 768.

StrictModes

Specifies whether **sshd** should check file modes and ownership of the user's files and home directory before accepting login. This is normally desirable in case users inadvertently leave their directory or files world-writable. The default is "yes".

Specifically, StrictModes checks that the following files, directories, and component path names are owned by the current user or superuser and that they are not group or world-writable:

- User's home directory
- User's `.rhosts` and `.shosts` files
- User's authorized keys file
- User's known hosts file

This setting does not apply to ChrootDirectory, whose permissions and ownership are checked unconditionally.

Subsystem

Configures an external subsystem (such as file transfer daemon) in protocol version 2. Arguments should be a subsystem name and a command with optional arguments to execute upon subsystem request.

The command **/usr/lib/ssh/sftp-server** implements the **sftp** file transfer subsystem. Alternatively, the name "internal-sftp" implements an in-process **sftp** server. Using the in-process sftp-server might simplify configurations that use the ChrootDirectory keyword to force a different file system root on clients. You can specify **sftp-server** options with the "internal-sftp" command by separating the options with blank spaces.

By default, no subsystems are defined. User-defined (non-builtin) subsystems are only supported between z/OS and z/OS. See “Limitations” on page 190 for more information.

SyslogFacility

Gives the facility code that is used when logging messages from **sshd**. The possible values are: DAEMON, USER, AUTH, LOCAL0, LOCAL1, LOCAL2, LOCAL3, LOCAL4, LOCAL5, LOCAL6, LOCAL7. If **sshd** is run in debug mode (invoked with **–d**), logging goes to stderr instead of the syslog. The default is AUTH.

For more information about these log facilities, see the syslog daemon section in *z/OS Communications Server: IP Configuration Reference*.

TCPKeepAlive

Specifies whether the system should send TCP keepalive messages to the other side. If they are sent, a lost network connection or stopping of one of the machines will be properly noticed. However, this means that connections will die if the route is down temporarily, and some people find it annoying. On the other hand, if keepalives are not sent, sessions may hang indefinitely on the server, leaving ghost users and consuming server resources. The default is "yes" (to send TCP keepalive messages), and the server will notice if the network goes down or the client host crashes. This option avoids infinitely hanging sessions. To disable TCP keepalive messages, set the value to "no".

TrustedUserCAKeys

Specifies a file containing public keys of certificate authorities that are trusted to sign user certificates for authentication. Keys are listed one per line; empty lines and comments starting with “#” are allowed. If a certificate is presented for authentication and has its signing CA key listed in this file, then it may be used for authentication for any user listed in the certificate's principals list.

Note: Certificates that lack a list of principals will not be permitted for authentication using TrustedUserCAKeys.
For more details on certificates, see “Certificates” on page 126. If running in **FIPSMODE**, this option will not be supported. Even though it's value is specified in the configuration file, it will be ignored.

UseDNS

Specifies whether **sshd** should look up the remote host name and check that the resolved host name for the remote IP address maps back to the same IP address. The default is "yes".

UseLogin

Specifies whether **login** is used for interactive login sessions. **login** is never used for remote command execution. If UseLogin is enabled, X11 forwarding will be disabled because **login** does not know how to handle xauth cookies. If UsePrivilegeSeparation is specified, UsePrivilegeSeparation is disabled after authentication. The default is "no".

UsePAM

Not supported on z/OS UNIX. Enables PAM authentication (via challenge-response) and session set up. The default is "no".

UsePrivilegeSeparation

Specifies whether **sshd** separates privileges by creating an unprivileged child process to deal with incoming network traffic. After successful authentication, another process will be created that has the privilege of the authenticated user. The goal of privilege separation is to prevent privilege escalation by containing any corruption within the unprivileged processes. The default is "yes".

Restriction: The option “sandbox” (used to impose additional preauthorization restrictions) is not supported on z/OS UNIX.

VersionAddendum

Optionally specifies additional text to append to the SSH protocol banner sent by the server upon connection. The default is “none”.

VerifyReverseMapping

This keyword is supported for compatibility with versions of OpenSSH before 3.8.1p1. On systems using OpenSSH 3.8.1p1 or later, use the keyword UseDNS.

Specifies whether **sshd** should try to verify the remote host name and check that the resolved host name for the remote IP address maps back to the same IP address. The default is "yes".

X11DisplayOffset

Specifies the first display number available for **sshd**'s X11 forwarding. This prevents **sshd** from interfering with real X11 servers. The default is "10".

X11Forwarding

Specifies whether X11 forwarding is permitted. Disabling X11 forwarding does not improve general z/OS security, because users can install their own forwarders. X11 forwarding is automatically disabled if UseLogin is enabled. The default is "no".

X11UseLocalhost

Specifies whether **sshd** should bind the X11 forwarding server to the loopback address or to the wildcard address. By default **sshd** binds the forwarding server to the loopback address and sets the hostname part of the DISPLAY environment variable to *localhost*. This prevents remote hosts from connecting to the fake display. However, some X11 clients may not function with this configuration. X11UseLocalhost can be set to "no" to specify that the forwarding server should be bound to the wildcard address. The argument must be "yes" (default) or "no".

XAuthLocation

Specifies the location of the xauth program. The default is `/usr/X11R6/bin/xauth`.

Limitations

User-defined subsystems are only supported between z/OS and z/OS. This is due to a limitation in the SECSH protocol with regards to EBCDIC platforms; for information about the IETF SECSH RFCs and internet drafts, see Appendix C, "RFCs and Internet drafts," on page 523. User-defined subsystems are specified by using the **sshd_config** subsystem keyword. Only the built-in **sftp** subsystem is supported for transfers between all platforms.

Time formats

sshd command-line arguments and configuration file options that specify time can be expressed using a sequence of the form: *time[qualifier]* where *time* is a positive integer value and *qualifier* is one of the following selections:

- <none> seconds
- s | S seconds
- m | M minutes
- h | H hours
- d | D days
- w | W weeks

Each member of the sequence is added together to calculate the total time value.

Time format examples:

```
600     600 seconds (10 minutes)
10m     10 minutes
1h30m   1 hour 30 minutes (90 minutes)
```

Files

/etc/ssh/sshd_config

Contains configuration data for **sshd**. This file should be writable by superuser only, but it is recommended (though not necessary) that it be world-readable.

Related information

sshd

Authors

OpenSSH is a derivative of the original and free ssh 1.2.12 release by Tatu Ylonen. Aaron Campbell, Bob Beck, Markus Friedl, Niels Provos, Theo de Raadt and Dug Song removed many bugs, re-added newer features and created OpenSSH. Markus Friedl contributed the support for SSH protocol versions 1.5 and 2.0. Niels Provos and Markus Friedl contributed support for privilege separation.

zos_sshd_config — z/OS-specific OpenSSH daemon configuration file

Description

z/OS obtains z/OS-specific daemon configuration data in the following order:

1. Command-line specification using the **sshd -o** option.

2. Configuration file specified with the environment variable _ZOS_SSHD_CONFIG. The default is `/etc/ssh/zos_sshd_config`. For each keyword, the first obtained value is used.

Restriction: z/OS-specific keywords cannot be specified in the **sshd_config** configuration files such as the system-wide configuration file (`/etc/ssh/sshd_config`) or the user-defined configuration file specified with the **sshd -f** option.

File format

The **zos_sshd_config** configuration file views empty lines and lines starting with # as comments. Configuration options can be specified using two different formats.

- The first format is the keyword argument pair separated by white space.
- The second format is the keyword argument pair separated with exactly one "=" and optional white space. This format avoids the need to quote white space when specifying configuration options using the **sshd -o** option. Arguments can optionally be enclosed in double quotes (") in order to represent arguments containing spaces.

  For example:

  ```
  keyword argument
  keyword=argument
  ```

Keywords are not case sensitive while arguments are case sensitive. Following are the possible keywords:

ChannelConvert

Specifies one or more ssh channel types that will automatically be converted between ASCII and EBCDIC using the default code pages for the current locale. The argument must be a comma-separated list selected from the following list of channel types:

shell Interactive session

exec Remote program execution

subsystem
Remote subsystem program execution

direct-tcpip
TCP/IP forwarding

forwarded-tcpip
TCP/IP reverse forwarding

The default is “shell,exec”, which is identical to the behavior of channel conversion in previous releases.

Note:

- “shell” conversion is enabled whether it is specified or not.
- This option only controls stdin/stdout conversion. stderr output (used with shell and exec channels) is always converted.
- The **sftp** protocol requires a binary connection. Do not specify “subsystem” conversion when using the **sftp** command or subsystem.
- The **scp** command requires a text (translated) connection. You must specify “exec” (which is enabled by default) when using the **scp** client or server.

- This option should not be used globally for an **sshd** server since, changing conversion options for channel types (for example "subystem" or "exec") could cause **sftp**, **scp**, and other exec connections to fail. The option may be used in **Host** or **Match** blocks for selected connections.

CiphersSource

Specifies the source used to implement the ciphers specified by the **sshd_config** keyword Ciphers. Valid arguments are "any", "OpenSSL" or "ICSF". The default is "OpenSSL". Specifying "OpenSSL" requests all ciphers to be implemented using the statically linked OpenSSL cryptographic library. Specifying "ICSF" requests all applicable ciphers to be implemented using Integrated Cryptographic Service Facility (ICSF). Ciphers that are not supported by ICSF will fail if used. Specifying "any" requests all applicable ciphers to be implemented using ICSF if available. Ciphers that are not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all ciphers are implemented using OpenSSL. For more information about the ICSF-supported ciphers and the setup required to use ICSF, see "Setting up OpenSSH to use ICSF cryptographic operations" on page 52. If **FIPSMODE** is set to "yes" and **CiphersSource** is set to "any", the **CiphersSource** option will be set to "ICSF" automatically.

Restriction: This option applies to protocol version 2 only.

FIPSMODE

Specifies whether or not OpenSSH is running in FIPS mode. Valid arguments are `no` or `yes`. The default value is `no` which means OpenSSH is not running in any FIPS mode. Specifying `yes` means that OpenSSH is running in FIPS 140-2 mode. If this option is set to "yes", it requires that **CiphersSource**, **MacsSource**, **KexAlgorithmsSource** are set to "ICSF" or "any".

Restriction: This option only applies to protocol version 2.

Note: This keyword will not be supported in a Match block.

HostKeyRingLabel

Specifies the key ring owner, name of the key ring and certificate label within the key ring containing a private host key used by OpenSSH. The key ring can be real or virtual, and certificate labels can contain embedded blanks. The key ring and the certificate connected to the key ring were created in the server authentication setup, which are described in "Steps for setting up user authentication when using key rings to store keys" on page 76. One or more blanks separate the key ring name from the certificate label. The host private key is read from this key ring before HostKey files are checked. The default is to use only the HostKey file (or files).

It is possible to have multiple host key files and key ring certificates in configuration files. If both host key files and key ring certificates are used, the key ring certificates are tried first. Only the first key found of each type (for example, RSA, DSA, or RSA1) is used. The maximum combined number of host key files and key ring certificates that can be specified is 256.

The option value must be surrounded by double quotes, when it appears in a configuration file, but these double quotes are optional if the option is specified on the **sshd** command line.

Example: An example of this option in the **zos_sshd_config** file for a key ring named SSHDring' that is owned by SSHDAEM and a certificate labeled 'my label with blanks' is as follows:

```
HostKeyRingLabel="SSHDAEM/SSHDring my label with blanks"
```

If the option is specified as a command-line option, you need to include double quote characters that surround the argument value, so that it is treated as a single argument:

```
-o HostKeyRingLabel="SSHDAEM/SSHDring my label with blanks"
```

Restriction: To meet FIPS 140-2 mode requirements, the RSA/DSA key size must be 2048 or greater. OpenSSH limits key sizes to 1024 or greater in FIPS mode. Users should therefore ensure appropriate key sizes, if they want to meet FIPS 140-2 mode standards. The DSA 2048 key OpenSSH uses is not currently supported by RACF in FIPS mode.

KexAlgorithmsSource

Specifies the source used to implement Key Exchange algorithms specified by the **sshd_config** keyword **KexAlgorithms**. Valid arguments are any, OpenSSL or ICSF. The default is OpenSSL. Specifying OpenSSL requests all Key Exchange algorithms to be implemented using the statically linked OpenSSL Cryptographic library. Specifying ICSF requests all applicable Key Exchange algorithms to be implemented using Integrated Cryptographic Service Facility (ICSF). Key Exchange algorithms that are not supported by ICSF will fail if used. Specifying any requests all applicable Key Exchange algorithms to be implemented using ICSF, if available. Key Exchange algorithms not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all Key Exchange algorithms are implemented using OpenSSL. For more information about the ICSF-supported Key Exchange algorithms and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations” on page 52. If **FIPSMODE** is set to “yes” and **KexAlgorithmsSource** is set to “any”, the **KexAlgorithmsSource** option will be set to “ICSF” automatically.

Restriction: This option applies to protocol version 2 only.

Note: This keyword will not be supported in a Match block.

MACsSource

Specifies the source used to implement the MAC algorithms specified by the **sshd_config** keyword MACs. Valid arguments are “any”, “OpenSSL” or “ICSF”. The default is “OpenSSL”. Specifying “OpenSSL” requests all MAC algorithms to be implemented using the statically linked OpenSSL cryptographic library. Specifying “ICSF” requests all applicable MAC algorithms to be implemented using Integrated Cryptographic Service Facility (ICSF). MAC algorithms not supported by ICSF will fail if used. Specifying “any” requests all applicable MAC algorithms to be implemented using ICSF if available. MAC algorithms that are not supported by ICSF are implemented using OpenSSL. If ICSF is not available, all MAC algorithms are implemented using OpenSSL. For more information about the ICSF-supported MAC algorithms and the setup required to use ICSF, see “Setting up OpenSSH to use ICSF cryptographic operations” on page 52. If **FIPSMODE** is set to “yes” and **MacsSource** is set to “any”, the **MacsSource** option will be set to “ICSF” automatically.

Restriction: This option applies to protocol version 2 only.

Note: This keyword will not be supported in a Match block.

Match Introduces a conditional block. If all of the criteria on the Match line are satisfied, the keywords on the following lines override those set in the global section of the config file, until either another Match line or the end of the file.

Rule: Global settings must be placed before the first Match block.

The arguments to Match are one or more criteria-pattern pairs. The available criteria are User, Group, Host, and Address. The match patterns can consist of single entries or comma-separated lists and can use the wildcard and negation operators described in the **ssh_config** section "Patterns" on page 163.

Restriction: Only the ServerSMF keyword can be used on the line following a Match keyword.

Guideline: User and group names are typically not case sensitive on z/OS systems. However, when matching user and group names for this keyword, the user and group names must be in the same alphabetical case as is stored in the user database, group database and user ID alias table (for example, USERIDALIASTABLE).

For example:

```
ServerSMF none

Match Address 192.168.32.*,127.0.0.1
    ServerSMF TYPE119_U83

Match User bar,baz
  ServerSMF TYPE119_U84

Match Host t*
  ServerSMF TYPE119_U83
```

ServerSMF
Specifies whether to collect server SMF records. The argument must be set to "TYPE119 _U83", "TYPE119_U84" or "none". The default is "none". If set to "TYPE119 _U83" or "TYPE119_U84" SMF Type 119 login failure records (subtype 98) are collected as well as server transfer completion records (subtype 96) for the **sftp** and **scp** commands. SMF record exit IEFU83 receives control for "TYPE119_U83". SMF record exit IEFU84 receives control for "TYPE119_U84".

SftpServerConvert
Specifies the file extensions which are allowed to perform the text file conversion between ASCII and EBCDIC on zOS **sftp-server**. The argument can be set as a single or a list of file extensions. The list of file extensions must be comma-separated. The transferred files that have extension types listed as part of these keywords are allowed to be converted between ASCII and EBCDIC. Otherwise, they are not converted. The maximum number of file extensions is 64.

Example: An example of this option in the **zos_sshd_config** file to allow the conversion for the text files with `*.c` or `*.h` file extension on the z/OS **sftp-server**:

```
SftpServerConvert=*.c,*.h
```

zEDCCompression
Specifies whether zEnterprise Data Compression hardware will be allowed for ssh packet compression. The argument must be set to "yes" or "no". The default is "no". When set to "yes", the zEDC zlib inflate/deflate

threshold is lowered so that the initial ssh packets will allow hardware enabled compression for the connection. This option should not be enabled for sshd servers that primarily service interactive connections or others that primarily use small packets, as this could result in reduced performance as compared to the default software-based compression. Performance benefits are more likely to be realized with sftp or scp file transfer connections. This option may be placed in a **Host** or **Match** block for use in selective connections. This option has no effect unless the OpenSSH **Compression** option is enabled. See "sshd_config — OpenSSH daemon configuration file" on page 171 for more information on enabling ssh compression. For more information see "zlib for zEnterprise Data Compression" in *z/OS MVS Programming: Callable Services for High-Level Languages*

Environment variable

_ZOS_SSHD_CONFIG

Specifies the path name of the user-defined **zos_sshd_config** configuration file. The default is `/etc/ssh/zos_sshd_config`. See "File format" on page 191 for the available keywords. The recommended permissions of the specified file are read/write for the user and not accessible by others.

Files

/etc/ssh/zos_sshd_config

z/OS-specific system-wide daemon configuration file. This file must be world-readable but writable only by a superuser.

Related information

scp, **sftp**, **sftp-server**, **sshd**

Other OpenSSH files

moduli — System moduli file

Description

The `/etc/ssh/moduli` file contains the system-wide Diffie-Hellman prime moduli for **sshd**. Each line in this file contains the following fields: Time, Type, Tests, Tries, Size, Generator, Modulus. The fields are separated by white space (tab or blank). The file is searched for moduli that meet the appropriate Time, Size and Generator criteria. When more than one meet the criteria, the selection should be weighted toward newer moduli, without completely disqualifying older moduli.

File format

Time: yyyymmddhhmmss

Specifies the system time that the line was appended to the file. The value 00000000000000 means unknown (historic).

Type: decimal

Specifies the internal structure of the prime modulus.

0 Unknown; often learned from peer during protocol operation, and saved for later analysis.

1 Unstructured; a common large number.

2 Safe (p = 2q + 1); meets basic structural requirements.

3 Schnorr.

4 Sophie-Germaine (q = (p-1)/2); usually generated in the process of testing safe or strong primes.

5 Strong; useful for RSA public key generation.

Tests: decimal (bit field)
Specifies the methods used in checking for primality. Usually, more than one test is used.

0 Not tested; often learned from peer during protocol operation, and saved for later analysis.

1 Composite; failed one or more tests. In this case, the highest bit specifies the test that failed.

2 Sieve; checked for division by a range of smaller primes.

4 Miller-Rabin.

8 Jacobi.

16 Elliptic Curve.

Tries: decimal
Depends on the value of the highest valid Test bit, where the method specified is:

0 Not tested (always zero).

1 Composite (irrelevant).

2 Sieve; number of primes sieved. Commonly on the order of 32,000,000.

4 Miller-Rabin; number of M-R iterations. Commonly on the order of 32 to 64.

8 Jacobi; unknown (always zero).

16 Elliptic Curve; unused (always zero).

Size: decimal
Specifies the number of significant bits.

Generator: hex string
Specifies the best generator for a Diffie-Hellman exchange. 0 = unknown or variable such as 2, 3, or 5.

Modulus: hex string
The prime modulus.

Related information

sshd

Chapter 11. OpenSSH files Quick Reference

Configuration files

Table 21 lists the configuration files that must be copied into the `/etc` directory. Samples provided by the installation must be copied into `/etc`.

Table 21. Configuration files to copy into /etc (including permissions)

File	Copied to	Description	Permissions	Owner
/samples/moduli	/etc/ssh/moduli	Contains Diffie-Hellman groups for **sshd**. See moduli.	644	UID(0)
/samples/ssh_config	/etc/ssh/ssh_config	OpenSSH client configuration file. See ssh_config.	644	UID(0)
/samples/sshd_config	/etc/ssh/sshd_config	OpenSSH daemon configuration file. See sshd_config.	644	UID(0)
/samples/zos_ssh_config	/etc/ssh/zos_ssh_config	z/OS-specific OpenSSH client configuration file. See zos_ssh_config.	644	UID(0)
/samples/zos_sshd_config	/etc/ssh/zos_sshd_config	z/OS-specific OpenSSH daemon configuration file. See zos_sshd_config.	644	UID(0)

Program-generated files

Table 22 lists the files created by OpenSSH and lists the owner and permissions that are set upon creation.

Table 22. Program-generated files (including permissions)

File	Produced by	Description	Permissions	Owner
/var/run/sshd.pid	**sshd**	**sshd** daemon process ID	644	UID(0)
/var/run/sshd.mm.XXXXXXXX	**sshd**	Temporary files used for compression with privilege separation	600	UID(0)

Administrator-generated user files

Table 23 lists the files created by the administrator and lists the owner and permissions that are set upon creation.

Table 23. Administrator-generated files (including permissions)

File	Produced by	Description	Permissions	Owner
/etc/ssh/sshrc	Administrator	Optional host-specific initialization script	644	UID(0)
/etc/ssh/ssh_host_key	ssh-keygen	Host private key file	600	UID(0)
/etc/ssh/ssh_host_dsa_key	ssh-keygen	Host private DSA key file	600	UID(0)

Table 23. Administrator-generated files (including permissions) (continued)

File	Produced by	Description	Permissions	Owner
/etc/ssh/ssh_host_ecdsa_key	ssh-keygen	Host private ECDSA key file	600	UID(0)
/etc/ssh/ssh_host_rsa_key	ssh-keygen	Host private RSA key file	600	UID(0)
/etc/ssh/ssh_host_key.pub	ssh-keygen	Host public key file	644	UID(0)
/etc/ssh/ssh_host_dsa_key.pub	ssh-keygen	Host public DSA key file	644	UID(0)
/etc/ssh/ssh_host_ecdsa_key.pub	ssh-keygen	Host public ECDSA key file	644	UID(0)
/etc/ssh/ssh_host_rsa_key.pub	ssh-keygen	Host public RSA key file	644	UID(0)
/etc/ssh/ssh_known_hosts	Administrator (possibly by using ssh-keyscan)	Public keys for remote hosts allowed by system	644	UID(0)
/etc/hosts.equiv	Administrator	Not recommended. Hosts listed in `.rhosts` authentication.	644	UID(0)
/etc/ssh/shosts.equiv	Administrator	Not recommended. Hosts list used in **ssh** host-based authentication.	644	UID(0)
/etc/nologin	Administrator	If it exists, prevents non-superuser **sshd** login and outputs contents to user.	644	UID(0)

User-generated files

Table 24 lists the files created by the user and lists the owner and permissions that are set upon creation.

Table 24. User-generated files (including permissions)

File	Produced by	Description	Permissions	Owner
~/.ssh/known_hosts	Remote host key added to the file when user connects to an unknown host.	Public keys for remote hosts that users can communicate with.	644	User
~/.ssh/authorized_keys	Copied from ~/.ssh/*.pub files of this user's accounts on other (remote) systems.	Public keys that can be used to log in to user's account.	644	User
~/.rhosts	User	Not recommended. Hosts and users lists to which user can login without password.	644	User
~/.shosts	User	Not recommended. Hosts and users lists that users can login (via **sshd** only) without password.	644	User
~/.ssh/config	Per-user OpenSSH client configuration file	Copied from `/samples/ssh_config` by user	644	User

Table 24. User-generated files (including permissions) (continued)

File	Produced by	Description	Permissions	Owner
~/.ssh/zos_user_ssh_config	User	z/OS-specific per-user OpenSSH client configuration file	644	User
~/.ssh/environment	User	User's environment variable initialization at **ssh** login	600	User
~/.ssh/rc	User	User's initialization script at **ssh** login	600	User
~/.ssh/identity	ssh-keygen	User private key file (protocol 1)	600	User
~/.ssh/id_dsa	ssh-keygen	User private DSA key file	600	User
~/.ssh/id_rsa	ssh-keygen	User private RSA key file	600	User
~/.ssh/identity.pub	ssh-keygen	User public key (protocol 1)	644	User
~/.ssh/id_dsa.pub	ssh-keygen	User public DSA key	644	User
~/.ssh/id_rsa.pub	ssh-keygen	User public RSA key	644	User

Chapter 12. SMF Type 119 records for OpenSSH

This topic describes the SMF Type 119 records collected for OpenSSH servers and clients.

Common SMF Type 119 record format

C-level macros for mapping OpenSSH SMF Type 119 records can be found in `/samples/ssh_smf.h`. Assembler mappings can be found in FOTSMF77 in SYS1.MACLIB.

All Type 119 SMF records are in the format shown in Table 25. For a list of record subtypes that OpenSSH supports, see "SMF 119 record subtypes for OpenSSH" on page 202.

Table 25. Records types and subtype information

Offset	Name	Length	Format	Description
0(x'0')	Standard header	24	Binary	SMF system header
0(x'0')	SMF_119SSH_HDLength	2	Binary	SMF record length
2(x'2')	SMF_119SSH_HDSegDesc	2	Binary	Segment descriptor
4(x'4')	SMF_119SSH_HDFlags	1	Binary	Record flags
5(x'5')	SMF_119SSH_HDType	1	Binary	Record type; is set to 119 (x'77')
6(x'6')	SMF_119SSH_HDTime	4	Binary	SMF system time stamp (is local time)
10(x'A')	SMF_119SSH_HDDate	4	Packed	SMF system date (is local date)
14(x'D')	SMF_119SSH_HDSID	4	EBCDIC	SMF system ID
18(x'12')	SMF_119SSH_HDSSI	4	EBCDIC	SMF subsystem ID
22(x'16')	SMF_119SSH_HDSubType	2	Binary	Record subtype
24(x'18')	Self-defining section		Binary	This section indicates how many sections follow and their location in the record.
...	TCP/IP identification section for OpenSSH	64	Binary	This section is present in every record; it describes the TCP/IP stack that issued the record. Its location and size are indicated by the self-defining section.
...	Record-specific data section 1	...	Binary	First record-specific data section. Its location and size are indicated by the self-defining section.
...	Record-specific data section 1, second entry	...	Binary	The self-defining section indicates how many occurrences of each record-specific data section are present in the record.
...	Record-specific data section 2 (optional)	...	Binary	Second record-specific data section.
...	...	...	Binary	...
...	Record-specific data section *n*, first entry (optional)	...	Binary	Last record-specific data section. The self-defining section indicates how many types of data sections there are.

z/OS MVS System Management Facilities (SMF) contains information about SMF headers. For more information about the other sections, see the section on SMF Type 119 records in *z/OS Communications Server: IP Programmer's Guide and Reference*.

SMF 119 record subtypes for OpenSSH

OpenSSH collects SMF Type 119 records for file transfer activity and login failure information. You can control the collection of these records by using the configuration keywords ClientSMF and ServerSMF in z/OS-specific client and daemon configuration files, respectively. These keywords also indicate whether system-wide SMF record exit IEFU83 or IEFU84 receives control. For more information about those keywords, see zos_ssh_config and zos_sshd_config.

The specified SMF record exit receives control before each record is written to the SMF data set. A return code from this exit indicates whether the system is to suppress the current SMF record. The parameter passed to this exit is the SMF record to be written. See *z/OS MVS System Management Facilities (SMF)* for more information.

All the records described in this topic are written using record type x'77' (format 119), and record subtype values, at offset 22(x'16') in the SMF record header, are used to uniquely identify the type of record being collected as well as describing the values that will be seen in the SMF_119SSH_TI_Comp and SMF_119SSH_TI_Reason fields of the TCP/IP identification section. Table 26 correlates the subtypes collected by OpenSSH to the type of record being produced.

Table 26. OpenSSH SMF Type 119 record subtype information and record type

Record subtype	Description	Component	Reason
94(x’5E’)	Client connection started record	SSH	Event
95(x’5F’)	Server connection started record	SSHD	Event
96(x'60')	Server transfer completion record	SFTPS or SCPS	Event
97(x'61')	Client transfer completion record	SFTPC or SCPC	Event
98(x'62')	Login failure record	SSHD	Event

Additional SMF Type 119 subtype records are provided by z/OS Communications Server and are described in *z/OS Communications Server: IP Programmer’s Guide and Reference* .

Standard data format concepts

The following concepts apply to standard data formats:

- Unless specified otherwise, all times are indicated in units of 1/100 seconds since midnight UTC/GMT (Universal Time, Coordinated/Greenwich Mean Time).
- All dates are indicated in packed binary-coded decimal (BCD) format, with digits x'01yydddF'. If no data is available, a date of x'0000000F' is written
- Interval durations are specified in units of 1/100 seconds.
- All IP addresses are in 128-bit IPv6 format. IPv4 addresses are reported in IPv4-mapped form where the 4-byte IPv4 address is preceded by 12 bytes, the first 10 of which are 0, and the last two of which are 'FF'x. IPv6 addresses appears in numeric form.

- Unless specified otherwise, all path names are absolute path names.

Common TCP/IP identification section for OpenSSH

Table 27 shows a section that is present in every SMF Type 119 record. It identifies the system and stack information associated with the SMF record.

Table 27. Common TCP/IP identification section for OpenSSH

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_TI_SYSName	8	EBCDIC	System name from SYSNAME in IEASYSxx
8(x'8')	SMF_119SSH_TI_SysplexName	8	EBCDIC	Sysplex name from SYSPLEX in COUPLExx
16(x'10')	SMF_119SSH_TI_Stack	8	EBCDIC	TCP/IP stack name
24(x'18')	SMF_119SSH_TI_ReleaseID	8	EBCDIC	z/OS release identifier
32(x'20')	SMF_119SSH_TI_Comp	8	EBCDIC	OpenSSH subcomponent (right-padded with blanks): **SFTPS** **sftp** server **SFTPC** **sftp** client **SCPS** **scp** server **SCPC** **scp** client **SSH** **ssh** client **SSHD** **sshd** daemon
40(x'28')	SMF_119SSH_TI_ASName	8	EBCDIC	Started task qualifier or address space name of address space that writes this SMF record
48(x'30')	SMF_119SSH_TI_UserID	8	EBCDIC	User ID of security context under which this SMF record is written
56(x'38')	Reserved	2	Binary	Reserved
58(x'3A')	SMF_119SSH_TI_ASID	2	Binary	ASID of address space that writes this SMF record
60(x'3C')	SMF_119SSH_TI_Reason	1	Binary	Reason for writing this SMF record **x'08'** Event record
61(x'3D')	SMF_119SSH_TI_RecordID	1	Binary	Record ID
61(x'3E')	Reserved	2	EBCDIC	Reserved

Common security section for OpenSSH

Table 28 shows a section that is present in every SMF Type 119 record. It identifies the security information associated with the SMF record.

Table 28. Common security section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_SSHV	16	EBCDIC	OpenSSH version
16(x'10')	SMF_119SSH_SSLV	32	EBCDIC	OpenSSL version
48(x'30')	SMF_119SSH_ZlibV	16	EBCDIC	zlib version
64(x'40')	SMF_119SSH_ProtoV	8	EBCDIC	Protocol version (right-padded with blanks): **'SSHV1'** Protocol version 1 **'SSHV2'** Protocol version 2

Table 28. Common security section (continued)

Offset	Name	Length	Format	Description
72(x'48')	SMF_119SSH_AuthMethod	2	Binary	Authentication method being used: **x'0000'** Unknown **x'0001'** None **x'0002'** Password **x'0003'** Public key **x'0004'** Host-based **x'0005'** Rhosts **x'0006'** RhostsRSA **x'0007'** RSA **x'0008'** Keyboard-interactive **x'0009'** Challenge-response **x'000A'** Control socket [1] **x'000B'** GSSAPI with MIC **x'000C'** GSSAPI Key exchange
74(x'4A')	SMF_119SSH_Cipher	2	Binary	Cipher type being used: **x'0000'** Unknown **x'0001'** None Possible values when protocol version 1: **x'0002'** 3DES **x'0003'** Blowfish **x'0004'** DES Possible values when protocol version 2: **x'0005'** 3des-cbc **x'0006'** blowfish-cbc **x'0007'** cast128-cbc **x'0008'** arcfour128 **x'0009'** arcfour256 **x'000A'** arcfour **x'000B'** aes128-cbc **x'000C'** aes192-cbc **x'000D'** aes256-cbc **x'000E'** aes128-ctr **x'000F'** aes192-ctr **x'0010'** aes256-ctr **x'0011'** rijndael-cbc@lysator.liu.se **x'0012'** acss@openssh.org **x'0013'** aes128-gcm@openssh.com **x'0014'** aes256-gcm@openssh.com **x'1005'** 3des-cbc (ICSF) **x'1006'** blowfish-cbc (ICSF) **x'1008'** arcfour128 (ICSF) **x'1009'** arcfour256 (ICSF) **x'100A'** arcfour (ICSF) **x'100B'** aes128-cbc (ICSF) **x'100C'** aes192-cbc (ICSF) **x'100D'** aes256-cbc (ICSF) **x'1011'** rijndael-cbc@lysator.liu.se (ICSF) **x'1012'** aes128-ctr (ICSF) **x'1013'** aes192-ctr (ICSF) **x'1014'** aes256-ctr (ICSF) **Note:** Unless indicated otherwise, the cipher source is OpenSSL.

Table 28. Common security section (continued)

Offset	Name	Length	Format	Description
76(x'4C')	SMF_119SSH_MAC	2	Binary	MAC algorithm being used: **x'0000'** Unknown **x'0001'** None (protocol version 1 or protocol version 2 with authenticated cipher, for example AES-GCM) **x'0002'** hmac-md5 **x'0003'** hmac-sha1 **x'0004'** umac-64@openssh.com **x'0005'** hmac-ripemd160 **x'0006'** hmac-sha1-96 **x'0007'** hmac-md5-96 **x'0008'** hmac-ripemd160@openssh.com **x'0009'** hmac-sha2-256 **x'000A'** hmac-sha2-512 **x'000B'** umac-128@openssh.com **x'1002'** hmac-md5 (ICSF) **x'1003'** hmac-sha1 (ICSF) **x'1005'** hmac-ripemd160 (ICSF) **x'1006'** hmac-sha1-96 (ICSF) **x'1007'** hmac-md5-96 (ICSF) **x'1008'** hmac-ripemd160@openssh.com (ICSF) **x'1009'** hmac-sha2-256 (ICSF) **x'100A'** hmac-sha2-512 (ICSF) **x'2002'** hmac-md5-etm@openssh.com **x'2003'** hmac-sha1-etm@openssh.com **x'2004'** umac-64-etm@openssh.com **x'2005'** hmac-ripemd160-etm@openssh.com **x'2006'** hmac-sha1-96-etm@openssh.com **x'2007'** hmac-md5-96-etm@openssh.com **x'2009'** hmac-sha2-256-etm@openssh.com **x'200A'** hmac-sha2-512-etm@openssh.com **x'200B'** umac-128-etm@openssh.com **x'3002'** hmac-md5-etm@openssh.com (ICSF) **x'3003'** hmac-sha1-etm@openssh.com (ICSF) **x'3005'** hmac-ripemd160-etm@openssh.com (ICSF) **x'3006'** hmac-sha1-96-etm@openssh.com (ICSF) **x'3007'** hmac-md5-96-etm@openssh.com (ICSF) **x'3008'** hmac-ripemd160-etm@openssh.com (ICSF) **x'3009'** hmac-sha2-256-etm@openssh.com (ICSF) **x'300A'** hmac-sha2-512-etm@openssh.com (ICSF) **Note:** Unless indicated otherwise, the MAC source is OpenSSL.
78(x'4E')	SMF_119SSH_COMP	2	Binary	Compression method being used: **x'0000'** Unknown **x'0001'** None (no) **x'0002'** zlib (yes) **x'0003'** zlib@openssh.com (delayed)
80(x'50')	SMF_119SSH_AuthMethod2	2	Binary	
82(x'52')	SMF_119SSH_FIPSMODE	2	Binary	Indicates whether or not OpenSSH for z/OS is running in FIPS mode: **x'0000'** Not running in FIPS mode **x'0001'** Running in FIPS mode

Table 28. Common security section (continued)

Offset	Name	Length	Format	Description
84(x'54')	SMF_119SSH_KexMethod	2	Binary	Key exchange method being used: **x'0000'** Unknown **x'0001'** None **x'0002'** diffie-hellman-group-exchangesha256 **x'0003'** diffie-hellman-group-exchangesha1 **x'0004'** diffie-hellman-group14-sha1 **x'0005'** diffie-hellman-group1-sha1 **x'0006'** ecdh-sha2-nistp256 **x'0007'** ecdh-sha2-nistp384 **x'0008'** ecdh-sha2-nistp521 **x'0009'** gss-group1-sha1- **x'000A'** gss-group14-sha1- **x'000B'** gss-gex-sha1- **x'1002'** diffie-hellman-group-exchangesha256(ICSF) **x'1003'** diffie-hellman-group-exchangesha1(ICSF) **x'1004'** diffie-hellman-group14- sha1(ICSF) **x'1005'** diffie-hellman-group1-sha1(ICSF) **x'1006'** ecdh-sha2-nistp256(ICSF) **x'1007'** ecdh-sha2-nistp384(ICSF) **x'1008'** ecdh-sha2-nistp521(ICSF) **x'1009'** gss-group1-sha1- (ICSF) **x'100A'** gss-group14-sha1- (ICSF) **x'100B'** gss-gex-sha1- (ICSF)
Note: 1. When the authentication method being used is Control Socket and the **ssh** connection information cannot be collected from the control socket, the EBCDIC fields are set to blanks and the binary fields are set to x'0000' Unknown.				

Client connection started (subtype 94)

Client connection started (subtype 94) is collected after an **ssh** client connection is started and the user is authenticated.

Table 29. Client connection started record self-defining section

Offset	Name	Length	Format	Description
0(x'0')	Standard SMF Header	24	Reserved	Standard SMF header, where the record subtype is 94 (x'5E')
Self-defining section				
24(x'18')	SMF_119SSH_SDTRN	2	Binary	Number of triplets in this record (3) . The third triplet is not used.
26(x'1A')	Reserved	2	Binary	Reserved
28(x'1C')	SMF_119SSH_IDOff	4	Binary	Offset to TCP/IP identification section
32(x'20')	SMF_119SSH_IDLen	2	Binary	Length of TCP/IP identification section

Table 29. Client connection started record self-defining section (continued)

Offset	Name	Length	Format	Description
34(x'22')	SMF_119SSH_IDNum	2	Binary	Number of TCP/IP identification sections
36(x'24')	SMF_119SSH_S1Off	4	Binary	Offset to security section
40(x'28')	SMF_119SSH_S1Len	2	Binary	Length of security section
42(x'2A')	SMF_119SSH_S1Num	2	Binary	Number of security sections

Server connection started (subtype 95)

Server connection started (subtype 95) is collected after an **sshd** server connection is started and the user is authenticated.

Table 30. Server connection started record self-defining section

Offset	Name	Length	Format	Description
0(x'0')	Standard SMF Header	24	Reserved	Standard SMF header, where the record subtype is 95 (x'5F')
Self-defining section				
24(x'18')	SMF_119SSH_SDTRN	2	Binary	Number of triplets in this record (3). The third triplet is not used.
26(x'1A')	Reserved	2	Binary	Reserved
28(x'1C')	SMF_119SSH_IDOff	4	Binary	Offset to TCP/IP identification section
32(x'20')	SMF_119SSH_IDLen	2	Binary	Length of TCP/IP identification section
34(x'22')	SMF_119SSH_IDNum	2	Binary	Number of TCP/IP identification sections
36(x'24')	SMF_119SSH_S1Off	4	Binary	Offset to security section
40(x'28')	SMF_119SSH_S1Len	2	Binary	Length of security section
42(x'2A')	SMF_119SSH_S1Num	2	Binary	Number of security sections

Restriction: For SSH protocol 1 connections, the SMF_119SSH_Comp field in the Common security section in the Server Connection Started (subtype 95) record will always be set to SMF_119SSH_CompUnknown (0).

Server transfer completion record (subtype 96)

The server transfer completion records are collected when the **sftp-server** (regular or "internal-sftp") or the server side of **scp** completes processing of one of the following file transfer subcommands:

- Creating, uploading, downloading, renaming or removing files
- Creating and removing directories
- Changing the file permissions, UIDs, or GIDs
- Creating symbolic links

For **scp**, only file downloading or uploading apply. A common format for the record is used for each **sftp** file transfer operation, so the record contains an indication of which subcommand was performed.

See Table 27 on page 203 for the contents of the TCP/IP identification section. For the server transfer completion record, the TCP/IP identification section indicates either SFTPS (**sftp-server**) or SCPS (server side of **scp**) as the OpenSSH subcomponent and x'08' (event record) as the record reason.

See Table 28 on page 203 for the contents of the security section.

Table 31 shows the server transfer completion record self-defining section.

Table 31. Server transfer completion record self-defining section

Offset	Name	Length	Format	Description
0(x'0')	Standard SMF Header	24	Reserved	Standard SMF header, where the record subtype is 96 (x'60')
Self-defining section				
24(x'18')	SMF_119SSH_SDTRN	2	Binary	Number of triplets in this record (6)
26(x'1A')	Reserved	2	Binary	Reserved
28(x'1C')	SMF_119SSH_IDOff	4	Binary	Offset to TCP/IP identification section
32(x'20')	SMF_119SSH_IDLen	2	Binary	Length of TCP/IP identification section
34(x'22')	SMF_119SSH_IDNum	2	Binary	Number of TCP/IP identification sections
36(x'24')	SMF_119SSH_S1Off	4	Binary	Offset to security section
40(x'28')	SMF_119SSH_S1Len	2	Binary	Length of security section
42(x'2A')	SMF_119SSH_S1Num	2	Binary	Number of security sections
44(x'2C')	SMF_119SSH_S2Off	4	Binary	Offset to server transfer completion section
48(x'30')	SMF_119SSH_S2Len	2	Binary	Length of server transfer completion section
50(x'32')	SMF_119SSH_S2Num	2	Binary	Number of server transfer completion sections
52(x'34')	SMF_119SSH_S3Off	4	Binary	Offset to server host name section
56(x'38')	SMF_119SSH_S3Len	2	Binary	Length of server host name section
58(x'3A')	SMF_119SSH_S3Num	2	Binary	Number of server host name sections
60(x'3C')	SMF_119SSH_S4Off	4	Binary	Offset to server first associated path name section
64(x'40')	SMF_119SSH_S4Len	2	Binary	Length of server first associated path name section
66(x'42')	SMF_119SSH_S4Num	2	Binary	Number of server first associated path name sections
68(x'44')	SMF_119SSH_S5Off	4	Binary	Offset to server second associated path name section
72(x'48')	SMF_119SSH_S5Len	2	Binary	Length of server second associated path name section
74(x'4A')	SMF_119SSH_S5Num	2	Binary	Number of server second associated path name sections

Table 32 shows the server transfer completion specific section of this SMF record.

Table 32. Server transfer completion record specific section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FSOper	1	Binary	**sftp** subcommand code (for **scp**, only get and put apply): **x'01'** rmdir **x'02'** rm **x'03'** rename **x'04'** get **x'05'** put **x'06'** chmod **x'07'** chown or chgrp **x'08'** mkdir **x'09'** symlink
1(x'1')	Reserved	3	EBCDIC	Reserved

Table 32. Server transfer completion record specific section (continued)

Offset	Name	Length	Format	Description
4(x'4')	SMF_119SSH_FSCmd	4	EBCDIC	**sftp** subcommand (the values are right-padded with blanks, and for **scp**, only GET and PUT apply): **RMD** Remove directory **RM** Remove file **RENM** Rename file **GET** Download file from the server **PUT** Upload file to the server **CHMD** Change file permission bits **CHOW** Change file owner or group **MKD** Create directory **SLNK** Create symbolic link
8(x'8')	SMF_119SSH_FSRIP	16	Binary	Remote IP address (client)
24(x'18')	SMF_119SSH_FSLIP	16	Binary	Local IP address (server)
40(x'28')	SMF_119SSH_FSRPort	2	Binary	Remote port number (client)
42(x'2A')	SMF_119SSH_FSLPort	2	Binary	Local port number (server)
44(x'2C')	SMF_119SSH_FSSUser	8	EBCDIC	Client User ID on server
52(x'34')	SMF_119SSH_FSTType	1	EBCDIC	Data transfer type: **A** ASCII **B** Binary
53(x'35')	SMF_119SSH_FSMode	1	EBCDIC	Transfer mode: **C** Compressed **S** Stream
54(x'36')	Reserved	2	Binary	Reserved
56(x'38')	SMF_119SSH_FSSTime	4	Binary	Transmission start time of day
60(x'3C')	SMF_119SSH_FSSDate	4	Packed	Transmission start date
64(x'40')	SMF_119SSH_FSETime	4	Binary	Transmission end time of day
68(x'44')	SMF_119SSH_FSEDate	4	Packed	Transmission end date
72(x'48')	SMF_119SSH_FSDur	4	Binary	File transmission duration in units of 1/100 seconds
76(x'4C')	SMF_119SSH_FSBytes	8	Binary	Transmission byte count; 64-bit integer
84(x'54')	SMF_119SSH_FSStat	4	EBCDIC	Server execution status (right-padded with blanks): **OK** Success **FAIL** Failure
88(x'58')	SMF_119SSH_FSCH1	8	Binary	Previous read/write/execute permissions of owner/group/other (in octal format) when **chmod** is used or the previous UID when **chown** or **chgrp** is used.
96(x'60')	SMF_119SSH_FSGP1	8	Binary	Previous GID when **chown** or **chgrp** is used.
104(x'68')	SMF_119SSH_FSCH2	8	Binary	New read/write/execute permissions of owner/group/other (in octal) when **chmod** is used or the new UID when **chown** or **chgrp** is used.
112(x'70')	SMF_119SSH_FSGP2	8	Binary	New GID when **chown** or **chgrp** is used.

Table 33 shows the host name section for the server transfer completion record.

Table 33. Server transfer completion record section: Host name

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FSHostname	*n*	EBCDIC	Host name

Table 34 shows the first associated path name section for the server transfer completion record. This section represents the server z/OS UNIX path name associated with the **sftp** or **scp** operation.

Table 34. Server transfer completion record section: First associated path name

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FSPath1	*n*	EBCDIC	z/OS UNIX path name associated with the **sftp** or **scp** command. When the subcommand is rename or symlink, this refers to the previous path name.

Table 35 shows the second associated path name section for the server transfer completion record. This section represents the server z/OS UNIX file name associated with the rename or symlink subcommand.

Table 35. Server transfer completion record section: Second associated path name

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FSPath2	*n*	EBCDIC	Second z/OS UNIX path name associated with rename or symlink subcommand. This is the new path name.

Client transfer completion record (subtype 97)

The client transfer completion records are collected when the client side of **sftp** or **scp** completes processing of one of the following file transfer operations:

- Uploading files
- Downloading files

A common format for the record is used for each file transfer operation, so the record contains an indication of which subcommand was performed.

See Table 27 on page 203 for the contents of the TCP/IP identification section. For the client transfer completion record, the TCP/IP identification section indicates either SFTPC (**sftp** client) or SCPC (**scp** client) as the subcomponent and x'08' (event record) as the record reason.

See Table 28 on page 203 for the contents of the security section.

Table 36 shows the client transfer completion record self-defining section.

Table 36. Client transfer completion record self-defining section

Offset	Name	Length	Format	Description
0(x'0')	Standard SMF Header	24	Reserved	Standard SMF header, where the record subtype is 97 (x'61')
Self-defining section				
24(x'18')	SMF_119SSH_SDTRN	2	Binary	Number of triplets in this record (7)
26(x'1A')	Reserved	2	Binary	Reserved
28(x'1C')	SMF_119SSH_IDOff	4	Binary	Offset to TCP/IP identification section
32(x'20')	SMF_119SSH_IDLen	2	Binary	Length of TCP/IP identification section
34(x'22')	SMF_119SSH_IDNum	2	Binary	Number of TCP/IP identification sections
36(x'24')	SMF_119SSH_S1Off	4	Binary	Offset to security section
40(x'28')	SMF_119SSH_S1Len	2	Binary	Length of security section
42(x'2A')	SMF_119SSH_S1Num	2	Binary	Number of security sections
44(x'2C')	SMF_119SSH_S2Off	4	Binary	Offset to client transfer completion section

Table 36. Client transfer completion record self-defining section (continued)

Offset	Name	Length	Format	Description
48(x'30')	SMF_119SSH_S2Len	2	Binary	Length of client transfer completion section
50(x'32')	SMF_119SSH_S2Num	2	Binary	Number of client transfer completion sections
52(x'34')	SMF_119SSH_S3Off	4	Binary	Offset to client transfer completion host name section
56(x'38')	SMF_119SH_S3Len	2	Binary	Length of client transfer completion host name section
58(x'3A')	SMF_119SSH_S3Num	2	Binary	Number of client transfer completion host name section
60(x'3C')	SMF_119SSH_S4Off	4	Binary	Offset to client transfer completion user name section
64(x'40')	SMF_119SSH_S4Len	2	Binary	Length of client transfer completion user name section
66(x'42')	SMF_119SSH_S4Num	2	Binary	Number of client transfer completion user name sections
68(x'44')	SMF_119SSH_S5Off	4	Binary	Offset to client transfer completion associated path name section
72(x'48')	SMF_119SSH_S5Len	2	Binary	Length of client transfer completion associated path name section
74(x'4A')	SMF_119SSH_S5Num	2	Binary	Number of client transfer completion associated path name sections
76(x'4C')	SMF_119SSH_S6Off	4	Binary	Offset to client transfer completion target path name section
80(x'50')	SMF_119SSH_S6Len	2	Binary	Length of client transfer completion target path name section
82(x'52')	SMF_119SSH_S6Num	2	Binary	Number of client transfer completion target path name sections

Table 37 shows the client transfer completion specific record of this SMF record.

Table 37. Client transfer completion record specific section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FCCmd	4	EBCDIC	**sftp** or **scp** subcommand (right-padded with blanks): **GET** Download file from the server **PUT** Upload file to the server
4(x'4')	SMF_119SSH_FCRIP	16	Binary	Remote IP address (server) [1]
20(x'14')	SMF_119SSH_FCLIP	16	Binary	Local IP address (client) [1]
36(x'24')	SMF_119SSH_FCRPort	2	Binary	Remote port number (server) [1]
38(x'26')	SMF_119SSH_FCLPort	2	Binary	Local port number (client) [1]
40(x'28')	SMF_119SSH_FCLUser	8	EBCDIC	Local user ID
48(x'30')	SMF_119SSH_FCTType	1	EBCDIC	Data transfer type: **A** ASCII **B** Binary
49(x'31')	SMF_119SSH_FCMode	1	EBCDIC	Transfer mode: [2] **C** Compressed **S** Stream
50(x'32')	SMF_119SSH_FCFlags	2	Binary	Flag bits X'0001' - SFTP **`reget`** or **`get -a`**
52(x'34')	SMF_119SSH_FCSTime	4	Binary	Transmission start time of day
50(x'32')	SMF_119SSH_FCSDate	4	Packed	Transmission start date
60(x'3C')	SMF_119SSH_FCETime	4	Binary	Transmission end time of day
64(x'40')	SMF_119SSH_FCEDate	4	Packed	Transmission end date

Table 37. Client transfer completion record specific section (continued)

Offset	Name	Length	Format	Description
68(x'44')	SMF_119SSH_FCDur	4	Binary	File transmission duration in units of 1/100 seconds
72(x'48')	SMF_119SSH_FCBytes	8	Binary	Transmission byte count; 64-bit integer
80(x'50')	SMF_119SSH_FCStat	4	EBCDIC	Subcommand execution status (right-padded with blanks): **OK** Success **FAIL** Failure

Note:

1. This field will be set to zero (0) when the Authentication method being used is Control Socket and the **ssh** connection information could not be collected from the control socket.
2. This field will be set to blank when the Authentication method being used is Control Socket and the **ssh** connection information could not be collected from the control socket.

Table 38 shows the client transfer completion host name section.

Table 38. Client transfer completion host name section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FCHostname	*n*	EBCDIC	Client host name

Table 39 shows the client transfer completion user name section.

Table 39. Client transfer completion user name section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FCUserID	*n*	EBCDIC	User name used to log into the server[1]

Note:

1. This field will not be set when the Authentication method being used is Control Socket and the **ssh** connection information could not be collected from the control socket.

Table 40 shows the client transfer completion associated path name section. This section represents the client z/OS UNIX path name associated with the **sftp** or **scp** subcommand.

Table 40. Client transfer completion associated path name section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FCPath	*n*	EBCDIC	Client z/OS UNIX path name

Table 41 shows the client transfer completion target path name section. This section represents the target (remote) path name associated with the **sftp** subcommand.

Table 41. Client transfer completion target path name section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FCPath2	*n*	EBCDIC	Client target path name (SFTP only)

Note: For SCP, this section will be present, but the count (SMF_119SSH_S6Num) and length (SMF_119SSH_S6Len) will be zero.

Login failure record (subtype 98)

Login failure records are collected after each unsuccessful attempt to log into the **sshd** daemon. A login failure record is collected for each authentication method and attempt that fails. A login failure reason code within the SMF record provides information about the cause of the login failure. Only failures during user authentication are collected with the following exception: records are not collected for a "none" authentication failure if it is the first authentication method attempted.

See Table 27 on page 203 for the contents of the TCP/IP identification section. For the login failure record, the TCP/IP identification section indicates SSHD (**ssh** daemon) as the subcomponent and x'08' (event record) as the record reason.

See Table 28 on page 203 for the contents of the security section.

Table 42 shows the login failure record self-defining section.

Table 42. Login failure record self-defining section

Offset	Name	Length	Format	Description
0(x'0')	Standard SMF Header	24	Reserved	Standard SMF header, where the record subtype is 98 (x'62')
Self-defining section				
24(x'18')	SMF_119SSH_SDTRN	2	Binary	Number of triplets in this record (3)
26(x'1A')	Reserved	2	Binary	Reserved
28(x'1C')	SMF_119SSH_IDOff	4	Binary	Offset to TCP/IP identification section
32(x'20')	SMF_119SSH_IDLen	2	Binary	Length of TCP/IP identification section
34(x'22')	SMF_119SSH_IDNum	2	Binary	Number of TCP/IP identification sections
36(x'24')	SMF_119SSH_S1Off	4	Binary	Offset to security section
40(x'28')	SMF_119SSH_S1Len	2	Binary	Length of security section
42(x'2A')	SMF_119SSH_S1Num	2	Binary	Number of security sections
44(x'2C')	SMF_119SSH_S2Off	4	Binary	Offset to login failure section
48(x'30')	SMF_119SSH_S2Len	2	Binary	Length of login failure section
50(x'32')	SMF_119SSH_S2Num	2	Binary	Number of login failure sections

Table 43 shows the login failure specific section of this SMF record.

Table 43. Login failure specific section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_LFRIP	16	Binary	Remote IP address
16(x'10')	SMF_119SSH_LFLIP	16	Binary	Local IP address
32(x'20')	SMF_119SSH_LFRPort	2	Binary	Remote port number (client)
34(x'22')	SMF_119SSH_LFLPort	2	Binary	Local port number (server)
36(x'24')	SMF_119SSH_LFUserID	8	EBCDIC	User name (login name) on server

Table 43. Login failure specific section (continued)

Offset	Name	Length	Format	Description
44(x'2C')	SMF_119SSH_LFReason	2	Binary	Login failure reason: **x'0000'** Unexpected authentication failure. **x'0001'** Unexpected authentication change **x'0002'** Password or password phrase is not valid. **x'0003'** User ID has been revoked **x'0004'** User does not have server access **x'0005'** User's file has bad file modes or ownership **x'0006'** Too many failed login attempts **x'0007'** Password error **x'0008'** User ID is unknown. **x'0009'** Root user authentication is not allowed **x'000A'** Empty passwords are not permitted **x'000B'** Authentication method did not exist or was not valid **x'000C'** Key did not exist or was not valid **x'000D'** Host did not exist or was not valid
46(x'2E')	Reserved	2	Binary	Reserved

Chapter 13. Troubleshooting

This topic discusses performance considerations when troubleshooting setup problems. A FAQ (frequently asked questions) section is included as well as information about setting up the syslogd daemon to debug **sshd** problems.

Performance considerations

Various setup problems might affect OpenSSH performance.

XPLINK is not set up

If performance is not ideal, verify that you have set up XPLINK as described in “Setting up the XPLINK environment for use by IBM Ported Tools for z/OS: OpenSSH” on page 12.

DNS is not configured properly

The **ssh** client performs some DNS lookups. If the DNS server is down, some operations might take a while to time out. Verify that the DNS is configured properly. Also verify that the servers in the DNS resolution files (for example, `/etc/resolv.conf`) are working. If the **ssh** command, when run in verbose mode (**-vvv**), seems to be waiting on this line:

```
debug2: ssh_connect: needpriv 0
```

then it is likely that the DNS is not configured properly.

Frequently asked questions

1. **Question:** The following RACF warning appeared on the console:

   ```
   ICH408I USER(WELLIE1   ) GROUP(SYS1   ) NAME(WELLIE1   )
      CSFRNG CL(CSFSERV )
      INSUFFICIENT ACCESS AUTHORITY
      FROM CSFRNG (G)
      ACCESS INTENT(READ   )  ACCESS ALLOWED(NONE   )
   ```

   Additionally, the OpenSSH client or server fails with message:

   ```
   FOTS1949 PRNG is not seeded. Please activate the
   Integrated Cryptographic Service Facility (ICSF).
   ```

   Answer: ICSF is required and must be started with `/dev/random` support prior to starting OpenSSH. **`ssh-rand-helper`** is no longer supported as an alternative. See “Using hardware support to generate random numbers” on page 49 for more information.

2. **Question:** The system administrator sees the following messages on the console:

   ```
   BPXP015I HFS PROGRAM /bin/ssh IS NOT MARKED PROGRAM CONTROLLED.
   BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON (BPX.DAEMON) PROCESSING
   ```

   Answer: A user invoked **ssh** from a user ID that has READ access to BPX.DAEMON. A user ID that is given READ access to BPX.DAEMON should be set up as a protected user ID (for example, with the NOPASSWORD option). Doing so prevents UID(0) users from working in the shell, because they would be able to perform unauthenticated setuids. It appears such a user does have shell access. The system (or security) administrator should double-check the security setup.

3. **Question:** I was trying to copy a 6GB file to a remote host using **scp**. The **scp** progress meter counted up to 100 percent copied. I received a `No space left on device` error message but I found out that the file system on the remote host didn't have enough space to begin with. Should **scp** terminate as soon as the remote file system is full?

   Answer: The server-side **scp** process will not return an out-of-space error until the client has finished transmitting all its data. If you are concerned about running out of space, run a remote command to check the file system space (such as **df** or **zfsadm**) on the remote host before issuing the **scp** command.

4. **Question:** When a user logs on via the ssh client, we are getting the following message in the system log:

   ```
   EZZ9297E UNABLE TO ACCESS FILE /etc/resolv.conf. - RC 00101708
   ```

   The user can still ssh in successfully, but what does this warning mean?

   Answer: The OpenSSH daemon runs with privilege separation enabled by default. During privilege separation, the daemon cleaves itself into two processes, one with privileges and one without. The unprivileged user (the SSHD privilege separation user) handles network traffic and everything not requiring special privileges. This unprivileged process runs in a chroot jail of `/var/empty`. The chroot service changes the root directory from the current one to a new one; in this case, `/var/empty`. The root directory is the starting point for path searches of path names beginning with a slash. At some point, the privilege separation user invokes a TCP/IP system call which requires access to the TCPIP.DATA file. If this file is stored in the UNIX file system as `/etc/resolv.conf`, the privilege separation user will not have access to the file because it is not located off the new root file system of `/var/empty`. The system administrator should copy `/etc/resolv.conf.` to `/var/empty/etc/resolv.conf.` in order to make this file visible to the privilege separation user.

5. **Question:** I am trying to use ssh with public key authentication, but it can't seem to find my keys. What is happening?

   Answer: It is likely that you are running **ssh** from a user that shares a UID. The **ssh** command description in ssh provides a tip for avoiding problems when running as a user that shares a UID.

6. **Question:** When I attempt to start the **sshd** daemon, I see the following error message, and the **sshd** daemon does not start.

   ```
   FOTS1451 Privilege separation user sshd does not exist.
   ```

   Answer: The **sshd** daemon runs with privilege separation enabled by default. Using privilege separation requires that a special user be created. For more information, see “Step for creating the sshd privilege separation user” on page 37.

7. **Question:** When I attempt to start the **sshd** daemon, I see the following error message, and the daemon does not start.

   ```
   /etc/ssh/sshd_config: EDC5129I No such file or directory. (errno2=0x05620062)
   ```

   Answer: The **sshd** daemon will not start without a configuration file. The default location for this file is `/etc/ssh/sshd_config`. Verify that you have performed all the setup to run the **sshd** daemon. See “Steps for creating or editing configuration files” on page 24 for information about copying the **sshd_config** file.

8. **Question:** If I attempt to start the **sshd** daemon, I see the following error in the syslog:

```
FOTS1464 Cannot bind any address
```

   Answer: Take the following actions:

   a. Verify that port 22 is not reserved in your TCP/IP setup and that port 22 is not in use by another application or another **sshd** daemon. By default, the **sshd** daemon uses port 22. However, the port can be changed by using the **sshd_config** keyword Port.
   b. Verify that the program control attribute is set for the **sshd** daemon.
   c. Verify that the invoking user ID is defined as UID(0) and has READ access to the BPX.DAEMON profile in the FACILITY class.

   For more information about **sshd** daemon setup and startup, see Chapter 5, “For system administrators,” on page 21.

9. **Question:** When I run an OpenSSH command and receive an error message, I do not see a message number (for example, FOTSnnnn) associated with it.

   Answer: Verify that the _ZOS_OPENSSH_MSGCAT environment variable is unset or set to “openssh.cat” before running the command. For more information, see “Setting up the message catalog for IBM Ported Tools for z/OS: OpenSSH” on page 38. If you have verified that your setup is correct and you are still not seeing message numbers, it could be that the output in question is considered "log" output that might or might not be an error message.

10. **Question:** When I run **ssh-keyscan**, it does not return the host key for a particular host and exits with a 0 (success) return value. I know the host has sshd running. Why aren't I getting any host key output?

   Answer: By default, **ssh-keyscan** returns only protocol version 1 keys. The **sshd** daemon might only be running protocol version 2. Try issuing **ssh-keyscan** again with a protocol version 2 key type.

   For example:

```
ssh-keyscan -t dsa hostname
```

11. **Question:** When I run **ssh-keyscan**, I receive the following error: FOTS0414 hostname: exception! What does this mean?

   Answer: This error is often the result when the remote server is down or not running a **sshd** daemon.

12. **Question:** When I invoke **ssh**, it seems to have poor performance. In particular, if I run in verbose mode (**ssh -vvv**), it appears to hang on this line: debug1: ssh_connect: needpriv 0

   Answer: **ssh** performs some DNS lookups. If the DNS server is down, some operations may take a while to time-out. Verify that DNS is configured properly. Check that the servers in the DNS resolution files (for example, `/etc/resolv.conf`) are working.

13. **Question:** When I use the ~# escape sequence to display forwarded connections, not all of them are displayed.

   Answer: Check if you have nested **ssh** clients. For nested **ssh** clients, escape characters are captured and processed by parent **ssh** processes first. To allow an escape sequence to pass through to a child **ssh** client, you can escape the escape character; for example, "~~".

14. **Question:** My sftp session hangs when I try to use these subcommands: ls, get, or put.

    Answer: You probably have a MTU fragmentation problem. Reduce the TCP/IP MTU (maximum transmission unit) by using the **ifconfig** command.

    For example:

    ```
    ifconfig enth0 mtu 1500
    ```

    Also, specifying a smaller buffer size (the default is 32768) on the **sftp** command line can be a workaround.

    For example:

    ```
    sftp -B 1024 user@host
    ```

15. **Question:** **scp** between two remote hosts doesn't work for me. I specified 'ForwardAgent yes' in my own configuration file and used '-F usr_config_file' to invoke it.

    Answer: When doing **scp** between two remote hosts, you need to specify 'ForwardAgent yes' in the **ssh** global configuration file `/etc/ssh/ssh_config` or the **ssh** default per-user configuration file `~/.ssh/config`. The command-line option **-F** *usr_config_file* does not get passed to the remote host. **scp** only passes options **-v, -r** or **-p** to the remote host regardless of what you specify on the command line.

16. **Question:** When I run **sftp** with protocol version 1 from z/OS to AIX, I keep getting `FOTS0841 Connection closed`.

    Answer: Due to a limitation of SECSH protocol and how OpenSSH uses channels, **sftp** for protocol version 1 is only supported between z/OS hosts.

17. **Question:** When running **sftp** with protocol version 2, why might I begin receiving `FOTS0841 Connection closed` messages, if this connection has worked previously?

    Answer: When using password authentication and the password has expired for the user on the target host system, **sftp** will return this message. If you were to use **ssh**, you would be prompted to change the expired password.

18. **Question:** My session hangs part way through logging on when I try to do `sftp -s sftp_server_path usr@host` between z/OS and Linux. I use protocol version 2.

    Answer: User-defined subsystems (those specified with the **-s** option) are only supported between z/OS hosts. This is due to a limitation of the SECSH protocol with regards to EBCDIC platforms.

19. **Question:** When I use **ssh** with the **-s** option to utilize a subsystem, my session hangs while logging on. I am using protocol version 2.

    Answer: User-defined subsystems (those specified with the **-s** option) are only supported between z/OS hosts. This is due to a limitation of the SECSH protocol with regards to EBCDIC platforms.

20. **Question:** When I attempt to start **ssh**, I get the error message `FOTS0944 buffer_get_bignum_ret: input buffer too small`.

    Answer: Your public key or private key file might be corrupted. Regenerate your keys and try again.

21. **Question:** When I attempt to copy a file using **scp** or **sftp**, after user authentication succeeds, the command fails and exits with a nonzero (failure) return code. I also saw some output from a sshrc file when using scp, or received a "FOTS0843 Received message too long" notification.

    Answer: This error is often seen when the user has `/etc/ssh/sshrc` or `~/.ssh/rc` on the remote host that is generating output to stdout. Make sure that both `/etc/ssh/sshrc` and `~/.ssh/rc` do not send output to stdout when either **scp** or **sftp** is used. Instead, the output should be written to stderr. (Output generated from the **sshrc** file is displayed for **scp** but not for **sftp**.)

22. **Question:** When I ssh to a remote host using public key or password authentication, I never get a chance to enter the passphrase/password, instead receiving the error message `FOTS1346 Permission denied, please try again`. This causes user authentication to fail. The ssh client then eventually fails with the error message `FOTS1373 Permission denied (publickey,password,keyboard-interactive)`.

    Answer: Verify that you are not trying to use **ssh** while switched to another user ID. In other words, did you issue **ssh** after the **su** command? The original controlling terminal (displayed by the **tty** command) is owned by the user ID originally logged in. Your target user might not have permission to read from it.

23. **Question:** I attempt to start **sftp** but I receive error message `FOTS0843 Received message too long` *xxxx* where *xxxx* is the length of message.

    Answer: Possibly, an **sftp** packet was corrupted by TCP/IP RESOLVER trace output written to stdout. To check whether RESOLVER trace output is being sent to stdout, issue the following shell command on both the local host and the remote host:

    ```
    netstat -S
    ```

    If you see messages about RESOLVER trace initialization in the output of the netstat command, then it means the RESOLVER trace output is written to stdout on the system that you issued the netstat command. You can redirect RESOLVER trace output to avoid conflicts with **sftp** by issuing the following command:

    ```
    export RESOLVER_TRACE=STDERR
    ```

    If the RESOLVER trace output is enabled on the remote host (the system running the daemon), the daemon will need to be restarted with the new environment.

    If the RESOLVER trace setting doesn't resolve this issue, determine if the failing user has `/etc/ssh/sshrc` or `~/.ssh/rc` on the remote host that is generating output to stdout. Ensure both `/etc/ssh/sshrc` and `~/.ssh/rc` do not send output to stdout when either **`scp`** or **`sftp`** is used. Instead, the output should be written to stderr.

24. **Question:** The **sshd** daemon fails to start and the stderr file contains `The signal SIGHUP was received`.

    Answer: You have come across a process race condition. You will need to do some setup tasks as described in "Using BPXBATCH" on page 39.

25. **Question:** When I use the **stty** command in a shell profile to set the terminal options for my interactive z/OS OpenSSH session, I see the following error message:

    ```
    stty: FSUMB039 error setting termios attributes: EDC5139I Operation not permitted
    ```

    Answer: The extended packet mode terminal option (PKTXTND in termios.h) setting was changed under APAR OA12576 in the previous release. The option is now turned on. Therefore, using the **stty** command to turn off the PKTXTND option within an interactive z/OS OpenSSH session will fail. Your **stty** command needs to be updated to leave the PKTXTND option unchanged (that is, turned on).

26. **Question:** I see a message similar to the following:

```
FOTS2275 WARNING: DSA key found for host xx.xx.xx.xx in
/u/ctware/.ssh/known_hosts:1
```

Answer: This condition may occur for either RSA or DSA keys if there is only one key in the `known_hosts` file for this remote host and dependent upon the **ssh** client's setting of the HostKeyAlgorithms configuration file option. If the HostKeyAlgorithms setting requests the checking of the RSA key first, and it encounters the DSA key, this message may be produced and vice versa. This behavior is treated as if there is no match found and if StrictHostKeyChecking=ask, then you will be prompted to add the remote host key. If running in batchmode and StrictHostKeyChecking is not set to 'no', processing will be terminated. If the client wishes to utilize DSA host keys prior to RSA, they should update their configuration file to list *ssh-dss* before *ssh-rsa* on the HostKeyAlgorithms option to prevent this condition. Another resolution would be to ensure the client has added both the host's RSA and DSA keys (if both exist) to their `known_hosts` file.

27. **Question:** When starting `sshd` with the `-d` parameter, the following messages appear when I try to connect:

```
BPXP014I ENVIRONMENT MUST BE CONTROLLED FOR DAEMON
(BPX.DAEMON) PROCESSING.
BPXP015I HFS PROGRAM /bin/nohup IS NOT MARKED PROGRAM
CONTROLLED.
```

Answer 1: If you must run with the `-d` option, remove the **`nohup`** command from the `sshd.sh` shell script. Since the daemon does not fork when running with the `-d` option, the initial address space may be marked dirty because `/bin/nohup` is not program controlled.

Answer 2: You could remove the `-d` specification. In this case, a copy of the `sshd` daemon is created in a new clean address space, so the **`nohup`** command does not need to be program controlled.

Debugging OpenSSH problems

Setting up the syslog daemon (**syslogd**) can help to debug OpenSSH problems. In addition, most OpenSSH commands provide a verbose (**-v**) or debug (**-d**) option to assist debugging. Using **syslogd** and these options can help resolve common OpenSSH problems. For more information about configuring **syslogd**, see *z/OS Communications Server: IP Configuration Guide*. For more information about the OpenSSH command options, see Chapter 9, “OpenSSH command descriptions,” on page 85.

Setting up syslogd to debug sshd

Setting up the syslog daemon (**syslogd**) can help to debug **sshd** problems. For more information about configuring **syslogd**, see *z/OS Communications Server: IP Configuration Guide*.

Steps for setting up syslogd to debug sshd

About this task

Before you begin: You need to have superuser authority in order to start the **syslogd** daemon.

Perform the following steps to set up **syslogd** to debug OpenSSH.

Procedure

1. Create the **syslogd** configuration file `/etc/syslog.conf`.
   1. Create directory `/tmp/syslogd`.

      ```
      mkdir /tmp/syslogd
      ```

   2. Add a configuration statement in the `syslogd.conf` file.

      For example:

      ```
      echo "daemon.debug   /tmp/syslogd/server.logfile" >> /etc/syslog.conf
      ```

      Result: Writes debug messages with facility daemon to `/tmp/syslogd/server.logfile`.

   3. Set the permission bits.

      ```
      chmod 644 /etc/syslog.conf
      ```

   4. Create the log file.

      ```
      touch  /tmp/syslogd/server.logfile
      ```

2. Start **syslogd**

   ```
   /usr/sbin/syslogd -f /etc/syslog.conf &
   ```

3. In the **sshd_config** configuration file, add the SyslogFacility and LogLevel keywords. The default SyslogFacility is AUTH. The default LogLevel is INFO. In addition, add the syslog facility and log level options to the **sftp** subsystem configuration. The default syslog facility option is AUTH and the default log level option is ERROR. For example:

   ```
   SyslogFacility DAEMON
   LogLevel    DEBUG3
   Subsystem sftp /usr/lib/ssh/sftp-server -f DAEMON -l DEBUG3
   ```

4. To force **sshd** or **syslogd** to reread its configuration files and activate any modified parameters without stopping, issue:

   ```
   kill -s HUP $(cat /var/run/sshd.pid)
   ```

   or

   ```
   kill -s HUP $(cat /var/run/syslogd.pid)
   ```

Results

When you are done, you have set up **syslogd**.

Chapter 14. OpenSSH messages

FOTS0101 **unknown key type** *type*

Explanation: You specified an option that is not valid for this command.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS0102 **bad key type**

Explanation: Incorrect key type was passed.

System action: Command ends.

User response: Verify that the key file entered is valid.

FOTS0103 **load failed**

Explanation: Either the specified file is not the correct type or the passphrase was incorrect.

System action: Command ends.

User response: Check the file, the specified passphrase, and try the command again.

FOTS0104 **fgets failed**

Explanation: **ssh–keygen** could not read the answer to the prompt.

System action: Command ends.

User response: Try reissuing **ssh–keygen** with options for input instead of prompts. Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS0105 **key_to_blob failed**

Explanation: **ssh–keygen** could not convert the key from OpenSSH format.

System action: Command ends.

User response: Check that the key specified is OpenSSH format.

FOTS0106 **input line too long.**

Explanation: **ssh–keygen** could not convert the key. Data in the key file had a line that was too long.

System action: Command ends.

User response: Check that you specified the correct key file, and try again.

FOTS0107 **uudecode failed.**

Explanation: **ssh–keygen** could not convert the key because uudecode() failed.

System action: Command ends.

User response: Check that you specified the correct key file, and try again.

FOTS0108 decode blob failed.

Explanation: **ssh–keygen** could not convert the key.

System action: Command ends.

User response: Check that you specified the correct key file, and try again.

FOTS0109 key_write failed

Explanation: The key information could not be written to either stdout or file.

System action: Command ends.

User response: If using options to create or change the key file, check that there is enough space to create a key file.

FOTS0110 *filename* **is not a public key file**

Explanation: The command expected the file to be a public key and it is not.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the options description.

FOTS0111 Bad passphrase.

Explanation: The key file could not be loaded. Either the file given is not the correct format or the passphrase is not correct.

System action: Command ends.

User response: Check the file and the passphrase, and try again.

FOTS0112 Pass phrases do not match. Try again.

Explanation: The two passphrases given were not the same.

System action: Command ends.

User response: You need to specify the same passphrase twice.

FOTS0113 Saving the key failed: *filename***.**

Explanation: The key file could not be saved.

System action: Command ends.

User response: Verify that you have correct permissions to create the key file.

FOTS0114 Could not create directory '*directory***':** *error_message***.**

Explanation: The mkdir() failed and could not create the *directory* directory.

System action: Command ends.

User response: Check that you have correct permissions to create directory.

FOTS0115 Comments are only supported for RSA1 keys.

Explanation: Comments can only be changed for RSA1 key types.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options and descriptions.

FOTS0116 Key now has comment '*string*'

Explanation: Informational message when comment is changed.

System action: Command continues.

User response: None.

FOTS0117 Enter new comment:

Explanation: This is a prompt for specifying a new comment.

System action: Command waiting for input.

User response: Specify the new comment.

FOTS0118 Could not save your public key in *filename*

Explanation: Creation of the public file failed.

System action: Command ends.

User response: Check that you have correct permissions to create the file.

FOTS0119 fdopen *filename* **failed**

Explanation: The system call fdopen() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0120 key_generate failed

Explanation: Could not generate the private key.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0121 No user exists for uid *UID*

Explanation: The getpwuid() system call failed. This may happen when there are multiple users with the same UID and one of them does not have the group defined in the OMVS segment or the default group does not have OMVS segment.

System action: Command ends.

User response: Check the users for the group and the default group.

FOTS0122 Bits has bad value.

Explanation: Allowed range is 768 to 32768 bits.

System action: Command ends.

User response: Change the bits value and reissue the command.

FOTS0123 Too many arguments.

Explanation: You specified arguments that are mutually exclusive.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS0124 Can only have one of -p and -c.

Explanation: You cannot change both the passphrase and the comment in the same command. You have to change them one at a time.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS0125 You must specify a key type (-t).

Explanation: You need to specify the key type when generating a key file. Option -t type and -d specify the key format.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the correct format.

FOTS0126 buffer_get_bignum_bits: input buffer too small: need *need_bits* **have** *have_bits*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0127 bad magic 0x*magic_value* **!= 0x***expected_value*

Explanation: Unexpected value in private key.

System action: Command ends.

User response: Check that you specified the correct key file, and try again.

FOTS0128 unsupported cipher *cipher*

Explanation: The specified cipher for the key is not supported.

System action: Command ends.

User response: Check that you specified the correct key file, verify that the cipher used to create the key is supported, and then try again.

FOTS0129 line *number* **too long:** *line***..."**

Explanation: **ssh–keygen** could not convert the key. Data in the key file had a line that was too long.

System action: Command ends.

User response: Check that you specified the correct key file, and try again.

FOTS0130 do_convert_private_ssh2_from_blob: remaining bytes in key blob *rlen*

Explanation: **ssh–keygen** could not convert the key.

System action: Command continues.

User response: Check that you specified the correct key file, and try again.

FOTS0131 strtol failed:

Explanation: A call to strtol() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0132 version 1 keys are not supported

Explanation: The -e option cannot be used with RSA keys for use by SSH protocol version 1.

System action: The program ends.

System programmer response: Not applicable

User response: Specify a RSA key for use by SSH protocol version 2 or a DSA key.

FOTS0133 Primality trials has bad value.

Explanation: Number of primality trials must be an integer greater than or equal to 4.

System action: The command ends.

System programmer response: Not applicable

User response: Select an integral value greater than or equal to 4.

FOTS0134 Desired generator has bad value.

Explanation: Generator value must be greater than or equal to 1.

System action: The command ends.

System programmer response: Not applicable

User response: Select a generator value greater than or equal to 1.

FOTS0135 Minimum primality trials is *TRIAL_MINIMUM*

Explanation: The number of trials specified must be greater than or equal to *TRIAL_MINIMUM*.

System action: The command ends.

System programmer response: Not applicable

User response: Select a trials value greater than or equal to *TRIAL_MINIMUM*.

FOTS0136 Invalid memory amount (min *min_memory***, max** *max_memory***)**

Explanation: The memory amount must be greater than or equal to *min_memory* and less than or equal to *max_memory*.

System action: The command ends.

System programmer response: Not applicable

User response: Select a memory value greater than or equal to *min_memory* and less than or equal to *max_memory*.

FOTS0137 Invalid start point.

Explanation: A call to OpenSSL function BN_hex2bn() failed for the specified start point.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Make sure the specified start point is a string which begins with one or more valid hexadecimal digits. If the specified string is valid and the problem persists then contact your system programmer.

FOTS0138 Couldn't open modulus candidate file "*filename*": *error_message*

Explanation: A call to fopen() failed on file *filename* The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0139 modulus candidate generation failed

Explanation: Internal error.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0140 Couldn't open moduli file "*filename*": *error_message*

Explanation: A call to fopen() failed on file *filename*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0141 modulus screening failed

Explanation: Internal error.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0142 Memory option has bad value.

Explanation: The value specified for the memory option must be an integer greater than 7 and less than 128.

System action: The command ends.

System programmer response: Not applicable

User response: Select an integer value greater than 7 and less than 128.

FOTS0143 buffer_get_bignum_bits: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0144 hash_host failed

Explanation: Internal error. Unable to hash host name information.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0145 Specified known hosts path too long

Explanation: The known_hosts file path name is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the path name of the known_hosts file is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS0146 fopen: *error_message*

Explanation: The fopen() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0147 known_hosts path too long

Explanation: The known_hosts file path name is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the path name of the known_hosts file is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS0148 mkstemp: *error_message*

Explanation: The mkstemp() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0149 fdopen: *error_message*

Explanation: The fdopen() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0150 line *line_number* **missing key:** *line_in_error***...**

Explanation: Line *line_number* in the known_hosts file is missing key information.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid known_hosts file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0151 line *line_number* **invalid key:** *line_in_error***...**

Explanation: Line *line_number* in the known_hosts file contains an invalid key.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid known_hosts file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0152 line *line_number***: invalid hashed name:** *line_in_error***...**

Explanation: Line *line_number* in the known_hosts file contains a hashed host name that is not valid.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid known_hosts file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0153 Warning: ignoring host name with metacharacters: *host_name*

Explanation: Skipped hashing host name *host_name* with metacharacters.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: If you expected all host names to be hashed, verify that a valid known_hosts file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0154 *filename* **is not a valid known_hosts file.**

Explanation: An error occurred while processing the known_hosts file *filename*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid known_hosts file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0155 Not replacing existing known_hosts file because of errors

Explanation: The existing known_hosts file was not replaced because an error occurred while processing the file.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid known_hosts file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0156 unlink *filename***:** *error_message*

Explanation: The unlink() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0157 link *filename1* **to** *filename2***:** *error_message*

Explanation: The link() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0158 rename "*filename1***" to "***filename2***":** *error_message*

Explanation: The rename() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0159 Identity filename too long

Explanation: The specified identity filename is too long.

System action: The program ends.

User response: Specify a valid identity filename, and try the request again.

FOTS0160 Output filename too long

Explanation: The specified output filename is too long.

System action: The program ends.

User response: Specify a valid output filename, and try the request again.

FOTS0161 no keys found.

Explanation: No keys were found in the key file.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid key file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0162 no support for smartcards.

Explanation: **ssh–keygen** on z/OS does not support smart cards.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Do not specify **ssh–keygen** smart card options. If unable to resolve, contact your system programmer.

FOTS0163 DSA keys must be 1024 bits

Explanation: The **ssh–keygen** bits value for the DSA key is not 1024.

System action: The program ends.

User response: Correct the **ssh–keygen** bits value, and try the request again.

FOTS0164 ungetc: *error_message*

Explanation: The ungetc() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0165 *filename* **updated.**

Explanation: The known_hosts file *filename* was updated.

System action: The program continues.

User response: None.

FOTS0166 Original contents retained as *filename*

Explanation: The original contents of the known_hosts file is retained in file *filename*.

System action: The program continues.

User response: None.

FOTS0167 WARNING: *filename* **contains unhashed entries**

Explanation: The known_hosts file *filename* contains unhashed host names. The file should be deleted to ensure privacy.

System action: The program continues.

User response: Delete file *filename* to ensure privacy of the host names.

FOTS0169 Entering new comment failed: *filename***.**

Explanation: Failed to enter new comment for key file *filename*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a valid key file is specified, and try the request again. If unable to resolve, contact your system programmer.

FOTS0170 Invalid number of trials: *number_of_trials* **(***error_message***)**

Explanation: The specified **ssh–keygen** number of trials value is not valid. The error is displayed with the message.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid **ssh–keygen** number of trials values, and try the request again.

FOTS0171 Memory limit is *error message***:** *memory_limit*

Explanation: The specified **ssh–keygen** memory limit value is not valid. The error is displayed with the message.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid **ssh–keygen** memory limit values, and try the request again.

FOTS0172 Bits has bad value *bits* **(***error_message***)**

Explanation: The specified **ssh–keygen** bits value is not valid. The error is displayed with the message.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid **ssh–keygen** bits values, and try the request again.

FOTS0173 Desired generator has bad value: *generator* **(***error_message***)**

Explanation: The specified **ssh–keygen** generator value is not valid. The error is displayed with the message.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid **ssh–keygen** generator values, and try the request again.

FOTS0174 Key must at least be 768 bits

Explanation: The **ssh–keygen** key length the key type must be at least 768 bits.

System action: The command ends.

User response: Correct the **ssh–keygen** bits value, and try the request again.

FOTS0175 Invalid ECDSA key length - valid lengths are 256, 384 or 521 bits

Explanation: The **ssh–keygen** bits value an ECDSA key must be 256, 384 or 521 bits.

System action: The command ends.

User response: Correct the **ssh–keygen** bits value, and try the request again.

FOTS0176 PEM_write_RSA_PUBKEY failed

Explanation: A call to OpenSSL function PEM_write_RSA_PUBKEY failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the provided key and try the request again. If unable to resolve, contact your system programmer.

FOTS0177 PEM_write_DSA_PUBKEY failed

Explanation: A call to OpenSSL function PEM_write_DSA_PUBKEY failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the provided key and try the request again. If unable to resolve, contact your system programmer.

FOTS0178 PEM_write_EC_PUBKEY failed

Explanation: A call to OpenSSL function PEM_write_EC_PUBKEY failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the provided key and try the request again. If unable to resolve, contact your system programmer.

FOTS0179 *function***: unsupported key type** *key_type*

Explanation: Key could not be converted.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the provided key and try the request again. If unable to resolve, contact your system programmer.

FOTS0180 PEM_write_RSAPublicKey failed

Explanation: A call to OpenSSL function PEM_write_RSAPublicKey failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the provided key and try the request again. If unable to resolve, contact your system programmer.

FOTS0181 *function***: unknown key format** *key_format*

Explanation: An unsupported key format was specified.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the provided key and try the request again. If unable to resolve, contact your system programmer.

| **FOTS0182** *program***:** *filename***:** *system error*

| **Explanation:** A call to fopen() failed on file *filename*. The system error is displayed with this message.

| **System action:** The command ends.

| **System programmer response:** Follow local procedures for reporting problems to IBM.

| **User response:** Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0183 *function***:** *filename* **is not a recognised public key format**

Explanation: A call to OpenSSL function PEM_read_PUBKEY failed.

System action: The command ends.

User response: Correct the provided identity file and try the request again.

FOTS0184 *function*: **unsupported pubkey type** *type*

Explanation: The converted identity file does not contain a supported public key type.

System action: The command ends.

User response: Correct the provided identity file and try the request again.

FOTS0185 *function*: **unrecognized raw private key format**

Explanation: The converted identity file does not contain a recognised raw private key format.

System action: The command ends.

User response: Correct the provided identity file and try the request again.

FOTS0186 **no pkcs11 support**

Explanation: pkcs11 key storage is not supported.

System action: The command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for supported functions.

FOTS0187 *function*: **no filename**

Explanation: The identity filename was not specified.

System action: The command ends.

User response: Provide the identity file and try the request again.

FOTS0189 **Couldn't load CA key "***filename***"**

Explanation: The CA key could not be loaded.

System action: The command ends.

User response: Correct the CA key and try the request again.

FOTS0190 **Empty principal name**

Explanation: The set of principals in the provide OpenSSH certificate contains an empty name.

System action: The command ends.

User response: Correct the set of principal names and try the request again.

FOTS0191 *function*: **unable to open "***filename***"**

Explanation: Unable to load the public key.

System action: The command ends.

User response: Correct the public key and try the request again.

FOTS0192 *function*: **key "***key***" type "***key_type***" cannot be certified**

Explanation: The type of the given public key cannot be used in an OpenSSH certificate.

System action: The command ends.

User response: Correct the public key and try the request again.

FOTS0193 **Could not upgrade key** *key* **to certificate**

Explanation: Failed to prepare the certificate for signing.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0194 *program*: *filename*: *message*

Explanation: A call to stat() failed on file *filename*. The system error is displayed with this message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0195 **Couldn't not certify key** *key*

Explanation: Failed to create an OpenSSH certificate with the provided key.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0196 **Could not open "***certificate***" for writing:** *message*

Explanation: Failed to write the resultant OpenSSH certificate.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0197 *function*: **fdopen:** *message*

Explanation: The fdopen() system call failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0198 **Could not write certified key to** *filename*

Explanation: Failed to write the certificate to the path identified in the message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0199 **Invalid relative certificate time** *validity_interval*

Explanation: The *validity_interval* specified on the **ssh_keygen** command was not valid.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS0201 *variable* **not set, cannot kill agent**

Explanation: *variable* environment variable was not set so **ssh–agent** could not get the PID of the agent to kill

System action: Command ends.

User response: Set the *variable* environment variable to the correct agent pid.

FOTS0202 *variable*="*value*"**,which is not a good PID**

Explanation: The *variable* environment variable does not contain the correct pid so the agent could not be killed.

System action: Command ends.

User response: Check the *variable* environment variable and its value.

FOTS0203 **internal error, bad protocol version** *version*

Explanation: **ssh–agent** supports version 1 and 2. The displayed version is not supported.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0204 **process_remove_identity: internal error: tab->nentries** *number*

Explanation: Failure occurred during internal processing of removing keys.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0205 **select:** *message*

Explanation: select() system call failed

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0206 **Unknown message** *number*

Explanation: **ssh–agent** could not process the given message.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0207 **fcntl O_NONBLOCK:** *message*

Explanation: fcnt() system call failed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0208 accept from AUTH_SOCKET: *message*

Explanation: accept() system call failed. could not get correct socket number

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0209 getpeereid *id* **failed:** *message*

Explanation: getpeereid fails for the given socket.

System action: The socket gets closed and command continues.

User response: Check the system error message which follows this message.

FOTS0210 uid mismatch: peer euid *id* **!= uid** *uid*

Explanation: ssh–agent sockets are owned by the uid which created it and can only be used by that uid and superuser.

System action: Command continues.

User response: Check that you are using the correct uid and SSH_AUTH_SOCK environment variable has correct value.

FOTS0211 kill

Explanation: kill system call failed and could not kill the agent.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0212 mkdtemp: private socket dir

Explanation: Could not create the private directory for agent socket.

System action: Command ends.

User response: Check the system error message which follows this message.

FOTS0213 socket

Explanation: Could not create socket because socket system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0214 bind

Explanation: bind system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0215 listen

Explanation: listen system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0216 fork

Explanation: fork system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0217 setenv

Explanation: setenv system call failed and **ssh–agent** could not set either SSH_AUTH_SOCK or SSH_AGENT_PID variables.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0218 setsid: *message*

Explanation: setsid system call failed

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0219 setrlimit RLIMIT_CORE: *string*

Explanation: setrlimit system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0220 process_authentication_challenge1: BN_new failed

Explanation: The BN_new function failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0221 Unknown socket type *number*

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0222 Unknown type *number*

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0231 process_add_identity: RSA_blinding_on failed

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0232 *variable***="***value***", which is not a good PID:** *error_message*

Explanation: The *variable* environment variable does not contain the correct pid so the agent could not be killed.

System action: The program ends.

User response: Check the *variable* environment variable and its value and try the request again.

FOTS0233 process_authentication_challenge: bad challenge length *length*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0234 Warning: identity keysize mismatch: actual *keysize1***, announced** *keysize2*

Explanation: Possible RSA key problem encountered while removing identity from the agent.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the RSA key is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0235 Certificate parse failed

Explanation: Failed to parse a certificate while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the certificate is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0236 *function*: **curve names mismatch**

Explanation: An ECC curve name mismatch occurred while adding an identity from an ecdsa key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0237 *function*: **EC_KEY_new_by_curve_name failed**

Explanation: The EC_KEY_new function failed while adding an identity from an ecdsa key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0238 *function*: **BN_new failed**

Explanation: The BN_new function failed while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0239 *function*: **EC_KEY_set_public_key failed**

Explanation: The EC_KEY_set_public_key function failed while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0240 *function*: **EC_KEY_set_private_key failed**

Explanation: The EC_KEY_set_private_key function failed while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS0241 *function*: **bad ECDSA public key**

Explanation: A bad ECDSA key was found failed while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0242 *function*: **bad ECDSA private key**

Explanation: A bad ECDSA key was found failed while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0243 *function***: bad ECDSA key**

Explanation: A bad ECDSA key was found failed while adding an identity.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key is valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0244 **process_add_identity: Unknown constraint type** *constraint_typt*

Explanation: An error occured while adding a key with constraints.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key constraints are valid and try the request again. If unable to resolve, contact your system programmer.

FOTS0301 **Bad key file** *filename*

Explanation: The public key of the specified identity could not be loaded.

System action: Command continues to the next file (if any).

User response: Make sure the public key exists in the same directory as the pathname of the identity.

FOTS0302 **Failed to remove all identities.**

Explanation: One or more version 1 identities could not be removed from the ssh-agent when trying to remove all.

System action: Command ends.

User response: Check what identities are still present in the ssh-agent. Contact system programmer.

FOTS0303 **Could not remove identity:** *filename*

Explanation: **ssh–agent** returned a bad code when removal was attempted.

System action: Command continues to next identity (if any).

User response: Contact system programmer.

FOTS0304 **Could not add identity:** *filename*

Explanation: The specified identity could not be added to the ssh-agent.

System action: Command continues to next file (if any).

User response: Contact system programmer.

FOTS0305 **key_write failed**

Explanation: The key parameter could not be written to the stdout.

System action: Command continues.

User response: Not applicable

FOTS0306 Passwords do not match.

Explanation: When prompted twice for the password, the passwords must match.

System action: Command ends.

User response: Retry command giving the same password twice.

FOTS0307 Failed to (un)lock agent.

Explanation: The ssh-agent could not be either locked or unlocked.

System action: Command ends.

User response: If unlocking, check that correct password was given. When unlocking, check that the same password was given twice.

FOTS0308 Could not open a connection to your authentication agent.

Explanation: **ssh–add** needs **ssh–agent** to be running to execute.

System action: Command ends.

User response: Check that you have **ssh–agent** running and the SSH_AGENT_PID and SSH_AUTH_SOCK environment variables hold the agent data and are exported.

FOTS0309 Invalid lifetime

Explanation: The format of the -t argument was incorrect and the lifetime could not be set.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS0310 Smartcards are not supported

Explanation: You tried to use -s or -e option which is not supported.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS0311 No user found with uid *uid*

Explanation: The getpwuid() system call failed. This may happen when there are multiple users with the same uid and one of them does not have the group defined in the omvs segment or the default group does not have omvs segment.

System action: Command ends.

User response: Check the users for the given uid for the group and the default group.

FOTS0327 *identity_file* **:** *message*

Explanation: A call to stat() failed on file *identity_file*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0331 *function***: no cert/certblob**

Explanation: An attempt to encode an OpenSSH certificate failed because the provided certificate was not complete. This can occur if an corrupted certificate was added using the ssh-add command.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS0332 **Certificate** *cert* **does not match private key** *key*

Explanation: While attempting to delete a key in ssh-add, the corresponding certificate was found to not match the key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS0333 **Certificate** *cert* **does not match private key** *key*

Explanation: While attempting to add a certificate in ssh-add, the corresponding certificate was found to not match the key.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS0334 *function***: key_to_certified failed**

Explanation: The key_to_certified failed while attempting to add a certificate in ssh-add.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to ensure that the certificate is valid and retry.

FOTS0335 **Certificate** *cert_key_id* **(***cert_key_id***) add failed**

Explanation: An attempt to add a certificate failed in ssh-add.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to ensure that the certificate is valid and retry.

FOTS0401 **Impossible! dispatch_run() returned!**

Explanation: Call to dispatch_run returned when it should not have.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0402 **Bad port '***port_num***'**

Explanation: The specified port number is not valid.

System action: Command ends.

User response: Specify a valid port number.

FOTS0403 Bad timeout '*time*'

Explanation: The specified timeout value is not valid.

System action: Command ends.

User response: Specify a valid timeout value.

FOTS0404 *hostname***: invalid packet type**

Explanation: Packet received from host was not in the proper format.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connections. If problem persists contact your system administrator to report the problem.

FOTS0405 getaddrinfo *hostname***:** *message*

Explanation: A call to getaddrinfo() failed. The system error is displayed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0406 socket: *message*

Explanation: A call to socket() failed. The system error is displayed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0407 F_SETFL: *error_message*

Explanation: fcntl() system call failed.

System action: Command ends

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0408 connect ('*hostname***'):** *message*

Explanation: A call to connect() failed. The system error is displayed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0409 read ('*hostname***'):** *message*

Explanation: Could not read from socket because the read system call failed. The system error is displayed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0410 *hostname***: Connection closed by remote host.**

Explanation: The remote host has closed the connection.

System action: Command continues.

User response: Contact the remote host sysadmin for further assistance.

FOTS0411 *hostname***: bad greeting**

Explanation: The greeting received from the server is not in the proper format.

System action: Command continues.

User response: Contact the remote host sysadmin for further assistance.

FOTS0412 **write ('***hostname***'):** *message*

Explanation: Could not write to the socket because the write system call failed. The system error is displayed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0414 *hostname***: exception!**

Explanation: There is an exception for the socket associated with the indicated hostname. This error is often the result when the remote server is down or not running ssh.

System action: Command continues.

User response: Contact the remote host sysadmin for further assistance.

FOTS0415 **conalloc: fdno** *number* **too high**

Explanation: The file descriptor value exceeds the maximum for the system.

System action: Command ends.

System programmer response: Verify system file descriptor settings. If problem cannot be resolved then follow local procedures for reporting problems to IBM.

User response: Contact the system programmer for further assistance.

FOTS0416 **conalloc: attempt to reuse fdno** *number*

Explanation: The program is attempting to allocate a file descriptor that is already in use.

System action: Command ends.

System programmer response: Verify system file descriptor settings. If problem cannot be resolved then follow local procedures for reporting problems to IBM.

User response: Contact the system programmer for further assistance.

FOTS0417 **confree: attempt to free bad fdno** *number*

Explanation: The program attempted to free a connection that did not exist.

System action: Command ends.

System programmer response: Verify system file descriptor settings. If problem cannot be resolved then follow local procedures for reporting problems to IBM.

User response: Contact the system programmer for further assistance.

FOTS0418 conread: invalid status *status*

Explanation: The connection status value is invalid.

System action: Command ends.

User response: Verify the status of hosts being scanned.

FOTS0419 Too high debugging level.

Explanation: The specified debugging level exceeds the maximum value of 3.

System action: Command ends.

User response: Specify a debugging level of 3 or less.

FOTS0420 unknown key type *keytype*

Explanation: The specified key type is not a valid key type.

System action: Command ends.

User response: Specify a valid key type.

FOTS0421 *progname*: **fdlim_get: bad value**

Explanation: The number of file descriptors available to the process is less than zero.

System action: Command ends.

System programmer response: Verify system file descriptor settings. If problem cannot be resolved then follow local procedures for reporting problems to IBM.

User response: Contact the system administrator for further assistance.

FOTS0422 *progname*: **not enough file descriptors**

Explanation: The number of file descriptors available to the process for use for connections is zero or less.

System action: Command ends.

System programmer response: Verify system file descriptor settings. If problem cannot be resolved then follow local procedures for reporting problems to IBM.

User response: Contact the system administrator for further assistance.

FOTS0424 *function*: **set_nonblock(***socket***)**

Explanation: **ssh–keyscan** failed to set the connection socket *socket* to non–blocking. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0425 host_hash failed

Explanation: Failed to hash the hostnames and addresses.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0426 **snprintf: buffer too small**

Explanation: Failed to set up the connection because an internal buffer was too small.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0427 *program*: *filename*: *message*

Explanation: A call to fopen() failed on file *filename*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0428 *program*: *filename*: *message*

Explanation: A call to ferror() failed on file *filename*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0501 *progname*: *resource_name* **must be boolean, not** *buf***.**

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0502 *progname*: *resource_name* **must be an integer, not** *buf***.**

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0503 *progname*: *resource_name* **must be a float, not** *buf***.**

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0504 *progname*: **can't parse color** *color*

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0505 *progname*: **couldn't allocate color** *color*

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0506 *appName*[*pid*]: **Aaahhh! I ran out of memory at line** *line*.

Explanation: Out of memory.

System action: Command ends.

User response: Free more system resources and reissue the command.

FOTS0507 *appName*[*pid*]: **invalid value** '*string_resource*' **for** *instanceName*.

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0508 *appName*[*pid*]: **performGrab: invalid grab type (***grabType***).**

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0509 *appName*[*pid*]: **performGrab: null grab type name.**

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0510 *appName*[*pid*]: **Could not grab** *grabTypeName* **(***reason***)**

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0511 *appName*[*pid*]**: *Yawn*...timed out after** *time* **seconds.**

Explanation: Timed out waiting for user response.

System action: Command ends.

User response: Respond to prompt prior to timeout.

FOTS0512 *appName*[*pid*]**: getrlimit failed (***system error***)**

Explanation: getrlimit() system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0513 *appName*[*pid*]**: setrlimit failed (***system error***)**

Explanation: setrlimit() system call failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0514 *appName*[*pid*]**: This should not happen.**

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS0603 **setegid:** *UID***:** *error_message*

Explanation: The setegid() system call was unable to set the real effective group id for the user with UID *UID*.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0604 **setresuid** *uid***:** *error_message*

Explanation: The setresuid() function call failed. The failure occurred due to an error in setuid() system call. The system error is displayed with the message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS0605 **setresgid** *uid***:** *error_message*

Explanation: The setresgid() function call failed. The failure occurred due to an error in either the setegid() or setgid() system call. The system error is displayed with the message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS0701 process_read: seek failed

Explanation: System call lseek() failed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0702 process_write: seek failed

Explanation: System call lseek() failed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0703 process_write: write failed

Explanation: System call write() failed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0704 bad message

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0705 Unknown message *request*

Explanation: The displayed *request* is not supported by **sftp-server**.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0706 read error

Explanation: System call read() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0707 write error

Explanation: System call write() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0708 iqueue grew unexpectedly

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0709 msg_len *length* **< consumed** *bytes*

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0711 bad message from *client_address* **local user** *user_name*

Explanation: Internal error. A bad message was received from the client at *client_address* for local user *user_name*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS0712 read: *error_message*

Explanation: The read() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0713 write: *error_message*

Explanation: The write() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0714 Invalid log level "*log_level***"**

Explanation: The specified **sftp–server** log level value is not valid.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid **sftp–server** log level values, and try the request again.

FOTS0715 **Invalid log facility "*log_facility*"**

Explanation: The specified **sftp–server** log facility value is not valid.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid **sftp–server** log facility values, and try the request again.

FOTS0716 **Malformed SSH_CONNECTION variable: "*value*"**

Explanation: The SSH_CONNECTION environment variable's value is malformed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS0717 **select:** *error_message*

Explanation: The select() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0718 **No user found for uid** *UID*

Explanation: The getpwuid() system call was unable to get information about a user with UID *UID*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS0720 **More than %d** *max_sftpServerconvert_patterns* **sftpServerConvert patterns are found**

Explanation: The maximum number of sftpServerConvert patterns(*max_sftpServerconvert_patterns*) has been exceeded.

System action: The program ends.

System programmer response: None.

User response: Reissue the command with a smaller number of sftpServerConvert patterns.

| **FOTS0721** **Invalid umask "*umask*"**

| **Explanation:** The umask provided is not valid. It must be an octal number between 1 and 777 inclusively.

| **System action:** The program ends.

| **System programmer response:** None.

| **User response:** Reissue the command with a correct umask.

FOTS0722 **chdir to "*dir*" failed:** *error_message*

Explanation: Failed to change to the specified directory.

System action: The program continues.

System programmer response: None.

User response: Verify that the directory exists and has correct permissions. Reissue the command. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0801 **pipe:** *system error*

Explanation: System call pipe() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0802 **socketpair:** *system error*

Explanation: System call socketpair() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0803 **fork:** *system error*

Explanation: System call fork() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0804 **dup2:** *system error*

Explanation: System call dup2() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0805 **exec:** *path***:** *system error*

Explanation: System call exec() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0806 *error* **(***pathname***).**

Explanation: Error occurred when specifying *pathname* after '-b'.

System action: Command ends.

User response: Check to make sure that you use a valid path name.

FOTS0807 Filename already specified.

Explanation: You specified option '-b' more than once.

System action: Command ends.

User response: Check and make sure that you specify option '-b' only once.

FOTS0808 Invalid buffer size "*size***"**

Explanation: Buffer size can only be an integer between 1 and 2147483647(LONG_MAX).

System action: Command ends.

User response: Specify a valid buffer size and retry.

FOTS0809 Invalid number of requests "*number***"**

Explanation: Number of requests can only be an integer between 1 and 2147483647(LONG_MAX).

System action: Command ends.

User response: Specify a valid number of requests and retry.

FOTS0810 Missing username

Explanation: User name is missing from the command line.

System action: Command ends.

User response: Check and make sure you issue a valid username on the command line.

FOTS0811 Missing hostname

Explanation: Host name is missing from the command line.

System action: Command ends.

User response: Check and make sure you issue a valid hostname on the command line.

FOTS0812 Couldn't wait for ssh process: *system error*

Explanation: System call waitpid() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0813 Shell exited abnormally

Explanation: The child process ended abnormally.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0814 Shell exited with status *status*

Explanation: The child process ended normally with the status listed previously.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0815 Invalid path

Explanation: Internal error.

System action: Command continues.

User response: Contact your system programmer.

FOTS0816 ls: Invalid flag –*flag*

Explanation: You specified an invalid flag *flag* after the subcommand **ls**.

System action: Command continues.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a valid flag.

FOTS0817 Unterminated quote

Explanation: You specified quoted filename and the quotes are not closed.

System action: Command continues.

User response: Check and make sure the quotes are closed.

FOTS0818 Empty quotes

Explanation: You specified quoted filename and the file name is missing between the quotes.

System action: Command continues.

User response: Check and make sure to specify filename between the quotes.

FOTS0819 File "*filename*" not found.

Explanation: You specified a file that was not found.

System action: Command continues.

User response: Make sure the file exists before reissuing command.

FOTS0820 Multiple source paths, but destination "*path*" is not a directory

Explanation: You attempted to upload more than one file but the target indicated by *path* was not a directory.

System action: Command continues.

User response: When uploading more than one file, ensure that the target *path* is a directory.

FOTS0821 Can't ls: "*path*" not found

Explanation: Internal error.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0822 Invalid command.

Explanation: You entered an invalid subcommand.

System action: Command continues.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of valid subcommands.

FOTS0823 **You must specify at least one path after a** *get or put* **command.**

Explanation: You omitted pathname after *get or put* command.

System action: Command continues.

User response: Check to make sure you specify at least one pathname after *get or put*.

FOTS0824 **You must specify two paths after a** *command* **command.**

Explanation: You specified only one pathname after the subcommand.

System action: Command continues.

User response: Check to make sure you specify two pathnames.

FOTS0825 **You must specify a path after a** *command* **command.**

Explanation: You omitted the pathname after the subcommand.

System action: Command continues.

User response: Check to make sure you did not omit the pathname.

FOTS0826 **You must supply a numeric argument to the** *cmd_string* **command.**

Explanation: You specified a non-numeric argument.

System action: Command continues.

User response: Check to make sure you specify a numeric argument.

FOTS0827 **Can't change directory: Can't check target**

Explanation: You can not change directory because the sftp-server protocol does not support remote file permission bits transferring.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0828 **Can't change directory: "***dir***" is not a directory**

Explanation: You can not change the directory because the argument specified after the subcommand **cd** is not a directory.

System action: Command continues.

User response: Check to make sure the argument you supply is a valid directory.

FOTS0829 **Couldn't change local directory to "***dir***":** *error*

Explanation: You can not change local directory because of the system error.

System action: Command continues.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0830 **Couldn't create local directory "***dir***":** *error*

Explanation: You can not create a local directory because of the system error.

System action: Command continues.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0831 Can't get current ownership of remote file "*pathname*"

Explanation: You can not get the ownership of the remote file because the sftp-server protocol does not support file ownership transferring.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact the system programmer.

FOTS0832 Couldn't get local cwd: *system error*

Explanation: You can not get local working directory because call to getcwd() failed.

System action: Command continues.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0833 Couldn't fork: *system error*

Explanation: System call fork() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0834 Couldn't wait for child: *system error*

Explanation: System call waitpid() failed.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0835 Command not implemented

Explanation: The subcommand you specified is not implemented in the program.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0836 *command number* **is not implemented**

Explanation: The specified interactive command is not implemented in the program.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0837 Couldn't initialize connection to server

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0838 Need cwd

Explanation: The program could not get the current working directory from the server.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0839 Couldn't execute "*shell program***":** *system error*

Explanation: You specified interactive command '!' to invoke the local shell and the program failed to execute the local shell.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0840 Couldn't send packet: *system error*

Explanation: A call to write() failed while **sftp** was attempting to send packet to the server.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0841 Connection closed

Explanation: A call to read() failed while **sftp** was attempting to get packet from the server. Therefore, the connection between the client and the server was closed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0842 Couldn't read packet: *system error*

Explanation: A call to read() failed while **sftp** was attempting to get packet from the server.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0843 Received message too long *length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0844 *function* **ID mismatch (***received msg_id* **!=** *expected msg_id***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0845 Expected SSH2_FXP_STATUS(*packet type1***) packet, got** *packet type2*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0846 *function* **Expected SSH2_FXP_HANDLE(***handle1***) packet, got** *handle2*

Explanation: Internal error

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0847 Couldn't stat remote file: *error message*

Explanation: **sftp** failed to get the remote file information due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0848 Expected SSH2_FXP_ATTRS(*packet type1***) packet, got** *packet type2*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0849 Invalid packet back from SSH2_FXP_INIT (type *packet type***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0850 **Couldn't close file:** *error message*

Explanation: **sftp** failed to close the connection between the client and the server due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0851 **Couldn't read directory:** *error message*

Explanation: **sftp** failed to read the remote directory due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0852 **Bad escaped character '***character***'**

Explanation: An invalid escaped character *character* was encountered after '\' in the file name.

System action: The program continues.

User response: Correct the file name and reissue the command.

FOTS0853 **Couldn't delete file:** *error message*

Explanation: **sftp** failed to delete the remote file due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0854 **Couldn't create directory:** *error message*

Explanation: **sftp** failed to create the remote directory due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0855 **Couldn't remove directory:** *error message*

Explanation: **sftp** failed to remove the remote directory due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0856 **Couldn't setstat on "***path***":** *error message*

Explanation: **sftp** failed to set remote file attributes due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0857 Couldn't fsetstat: *error message*

Explanation: **sftp** failed to set remote file attributes due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0858 Couldn't canonicalise: *error_msg*

Explanation: Internal error.

System action: The program continues.

System programmer response: Not applicable

User response: Not applicable

FOTS0859 Expected SSH2_FXP_NAME(*packet type1***) packet, got** *packet type2*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0860 Got multiple names (*count***) from SSH_FXP_REALPATH**

Explanation: **sftp** received more than one remote real path.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0861 Couldn't rename file "*old_path***" to "***new_path***":** *error message*

Explanation: **sftp** failed to rename remote file due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0862 This server does not support the symlink operation

Explanation: The sftp server you connected to does not support the **ln** and **symlink** subcommands.

System action: The program continues.

User response: Do not use the **symlink** or **ln** subcommands.

FOTS0863 Couldn't readlink: *error message*

Explanation: **sftp** failed to read the remote symlink.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0864 Got multiple names (*count*) from SSH_FXP_READLINK

Explanation: **sftp** received more than one symbolic names resolved for remote symlink.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0865 Cannot download a directory: *remote path*

Explanation: You can not download a remote directory.

System action: The program continues.

User response: Check to make sure that you do not specify a remote directory.

FOTS0866 Couldn't open local file "*local path***" for writing:** *system error*

Explanation: Opening local file failed due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0867 Unexpected reply *message id*

Explanation: Received unexpected reply from the server while attempting to download remote file.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0868 Received more data than asked for *length of transferred data* **>** *buffer size*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0869 Expected SSH2_FXP_DATA(*packet type1***) packet, got** *packet type2*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0870 Transfer complete, but requests still in queue

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0871 Couldn't read from remote file "*remote path***" :** *error message*

Explanation: sftp server failed to read from the remote file during downloading due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0872 Couldn't write to "*local file***":** *system error*

Explanation: **sftp** failed to write to the local file during downloading due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0873 Couldn't set mode on "*local file***":** *system error*

Explanation: **sftp** failed to change the mode of the local file due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0874 Can't set times on "*local file***":** *system error*

Explanation: **sftp** failed to set the access and modification times of the local file due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0875 Couldn't open local file "*local file***" for reading:** *system error*

Explanation: **sftp** failed to open the local file for reading (while attempting to upload the local file) due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0876 Couldn't fstat local file "*local file***":** *system error*

Explanation: **sftp** failed to retrieve status information about the local file (while attempting to upload the local file) due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0877 Couldn't read from "*local file***":** *system error*

Explanation: **sftp** failed to read from the local file (while attempting to upload the local file) due to the displayed system error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0878 Unexpected ACK *message id*

Explanation: Internal error. Unexpected acknowledgment was received.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0879 Expected SSH2_FXP_STATUS(*packet type1***) packet, got** *packet type2*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0880 Can't find request for ID *request id*

Explanation: **sftp** failed to find the request from the request queue.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0881 Couldn't write to remote file "*filename***":** *error_message*

Explanation: **sftp** failed to write to the remote file *filename* (while attempting to upload file) due to the displayed error message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the error, if possible, and attempt to upload the file again. If unable to resolve, contact your system programmer.

FOTS0882 Couldn't close local file "*local file***":** *system error*

Explanation: **sftp** failed to close the local file (after uploading the local file to the remote host) due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0883 *request***:** *error message*

Explanation: **sftp** failed to get handle sent from the server due to the displayed error message. The error occurred while performing *request*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0884 **skipping non-regular file** *file_name*

Explanation: While processing file to be uploaded, a non-regular file *file_name* was encountered and was ignored by **sftp**.

System action: The program continues.

User response: Check to make sure not to upload a non-regular file.

FOTS0885 **stat** *path***:** *system error*

Explanation: System call stat() failed on *path* due to the displayed system error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0886 **Batch file already specified.**

Explanation: You specified option '-b' more than once.

System action: Command ends.

User response: Check and make sure that you specify option '-b' only once.

FOTS0887 **Couldn't symlink file "***old_path***" to "***new_path***":** *error message*

Explanation: **sftp** failed to symlink from *old_path* to *new_path* due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: If unable to resolve based on the displayed error, contact your system programmer.

FOTS0888 **Cannot download non-regular file:** *file_name*

Explanation: You were trying to download a non-regular file *file_name* from the remote host. This cannot be performed by **sftp**.

System action: The program continues.

User response: Check and make sure not to download a non-regular file.

FOTS0889 *file_name* **is not a regular file**

Explanation: You were trying to download a non-regular file *file_name* from the remote host. This cannot be performed by **sftp**.

System action: The program continues.

User response: Check and make sure not to download a non-regular file.

FOTS0890 Outbound message too long *msg_len*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0891 Read packet: *system error*

Explanation: System call read() failed due to the displayed system error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0893 remote_glob failed with return code *return code***.**

Explanation: A call to the OpenSSH function remote_glob failed. The function's return value is displayed with this message.

System action: If running in an interactive session, the command continues. If running in batchmode, the command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Internal error. Contact your system administrator to report the problem.

FOTS0894 *command***: Invalid flag –***flag*

Explanation: You specified an invalid flag *flag* after the subcommand *command*.

System action: Command continues.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a valid flag.

FOTS0895 string too long

Explanation: **sftp** encountered a command string that was too long.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Shorten the command string length and try the request again. If unable to resolve, contact your system programer.

FOTS0896 Unterminated quoted argument

Explanation: **sftp** encountered an unterminated quoted argument while parsing a command string.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify quoted arguments are properly terminated and try the request again. If unable to resolve, contact your system programmer.

FOTS0897 Unknown ls sort type

Explanation: You specified an unknown **ls** sort type.

System action: The program ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a valid **ls** sort type.

FOTS0898 Couldn't statvfs: *error message*

Explanation: **sftp** failed to get the remote file system information due to the displayed error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0899 Expected SSH2_FXP_EXTENDED_REPLY(*expected***) packet, got** *actual*

Explanation: **sftp** was expecting an extended reply packet during statvfs processing, but received an unexpected reponse.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0901 Couldn't obtain random bytes (error *error***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0902 *function***: fstat of key file** *file_name* **failed:** *system error*

Explanation: System call fstat() failed on key file *file_name* due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0903 key_load_private_rsa1: RSA_blinding_on failed

Explanation: A call to OpenSSL function RSA_blinding_on() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function RSA_blinding_on() for more information.

FOTS0904 *function***: RSA_blinding_on failed**

Explanation: A call to OpenSSL function RSA_blinding_on() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function RSA_blinding_on() for more information.

FOTS0905 buffer_put_bignum2_ret: negative numbers not supported

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0906 buffer_put_bignum2_ret: BN too small

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0907 ssh1_3des_cbc: no context

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0908 ssh_rijndael_iv: no context

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0909 ssh_aes_ctr_iv: no context

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0910 Authentication response too long: *length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0914 mkstemp("*temp file***"):** *system error*

Explanation: Failed to open/create temp file due to the displayed system error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0915 *function*: **UsePrivilegeSeparation=yes and Compression=yes not supported**

Explanation: ssh does not support when you specify both UsePrivilegeSeparation=yes and Compression=yes at the same time.

System action: The program continues.

User response: Check to make sure that you do not specify UsePrivilegeSeparation=yes and Compression=yes at the same time.

FOTS0916 **Error writing to authentication socket.**

Explanation: Failure occurred while writing to authentication socket.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0917 **Error reading response length from authentication socket.**

Explanation: Failure occurred while reading from authentication socket.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0918 **Error reading response from authentication socket.**

Explanation: Failure occurred while reading from authentication socket.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0919 **Authentication response too long:** *length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0920 **Bad authentication reply message type:** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0921 **Too many identities in authentication reply:** *number*

Explanation: Received too many identities in reply.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0922 **Bad authentication response:** *response type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0924 **Bad response from authentication agent:** *response type*

Explanation: Received unsupported response from ssh-agent.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0925 **open** *filename* **failed:** *system error***.**

Explanation: Failure occurred while attempting to open the key file. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0926 **write to key file** *filename* **failed:** *system error*

Explanation: Failure occurred while attempting to write into a key file. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0927 **passphrase too short: have** *number* **bytes, need > 4**

Explanation: The new passphrase is too short. **ssh–keygen** does not allow passphrases that are less than or equal to 4 bytes.

System action: The program ends.

System programmer response: Not applicable.

User response: Check to make sure that you enter a passphrase greater than 4 bytes long. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for an explanation of a valid passphrase.

FOTS0928 *function***: key file** *filename* **too large**

Explanation: The key file *filename* is too large.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the file *filename* is a valid RSA key file, and try the request again. If unable to resolve, contact your system programmer.

FOTS0929 fdopen *filename* **failed:** *system error***.**

Explanation: Failure occurred while attempting to open the file for write. The system error is displayed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0930 *function* **cannot save key type** *type*

Explanation: The displayed key type can not be saved.

System action: The program ends.

System programmer response: Not applicable

User response: Contact your system programmer.

FOTS0931 fdopen failed: *system error*

Explanation: Failure occurred while attempting to open the file for read. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0932 *function***: PEM_read_PrivateKey: mismatch or unknown EVP_PKEY save_type** *save_type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0934 @ WARNING: UNPROTECTED PRIVATE KEY FILE! @ Permissions 0*permission bits* **for '***file name***' are too open. It is recommended that your private key files are NOT accessible by others. This private key will be ignored.**

Explanation: The permission bits of your key file is too open and that makes your key file insecure.

System action: The program continues.

User response: Check to make sure that your private key file is only readable by you.

FOTS0939 bad permissions: ignore key: *file name*

Explanation: The key file is readable by others.

System action: The program continues.

User response: Check to make sure that the private key file is only readable by you.

FOTS0941 save_private_key_rsa: bad cipher

Explanation: The cipher used to encrypt private keys is not supported.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0942 buffer_put_bignum_ret: BN_bn2bin() failed: oi *length* **!= bin_size** *size*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0943 buffer_get_bignum_ret: cannot handle BN of size *bytes*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0944 buffer_get_bignum_ret: input buffer too small

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0945 buffer_put_bignum2_ret: BN_bn2bin() failed: oi *length* **!= bin_size** *size*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0946 buffer_get_bignum2_ret: cannot handle BN of size *bytes*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0947 buffer_get_string_ret: bad string length *number*

Explanation: Internal error. Received string too long.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0948 buffer_put_cstring: s == NULL

Explanation: s is the input string to function buffer_put_cstring(). s cannot be an empty string.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0949 **buffer_append_space: len** *length* **not supported**

Explanation: Appended space cannot be greater than 1048576 bytes.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0950 **buffer_append_space: alloc** *number* **not supported**

Explanation: Cannot allocate buffer of size greater than 10485760 bytes.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0951 **buffer_get_ret: trying to get more bytes** *length* **than in buffer** *size available*

Explanation: The size of the available buffer is not big enough for the string.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0952 **buffer_consume: buffer error**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0953 **buffer_consume_end: trying to get more bytes than in buffer**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0954 **buffer_get_string_bin_ret: bad string length** *string_length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0955 **buffer_get_short: buffer error**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0956 get_socket_ipaddr: getnameinfo ***flag*** **failed**

Explanation: A call to getnameinfo() failed. *flag* is the argument of getnameinfo().

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0957 getsockname failed: *system error*

Explanation: A call to getsockname() failed with the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0958 get_remote_hostname: getnameinfo NI_NUMERICHOST failed

Explanation: A call to getnameinfo() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of argument NI_NUMERICHOST. Contact your system programmer.

FOTS0959 get_sock_port: getnameinfo NI_NUMERICSERV failed

Explanation: A call to getnameinfo() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of argument NI_NUMERICSERV. Contact your system programmer.

FOTS0960 channel *channel identifier***: wfd** *write_fd* **is not a tty?**

Explanation: The write file descriptor of the channel is not associated with a terminal.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check your command line options to see whether you need a tty. If the code sets were changed for the terminal, for example by issuing the **chcp** command, conversion may not be performed properly. If unable to resolve, contact your system programmer.

FOTS0961 X11 fake_data_len *length* **!= saved_data_len** *length*

Explanation: During X11 forwarding, fake data length is not equal to the saved data length.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0962 accept: *system error*

Explanation: A call to accept() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0963 setsockopt SO_REUSEADDR fd *file_descriptor***:** *system error*

Explanation: A call to setsockopt() failed. The system error is displayed. SO_REUSEADDR is one of the arguments of setsockopt().

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0964 accept from auth socket: *system error*

Explanation: A call to accept() failed. Authentication agent socket failed to accept the connection from the client. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0965 getsockopt SO_ERROR failed

Explanation: A call to getsockopt() failed. *SO_ERROR* is one of the arguments of getsockopt().

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0966 No forward host name.

Explanation: Port forwarding host name is NULL.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0967 Forward host name too long.

Explanation: The size of the forwarding host name is greater than 255.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to make sure that you do not specify a host name greater than 255. If unable to resolve, contact your system programmer.

FOTS0968 channel_setup_fwd_listener: getnameinfo failed

Explanation: A call to getnameinfo() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0969 setsockopt SO_REUSEADDR: *system error*

Explanation: A call to setsockopt() failed. The system error is displayed. *SO_REUSEADDR* is one of the arguments of setsockopt().

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0970 bind: *system error*

Explanation: A call to bind() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0971 listen: *system error*

Explanation: A call to listen() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0972 channel_setup_fwd_listener: cannot listen to port: *port*

Explanation: Port forwarding failed to listen to the displayed port.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0973 connect_to *hostname***: unknown host (***system error***)**

Explanation: A call to getaddrinfo() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0974 connect_next: getnameinfo failed

Explanation: A call to getnameinfo() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0975 socket: *system error*

Explanation: A call to socket() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0976 connect_to *host name* **port** *service name*: *system error*

Explanation: A call to connect() failed and the system error is displayed. *host name* and *service name* are the host name and the service location of the socket to which a connection was attempting. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0977 connect_to *host* **port** *port*: **failed.**

Explanation: Failed to connect to *host* on *port*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0978 WARNING: Server requests forwarding for unknown listen_port *listen_port*

Explanation: Internal error occurred. The displayed *listen_port* is not permitted for forwarding.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0979 getaddrinfo: *system error*

Explanation: A call to getaddrinfo() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0980 channel_setup_fwd_listener: getaddrinfo(*address***):** *error_message*

Explanation: The getaddrinfo() system call failed. The system error is displayed with the message.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0981 setsockopt IPV6_V6ONLY: *system error*

Explanation: A call to setsockopt() failed. IPV6_V6ONLY is one of the arguments of setsockopt(). The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0982 Failed to allocate internet-domain X11 display socket.

Explanation: The number of internet-domain X11 display sockets is greater than 1000.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0983 x11_request_forwarding_with_spoofing : different $DISPLAY already forwarded

Explanation: Unable to complete the X11 forwarding request because a different display has already been forwarded.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the value of your DISPLAY environment variable is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS0984 socket: *system error*

Explanation: A call to socket() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0985 connect *path_name***:** *system error*

Explanation: A call to connect() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0986 DISPLAY not set.

Explanation: Environment variable DISPLAY is not set.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to ssh in *IBM Ported Tools for z/OS: OpenSSH User's Guide* on how to set environment variable DISPLAY. If unable to resolve, contact your system programmer.

FOTS0987 Could not parse display number from DISPLAY: *display*

Explanation: A call to sscanf() failed. UNIX domain display number cannot be parsed from environment variable DISPLAY *display*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to **ssh** in *IBM Ported Tools for z/OS: OpenSSH User's Guide* on how to set environment variable DISPLAY. If unable to resolve, contact your system programmer.

FOTS0988 Could not find ':' in DISPLAY: *display*

Explanation: Did not find ':' in environment variable DISPLAY *display*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to ssh in *IBM Ported Tools for z/OS: OpenSSH User's Guide* on how to set environment variable DISPLAY. If unable to resolve, contact your system programmer.

FOTS0989 *function***: unexpected data on ctl fd**

Explanation: Unexpected data read from the control file descriptor. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS0990 *host_name***: unknown host. (***system error***)**

Explanation: A call to getaddrinfo() failed. The *host_name* is unknown. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to make sure the host name specified by the DISPLAY environment variable is valid. If unable to resolve, contact your system programmer.

FOTS0991 connect *host_name* **port** *port***:** *system error*

Explanation: A call to connect() failed. Failure occurred while attempting to connect to *host_name* on *port*. The system error is displayed.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0992 Warning: ssh server tried agent forwarding.

Explanation: The ssh configuration option ForwardAgent was disabled but ssh server requested a connection to the authentication agent.

System action: The program continues.

User response: Enable ForwardAgent option in ssh_config or on the command line.

FOTS0993 Warning: ssh server tried X11 forwarding.

Explanation: The ssh configuration option ForwardX11 was disabled but ssh server requested an X11 channel.

System action: The program continues.

User response: Enable ForwardX11 option in ssh_config or on the command line.

FOTS0994 deny_input_open: type *request type*

Explanation: Internal error. The *request type* is unsupported.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0995 Warning: this is probably a break–in attempt by a malicious server.

Explanation: Internal error or you requested to open an X11/Agent forwarding channel without enabling ForwardX11/ForwardAgent.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Enable ForwardX11 or ForwardAgent option in ssh_config or on the command line. If unable to resolve, contact your system programmer.

FOTS0996 channel_new: internal error: channels_alloc *number of allocations* **too big.**

Explanation: Internal error occurred. The number of allocated channels is greater than 10000.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0997 cannot happen: SSH_CHANNEL_LARVAL

Explanation: Channel type SSH_CHANNEL_LARVAL cannot happen with SSH Protocol 2.0

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0998 cannot happen: OUT_DRAIN

Explanation: Channel type OUT_DRAIN cannot happen with SSH Protocol 1.3

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS0999 channel_still_open: bad channel type *channel_type*

Explanation: Channel is still open with invalid channel type.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1001 evp_crypt: EVP_Cipher failed during discard

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1002 channel_find_open: bad channel type *channel_type*

Explanation: Found a channel open with invalid channel type.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1003 channel_open_message: bad channel type *channel_type*

Explanation: Channel with invalid channel type is open.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1004 channel_activate for non–larval channel *channel_id***.**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1005 channel *channel_id***: decode socks4: len** *expected length* **> have** *actual length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1006 cannot happen: istate == INPUT_WAIT_DRAIN for proto 1.3

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1007 channel_add_permitted_opens: too many forwards

Explanation: A request for forwarding an application over a new channel was denied because the internal maximum of forwarded channels has been reached.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the authorized keys file permitopen option. If unable to resolve, contact your system programmer.

FOTS1009 connect_to: F_SETFL: *system error*

Explanation: A call to fcntl() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1010 x11_request_forwarding: bad authentication data: *data*

Explanation: Internal error or your xauth program generated invalid authentication data.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check xauth program to make sure it generates valid authentication data or contact your system programmer.

FOTS1011 Warning: use of DES is strongly discouraged due to cryptographic weaknesses

Explanation: You are using cipher type DES and it is strongly discouraged due to cryptographic weaknesses.

System action: The program continues.

User response: Refer to **ssh** in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for an explanation of DES.

FOTS1012 cipher_cleanup: EVP_CIPHER_CTX_cleanup failed

Explanation: A call to OpenSSL function EVP_CIPHER_CTX_cleanup() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CIPHER_CTX_cleanup() for more information.

FOTS1013 ssh1_3des_cbc: no context

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1014 ssh_rijndael_cbc: no context

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1015 cipher_init: key length *length* **is insufficient for** *cipher type***.**

Explanation: Internal error occurred. The length of the key is insufficient for the displayed *cipher type*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1016 cipher_init: iv length *length* **is insufficient for** *cipher type*

Explanation: Internal error occurred. IV length is not sufficient for the displayed *cipher type*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1017 cipher_init: EVP_CipherInit failed for *cipher type*

Explanation: A call to OpenSSL function EVP_CipherInit() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CipherInit() for more information. If unable to resolve, contact your system programmer.

FOTS1018 cipher_init: set keylen failed (*key_length* **->** *key_length setting to***)**

Explanation: A call to OpenSSL function EVP_CIPHER_CTX_set_key_length() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CIPHER_CTX_set_key_length() for more information. If unable to resolve, contact your system programmer.

FOTS1019 cipher_init: EVP_CipherInit: set key failed for *cipher type*

Explanation: A call to OpenSSL function EVP_CipherInit() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CipherInit() for more information. If unable to resolve, contact your system programmer.

FOTS1020 cipher_encrypt: bad plaintext length *length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1021 evp_crypt: EVP_Cipher failed

Explanation: A call to OpenSSL function EVP_Cipher() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_Cipher() for more information. If unable to resolve, contact your system programmer.

FOTS1022 ssh_rijndael_cbc: bad len *length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1023 *function***: wrong iv length** *expected length* **!=** *actual length*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1024 *function***: no rijndael context**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1025 *function***: bad 3des iv length:** *length*

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1026 *function***: no 3des context**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1027 *function***: bad cipher** *cipher_type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1028 mac_compute: unknown MAC type

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1029 mac *MAC_name* **len** *MAC_length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1030 mac_compute: mac too long *MAC_length maximum_MAC_length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1031 No available ciphers found.

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1032 Bad compression level *number***.**

Explanation: You specified an invalid compression level.

System action: The program ends.

User response: Check your ssh_config file or command line to make sure you specify a valid CompressionLevel.

FOTS1033 buffer_compress: deflate returned *status*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1034 buffer_uncompress: inflate returned *status*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1035 detect_attack: bad length *number*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1036 Bad prime description in line *line_number*

Explanation: File moduli or primes contains invalid prime description in *line_number*.

System action: The program continues.

User response: Check moduli or primes to make sure prime descriptions are valid.

FOTS1037 parse_prime: BN_new failed

Explanation: A call to OpenSSL function BN_new() failed. BN_new() allocates and initializes a BIGNUM structure.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1038 *function***: BN_new failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1039 WARNING: line *line_num* **disappeared in** *file***, giving up**

Explanation: Internal error or the displayed *line_num* is missing from file primes.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check your primes file to make sure the displayed *line_num* exists. If unable to resolve, contact your system programmer.

FOTS1040 dh_gen_key: dh->p == NULL

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1041 dh_gen_key: group too small: *bits* **(2*need** *bits***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1042 dh_gen_key: BN_new failed

Explanation: A call to OpenSSL function BN_new() failed. BN_new() allocates and initializes a BIGNUM structure.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1043 dh_gen_key: BN_rand failed

Explanation: A call to OpenSSL function BN_rand() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1044 DH_generate_key

Explanation: A call to OpenSSL function DH_generate_key() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1045 dh_gen_key: too many bad keys: giving up

Explanation: Internal error. Too many invalid public keys are generated.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1046 dh_new_group_asc: DH_new

Explanation: A call to OpenSSL function DH_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1047 BN_hex2bn p

Explanation: A call to OpenSSL function BN_hex2bn() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1048 BN_hex2bn g

Explanation: A call to OpenSSL function BN_hex2bn() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1049 dh_new_group: DH_new

Explanation: A call to OpenSSL function DH_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1050 protocol error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1051 mac_init: no key

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1052 mac_compute: mac too long

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1053 ssh_msg_send: write

Explanation: Internal error. Partial data was written from the buffer into the file descriptor.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1054 add_host_to_hostfile: host_hash failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1055 ssh_msg_recv: read: header *bytes*

Explanation: Internal error. Partial data was read from the file descriptor into the buffer.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1056 ssh_msg_recv: read: bad msg_len *bytes*

Explanation: Internal error. The data received was too long.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1057 ssh_msg_recv: read: *bytes* **!= msg_len**

Explanation: Internal error. Partial data was read from the file descriptor into the buffer.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1058 add_host_to_hostfile: saving key in *file* **failed**

Explanation: Adding keys to host file failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1059 no key to look up

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1060 write_bignum: BN_bn2dec() failed

Explanation: A call to OpenSSL function BN_bn2dec() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1061 key_read: uudecode *key* **failed**

Explanation: Internal error. A call to uudecode() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1062 key_read: key_from_blob *key* **failed**

Explanation: Internal error. A call to key_from_blob() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1063 key_read: type mismatch: encoding error

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1064 key_write: failed for RSA key

Explanation: Internal error. A call to OpenSSL function BN_bn2dec() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1065 key_from_blob: cannot handle type *key_type*

Explanation: Internal error. The displayed key type is not valid.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1066 key_from_blob: remaining bytes in key blob *bytes*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1067 key_to_blob: key == NULL

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1068 key_to_blob: unsupported key type *type*

Explanation: The displayed key *type* is not valid.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1069 key_sign: illegal key type *type*

Explanation: Internal error. The displayed key *type* is not valid.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1070 key_verify: illegal key type ***type***

Explanation: The displayed key *type* is not valid.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1071 key_new: RSA_new failed

Explanation: A call to OpenSSL function RSA_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1072 key_new: BN_new failed

Explanation: A call to OpenSSL function BN_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1073 host_hash: __b64_ntop failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1074 key_new: DSA_new failed

Explanation: A call to OpenSSL function DSA_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1079 key_new: bad key type ***type***

Explanation: Internal error. The displayed key *type* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1080 key_new_private: BN_new failed

Explanation: A call to OpenSSL function BN_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1085 key_from_private: BN_copy failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1086 key_free: key is NULL

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1087 key_free: bad key type *type*

Explanation: Internal error. The displayed key *type* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1088 key_equal: bad key type *type*

Explanation: Internal error. The displayed key *type* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1089 key_fingerprint_raw: bad digest type *MAC_algorithm*

Explanation: The displayed *MAC_algorithm* is not supported.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1090 key_fingerprint_raw: bad key type *type*

Explanation: Internal error. The displayed key *type* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1091 key_fingerprint_raw: blob is null

Explanation: internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1092 key_fingerprint: null from key_fingerprint_raw()

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1093 key_fingerprint: bad digest representation *fingerprint*

Explanation: Internal error. The displayed *fingerprint* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1094 key_read: bad key type: *type*

Explanation: The key type *type* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1095 *function***: key generation failed.**

Explanation: A call to OpenSSL function RSA_generate_key() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1096 *function***: DSA_generate_parameters failed**

Explanation: A call to OpenSSL function DSA_generate_parameters() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1097 *function***: DSA_generate_key failed.**

Explanation: A call to OpenSSL function DSA_generate_key() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1098 dsa_generate_private_key: NULL.

Explanation: A call to OpenSSL function DSA_generate_key() generated a NULL private DSA key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1099 key_generate: unknown type *key_type*

Explanation: You specified an invalid key type on the command line.

System action: The program continues.

User response: Check to make sure you specify a valid key type on the command line.

FOTS1101 key_from_private: unknown type *key_type*

Explanation: The *key_type* is not valid. The error is usually caused by an invalid key type specified after option –t. This message can also be displayed for an internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to make sure you specify a valid key type after option –t. If unable to resolve, contact your system programmer.

FOTS1102 key_demote: RSA_new failed

Explanation: A call to OpenSSL function RSA_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1103 key_demote: BN_dup failed

Explanation: A call to OpenSSL function BN_dup() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1105 key_demote: DSA_new failed

Explanation: A call to OpenSSL function DSA_new() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1108 *function***: bad server modulus (len** *length***)**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1109 *function***: bad host modulus (len** *length***)**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1110 bad kex md size *MD_size*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1111 Hm, kex protocol error: type *protocol_type* **seq** *packet_id*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1112 kex_send_kexinit: no kex, cannot rekey

Explanation: The kex structure is NULL.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1113 kex_send_kexinit: kex proposal too short

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1114 kex_input_kexinit: no kex, cannot rekey

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1115 Unsupported key exchange *type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1116 no matching cipher found: client *proposal* **server** *proposal*

Explanation: Did not find the cipher that the client and the server both support.

System action: The program ends.

User response: Reissue the command with specifying the cipher that the server supports.

FOTS1117 matching cipher is not supported: *cipher*

Explanation: The *cipher* is not supported by the daemon.

System action: The program ends.

User response: Reissue the command with specifying the cipher that the server supports either in ssh_config file or on the command line.

FOTS1118 no matching mac found: client *proposal* **server** *proposal*

Explanation: Did not find the MAC that the client and the server both support.

System action: The program ends.

User response: Reissue the command with specifying the MAC that the server supports either in ssh_config file or on the command line.

FOTS1119 unsupported mac *MAC*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1120 no matching comp found: client *proposal1* **server** *proposal2*

Explanation: Did not find the Compression option that the client and the server both support.

System action: The program ends.

User response: Reissue the command specifying the Compression option that the server supports either in ssh_config file or on the command line.

FOTS1121 unsupported comp *compression*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1122 Unable to negotiate a key exchange method

Explanation: Did not find the key–exchange algorithm that the client and the server both support.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1123 bad kex alg *algorithm*

Explanation: The displayed key-exchange *algorithm* is not supported.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1124 no hostkey alg

Explanation: Did not find the key type that the client and the server both support.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1125 bad hostkey alg '*key_type*'

Explanation: The displayed *key_type* is not supported.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1129 cannot decode server_host_key_blob

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1130 type mismatch for decoded server_host_key_blob

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1131 cannot verify server_host_key

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1132 server_host_key verification failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1133 dh_server_pub == NULL

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1134 kexdh_client: BN_new failed

Explanation: Internal error. A call to OpenSSL function BN_new() failed.

System action: The program ends.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1135 key_verify failed for server_host_key

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1136 Cannot load hostkey

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1137 Unsupported hostkey type *key_type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1138 dh_client_pub == NULL

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1139 kexdh_server: BN_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1144 BN_new

Explanation: The BN_new() function failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1146 DH_GEX group out of range: *min* **!<** *num_bits* **!<** *max*

Explanation: The big number returned by BN_new is malformed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1147 cannot decode server_host_key_blob

Explanation: Unable to decode the server host key blob.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1148 type mismatch for decoded server_host_key_blob

Explanation: The key received from the server is not the proper type.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1149 cannot verify server_host_key

Explanation: Unable to verify the server host key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the public key for the remote host is accurate. Contact the system programmer of the server for further assistance.

FOTS1150 server_host_key verification failed

Explanation: Server host key verification failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the public key for the remote host is accurate. Contact the system programmer of the server for further assistance.

FOTS1151 dh_server_pub == NULL

Explanation: The value of dh_server_pub generated by BN_new is NULL.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1152 kexgex_client: BN_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1153 key_verify failed for server_host_key

Explanation: The key_verify() function failed for the given server_host_key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the public key for the remote host is accurate. Contact the system programmer of the server for further assistance.

FOTS1154 Cannot load hostkey

Explanation: Unable to load the host key.

System action: The program ends.

System programmer response: Verify host key file. If problem cannot be resolved follow local procedures for reporting problems to IBM.

User response: Verify that the host key exists on your system or contact the system programmer for further assistance.

FOTS1155 Unsupported hostkey type *keytype*

Explanation: The type of host key specified is not supported.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1156 protocol error during kex, no DH_GEX_REQUEST: *type*

Explanation: Packet received does not match recognized request types.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and ssh server status. If problem persists contact your system programmer to report the problem.

FOTS1157 DH_GEX_REQUEST, bad parameters: *min* **!<** *num_bits* **!<** *max*

Explanation: The number of bits received in a server packet is incorrect.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and ssh server status. If problem persists contact your system programmer to report the problem.

FOTS1158 dh_client_pub == NULL

Explanation: BN_new() function call returned NULL.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1159 kexgex_server: BN_new failed

Explanation: BN_new() function call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1165 fatal_remove_cleanup: no such cleanup function: 0x*proc* **0x***context*

Explanation: Cleanup error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1168 Unrecognized internal syslog level code *level*

Explanation: Invalid syslog level specified. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1169 Unrecognized internal syslog facility code *facility*

Explanation: Invalid syslog facility specified. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1171 fcntl(*fd***, F_GETFL, 0):** *error_code*

Explanation: fcnt() system call failed.

System action: Command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1173 getsockopt TCP_NODELAY: *error_code*

Explanation: getsockopt() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1174 setsockopt TCP_NODELAY: *error_code*

Explanation: setsockopt() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1175 Warning: identity keysize mismatch: actual *keysize1***, announced** *keysize2*

Explanation: The agent's RSA identity contains a keysize mismatch.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the agent's RSA identity is valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS1176 Compatibility with ssh protocol version 1.0 no longer supported.

Explanation: RSA authentication challenge not supported with SSH protocol version 1.0.

System action: The program continues.

User response: Use a newer version of SSH protocol version 1, and try the request again.

FOTS1177 Agent admitted failure to authenticate using the key.

Explanation: The agent failed the RSA authentication challenge.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the agent's RSA identity is valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS1178 Agent admitted failure to sign using the key.

Explanation: The agent failed to generate a signature using a key.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the agent's identities are valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS1179 SSH_AGENT_FAILURE

Explanation: The agent indicated a failure to handle a request.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the agent's identities, connection, and request are valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS1180 parse_tty_modes: unknown opcode *opcode*

Explanation: The tty mode opcode *opcode* is undefined.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify the tty mode opcode, and try the request again. If unable to resolve, contact your system programmer.

FOTS1181 parse_tty_modes: n_bytes_ptr != n_bytes: *bytes1 bytes2*

Explanation: The tty mode packet contained the incorrect number of bytes.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS1182 Value "*value***" not valid for environment variable** *environment_variable*

Explanation: The value *value* for environment variable *environment_variable* is not valid.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid environment variable values, and try the request again. If unable to resolve, contact your system programmer.

FOTS1183 Couldn't open /dev/null: *error_message*

Explanation: The open() system call failed to open /dev/null. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1184 dup2: *error_message*

Explanation: The dup2() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1185 *function***: out of memory (allocating** *size* **bytes)**

Explanation: Unable to allocate requested number of bytes. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1186 Finished discarding for *ip_address*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1187 Bad packet length *packet_length***.**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1188 padding error: need *needed_size* **block** *block_size* **mod** *modulus*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1189 Corrupted MAC on input.

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1190 internal error need *needed_size*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1237 Could not create directory *dirname***:** *error_message*

Explanation: The directory *dirname* could not be created. A call to mkdir() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Make sure you have appropriate authority to create the directory. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error If unable to resolve, contact your system programmer.

FOTS1238 Could not request local forwarding.

Explanation: A local forwarding request has failed.

System action: The program continues.

System programmer response: Take appropriate action based on the error messages displayed with this message. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Check for additional error messages displayed with this message, and take appropriate action. If unable to resolve, contact your system programmer.

FOTS1239 setrlimit failed: *system error*

Explanation: A call to setrlimit() failed while attempting to set RLIMT_CORE to zero. The system error is displayed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1240 Too many identity files specified (max *max*)

Explanation: The maximum number of authentication identity files and key ring certificates (*max*) that can be specified in configuration files or the command line has been exceeded.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Reissue the command with a smaller number of identity files or key ring certificates.

FOTS1241 Too high debugging level.

Explanation: For **ssh**, the -v (verbose) option was specified too many times. For **sshd**, the -d (debug) option was specified too many times.

System action: The program ends.

User response: Reissue the command with less instances of -v (or -d) specified.

FOTS1242 Cannot fork into background without a command to execute.

Explanation: The **ssh** -f option was specified without a command to execute.

System action: The program ends.

User response: Reissue **ssh** with a command or without the -f option.

FOTS1243 Can't open user config file *filename*: *system error*

Explanation: ssh was unable to open the user configuration file *filename*. The system error is displayed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1244 Compression level must be from 1 (fast) to 9 (slow, best).

Explanation: An invalid compression level was specified.

System action: The program ends.

User response: Reissue the command with an appropriate compression level.

FOTS1245 daemon() failed: *system error*

Explanation: Either a call to fork() or setsid() failed while ssh was attempting to continue running in the background. The system error is displayed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1246 Request for subsystem '*command*' failed on channel *channel*

Explanation: The ssh daemon rejected the client's request for subsystem *command* on channel *channel*.

System action: The program ends.

System programmer response: Verify sshd is configured to use the subsystem.

User response: Verify sshd is configured to use the subsystem or contact your system programmer.

FOTS1247 dup() in/out/err failed: *system error*

Explanation: A call to dup() for stdin, stdout or stderr failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1248 No support for forwarding GSSAPI credentials.

Explanation: ssh on z/OS does not provide support for forwarding GSS-API credentials.

System action: The program continues.

System programmer response: None.

User response: Issue the command without the options to enable or disable forwarding GSS-API credentials (-k or -K for ssh).

FOTS1252 The SSH client cannot be run under OMVS.

Explanation: The SSH client cannot be run under OMVS (a 3270 session) due to password visibility issues.

System action: The program ends.

System programmer response: Not applicable

User response: Reissue the command from a non-OMVS environment, for example, a TCP/IP session.

FOTS1254 *function* **listen():** *error_message*

Explanation: The listen() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1255 load_public_identity_files: getpwuid failed

Explanation: The getpwuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1256 load_public_identity_files: gethostname: *error_message*

Explanation: The gethostname() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1257 env_permitted: name '*environment_variable...*' too long

Explanation: The environment variable name *environment_variable...* is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that your environment variable names do not exceed 1023 bytes, and try the request again. If unable to resolve, contact your system programmer.

FOTS1258 Control socket connect(*control_path*): *error_message*

Explanation: The connect() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1259 open(/dev/null): *error_message*

Explanation: The open() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1260 dup2: *error_message*

Explanation: The dup2() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1261 *function***: msg_send**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1262 *function***: msg_recv**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1263 *function***: wrong version**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1264 **Connection to master denied**

Explanation: The master process denied access to its shared connection.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the control path is valid and that the master process permits access to its shared connection, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config ControlPath and ControlMaster keywords. If unable to resolve, contact your system programmer.

FOTS1265 **silly mux_command** *command_value*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1266 *function***: send fds failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1267 *function***: read** *error_message*

Explanation: The read() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1268 *function***: master returned too much data (***actual_data_length* **>** *expected_data_length***)**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1272 Control socket connect(*control_path*): *error_message*

Explanation: The connect() system call failed. The system error is displayed with the message.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1273 Warning: Identity file *filename* **not accessible:** *error_message***.**

Explanation: The **ssh** –i option is set to a file that is not accessible. The system error is displayed with the message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the value for the **ssh** –i option is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –i option. If unable to resolve, contact your system programmer.

FOTS1274 Bad local forwarding specification '*value***'**

Explanation: The **ssh** –L option is set to a bad value *value*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the value for the **ssh** –L option is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –L option. If unable to resolve, contact your system programmer.

FOTS1275 Bad remote forwarding specification '*value***'**

Explanation: The **ssh** –R option is set to a bad value *value*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the value for the **ssh** –R option is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –R option. If unable to resolve, contact your system programmer.

FOTS1276 Invalid multiplex command.

Explanation: The **ssh** –O option is set to an unsupported value.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the value for the **ssh** –O option is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –O option. If unable to resolve, contact your system programmer.

FOTS1277 gethostname: *error_message*

Explanation: The gethostname() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1278 No ControlPath specified for "–O" command

Explanation: The **ssh** –O option was specified, but no control path was set via the **ssh** –S option or the ssh_config ControlPath keyword.

System action: The program ends.

User response: Verify that a control path is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** options and the ssh_config keywords.

FOTS1279 Could not request local forwarding.

Explanation: A local forwarding request has failed.

System action: The program ends.

System programmer response: Take appropriate action based on the error messages displayed with this message. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Check for additional error messages displayed with this message, and take appropriate action. If unable to resolve, contact your system programmer.

FOTS1280 Could not request remote forwarding.

Explanation: A remote forwarding request has failed.

System action: The program ends.

System programmer response: Take appropriate action based on the error messages displayed with this message. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Check for additional error messages displayed with this message, and take appropriate action. If unable to resolve, contact your system programmer.

FOTS1282 Bad dynamic forwarding specification '*value*'

Explanation: The **ssh** –D option is set to a bad value *value*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the value for the **ssh** –D option is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –D option. If unable to resolve, contact your system programmer.

FOTS1283 Master running (pid=*pid*)

Explanation: The master process of the specified multiplexed connection is running. Its process id is *pid*.

System action: The program ends.

User response: No response required. This message reports information on a multiplexed connection.

FOTS1284 Exit request sent.

Explanation: An exit request was sent to the master process of the specified multiplexed connection.

System action: The program ends.

User response: No response required. This message reports information on a multiplexed connection.

FOTS1285 Shared connection to *host_name* closed.

Explanation: The shared connection to the master process of the specified multiplexed connection on host *host_name* has been closed.

System action: The program ends.

User response: No response required. This message reports information on a multiplexed connection.

FOTS1287 Warning: Identity file *filename* does not exist.

Explanation: The filename specified with the ssh -i option does not exist.

System action: The program continues.

User response: Verify that the filename specified is correct and exists.

FOTS1288 no support for smartcards.

Explanation: ssh on z/OS does not provide support for smart cards.

System action: The program continues.

System programmer response: None.

User response: Reissue the command without the smart card option (-I for ssh).

FOTS1289 No support for Kerberos ticket or AFS token forwarding.

Explanation: ssh on z/OS does not provide support for Kerberos tickets or AFS tokens.

System action: The program continues.

System programmer response: None.

User response: Reissue the command without the option to disable Kerberos ticket and AFS token forwarding (-k for ssh).

FOTS1290 Bad escape character '*escape char*'.

Explanation: You specified an invalid escape character.

System action: The program ends.

System programmer response: None.

User response: An escape character can be either a single character or a control character. Reissue the command with a valid escape character.

FOTS1291 Unknown cipher type '*cipher_spec*'

Explanation: ssh does not recognize the cipher specified with the -c option.

System action: The program ends.

System programmer response: None.

User response: Check ssh documentation for a valid cipher specification.

FOTS1292 Unknown mac type '*mac_spec*'

Explanation: ssh does not recognize the message authentication code specified with the -m option.

System action: The program ends.

System programmer response: None.

User response: Check ssh documentation for a valid MAC specification.

FOTS1293 Bad port '*port*'

Explanation: The port number specified is invalid. It should be greater than zero and less than or equal to 65535.

System action: The program ends.

System programmer response: None.

User response: Reissue **ssh** with a valid port number.

FOTS1294 Bad forwarding port(s) '*port*'

Explanation: One of the port numbers specified with ssh options -R or -L are invalid. A port number should be greater than zero and less than or equal to 65535.

System action: The program ends.

System programmer response: None.

User response: Reissue **ssh** with valid port numbers.

FOTS1295 Bad forwarding specification '*specification*'

Explanation: The syntax of specification is incorrect.

System action: If the forwarding specification was issued through an opened command line (through an escape character), the program continues. Otherwise, the program ends.

System programmer response: None.

User response: Check ssh documentation for the proper syntax.

FOTS1296 Bad dynamic port '*port*'

Explanation: The port number specified is invalid. It should be greater than zero and less than or equal to 65535.

System action: The program ends.

System programmer response: None.

User response: Reissue **ssh** with a valid port number.

FOTS1297 You must specify a subsystem to invoke.

Explanation: You specified **ssh** -s without a subsystem.

System action: The program ends.

User response: Reissue **ssh** -s with a subsystem as the command.

FOTS1298 rresvport: af=*family system error*

Explanation: An error occurred while ssh was attempting to connect to a privileged port (because configuration option UsePrivilegedPort was specified). A call to bind(), socket(), or getsockname() may have failed, or the address family *family* is not supported. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check that ssh is setuid root. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1299 **socket:** *system error*

Explanation: A call to socket() failed. The system error is displayed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1301 **getaddrinfo:** *bindaddress***:** *system error*

Explanation: The ssh client failed when trying to get the address information for the interface specified by ssh configuration option BindAddress. The system error is displayed with this message.

System action: The program continues.

User response: Verify *bindaddress* is valid.

FOTS1302 **bind:** *bindaddress***:** *system error*

Explanation: A call to bind() failed with the *bind address* specified by ssh configuration option BindAddress.

System action: The program continues.

User response: Verify *bindaddress* is valid.

FOTS1303 **ssh_connect: getnameinfo failed**

Explanation: ssh was unable to get the name information from an IP address.

System action: The program continues.

User response: Check that all the specified addresses for the host are valid.

FOTS1304 **setsockopt SO_KEEPALIVE:** *system error*

Explanation: The KeepAlive configuration option was specified but the setsockopt() system call for SO_KEEPALIVE failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1305 **No** *key type* **host key is known for** *hostname* **and you have requested strict checking.**

Explanation: While ssh is checking if a host key is valid, it could not find a key for *hostname*.

System action: The program ends.

System programmer response: None.

User response: Check that the file containing the list of known hosts exists. Check that the key for the desired host is in the known hosts file.

FOTS1306 **Keyboard-interactive authentication is disabled to avoid man-in-the-middle attacks.**

Explanation: Strict host key checking has been requested, so keyboard-interactive authentication has been disabled to prevent man-in-the-middle attacks. Challenge-response authentication is also disabled.

System action: The program continues.

User response: Check that the host key in the user's known hosts file is valid.

FOTS1307 Challenge/response authentication is disabled to avoid man-in-the-middle attacks.

Explanation: Strict host key checking has been requested, so challenge-response authentication has been disabled to prevent man-in-the-middle attacks.

System action: The program continues.

User response: Check that the host key in the user's known hosts file is valid.

FOTS1308 @ WARNING: POSSIBLE DNS SPOOFING DETECTED! @ The *type* **host key for** *hostname* **has changed, and the key for the according IP address** *ip address problem***. This could either mean that DNS SPOOFING is happening or the IP address for the host and its host key have changed at the same time.**

Explanation: See message text.

System action: The program continues unless strict host key checking is enabled.

User response: Check whether the host key is accurate.

FOTS1314 Offending key for IP in *filename***:***line_number*

Explanation: The key found on line *line_number* of file *filename* is not valid. The host's public key may have changed.

System action: The program continues unless strict host key checking is enabled.

User response: Check the specified line number and file for a valid host key.

FOTS1315 Update the SSHFP RR in DNS with the new host key to get rid of this message.

Explanation: The SSH fingerprint resource record in DNS does not have the proper data for the host key.

System action: The program continues.

System programmer response: Update the DNS server to correct the problem.

User response: Contact your system administrator to fix the resource record.

FOTS1316 Bogus return (*return code***) from select()**

Explanation: A call to select() failed with return code *return code*.

System action: The program ends.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1317 @ WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED! @ IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY! Someone could be eavesdropping on you right now (man–in–the–middle attack)! It is also possible that the *keytype* **host key has just been changed. The fingerprint for the** *keytype* **key sent by the remote host is** *fingerprint***. Please contact your system administrator. Add correct host key in** *userhostfile* **to get rid of this message. Offending key in** *hostfile***:***line_number*

Explanation: ssh has detected that the remote host key has changed.

System action: The program continues unless strict host key checking is enabled.

User response: Check that you have a valid host key for the remote host.

FOTS1325 *key type* **host key for** *host name* **has changed and you have requested strict checking.**

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) is enabled which causes ssh to exit if the host key has changed.

System action: The program ends.

System programmer response: None.

User response: Edit the key in your user known hosts file.

FOTS1326 Password authentication is disabled to avoid man–in–the–middle attacks.

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) has not been requested, so the connection is allowed, but password authentication is disabled.

System action: The program continues.

System programmer response: None.

User response: Check that the host key in the user's known hosts file is valid.

FOTS1327 Agent forwarding is disabled to avoid man-in-the-middle attacks.

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) has not been requested, so the connection is allowed, but agent forwarding is disabled.

System action: The program continues.

System programmer response: None.

User response: Check that the host key in the user's known hosts file is valid.

FOTS1328 X11 forwarding is disabled to avoid man-in-the-middle attacks.

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) has not been requested, so the connection is allowed, but X11 forwarding is disabled.

System action: The program continues.

System programmer response: None.

User response: Check that the host key in the user's known hosts file is valid.

FOTS1329 Port forwarding is disabled to avoid man-in-the-middle attacks.

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) has not been requested, so the connection is allowed, but port forwarding is disabled.

System action: The program continues.

System programmer response: None

User response: Check that the host key in the user's known hosts file is valid.

FOTS1330 Exiting, you have requested strict checking.

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) has been requested, CheckHostIp was enabled, and the host name is not known.

System action: The program ends.

System programmer response: None.

User response: Make sure the host key for the remote host is in the user's known hosts file.

FOTS1331 dup2 stdin

Explanation: A call to dup2() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1332 dup2 stdout

Explanation: A call to dup2() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1333 *shell_path* **:** *message*

Explanation: A call to execv() failed to execute *shell_path*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1334 Could not create pipes to communicate with the proxy: *system error*

Explanation: A call to pipe() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1335 fork failed: *error_message*

Explanation: The fork() system call failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1336 *program name***: Could not resolve hostname** *host***:** *system error*

Explanation: The ssh client failed when trying to get the address information for *host* The system error is displayed with this message.

System action: The program ends.

User response: Verify *host* is valid.

FOTS1337 ssh_exchange_identification: read: *system error*

Explanation: ssh was unable to read the other side of the connection's identification information. A read() on the socket failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1338 ssh_exchange_identification: Connection closed by remote host

Explanation: While attempting to read the other side of the connection's version identification, the connection was closed by the remote host.

System action: The program ends.

User response: Verify that the remote host is still operable. Verify that the remote host has an implementation of SSH which is compatible with OpenSSH.

FOTS1339 Bad remote protocol version identification: '*server version string*'

Explanation: The OpenSSH version of the server does not match the version of the client.

System action: The program ends.

System programmer response: None.

User response: Check that the local and remote versions of OpenSSH are compatible.

FOTS1340 Remote machine has too old SSH software version.

Explanation: The remote sshd minor version is less than 3.

System action: The program ends.

User response: Verify local OpenSSH suite is compatible with remote version.

FOTS1341 Protocol major versions differ: *localprotocol* **vs.** *remoteprotocol*

Explanation: The ssh client requested using SSH Protocol Version *localprotocol*, but the remote server requires *remoteprotocol*.

System action: The program ends.

User response: Reissue **ssh** using the protocol that the server expects, or contact system administrator of remote machine.

FOTS1342 write: *system error*

Explanation: A call to write() failed for the outgoing socket. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1343 check_host_key: getnameinfo failed

Explanation: ssh was unable to get the name information for the current host.

System action: The program ends.

User response: Check that all the specified addresses for the host are valid.

FOTS1344 internal error

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1345 Bad passphrase.

Explanation: During RSA authentication for protocol version 1, the given passphrase is invalid for the current RSA key.

System action: The program continues.

User response: Verify you entered the correct passphrase.

FOTS1346 Permission denied, please try again.

Explanation: You do not have permission to log into the system.

System action: The program continues.

User response: Contact system administrator for the system in which you are refused access.

FOTS1348 try_agent_authentication: BN_new failed

Explanation: The ssh client tried to authenticate using the ssh-agent. A call to the OpenSSL function BN_new() failed. BN_new() allocates and initializes a BIGNUM structure. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1349 try_rsa_authentication: BN_new failed

Explanation: The ssh client tried to authenticate using RSA authentication. A call to the OpenSSL function BN_new() failed. BN_new() allocates and initializes a BIGNUM structure. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1350 try_rhosts_rsa_authentication: BN_new failed

Explanation: The ssh client tried to authenticate using combined rhosts or /etc/hosts.equiv authentication and RSA authentication. A call to the OpenSSL function BN_new() failed. BN_new() allocates and initializes a BIGNUM structure. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1351 Kerberos v4: Malformed response from server

Explanation: The ssh client got an invalid response from the server.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify Kerberos is configured properly. If unable to resolve, contact your system programmer.

FOTS1352 Host key verification failed.

Explanation: During SSH key exchange, ssh was unable to verify the host key.

System action: The program continues.

User response: Verify your list of known hosts is accurate. Check if the remote host changed their host key.

FOTS1353 ssh_kex: BN_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1354 respond_to_rsa_challenge: host_key *hostbits* **< server_key** *serverbits* **+ SSH_KEY_BITS_RESERVED** *bits*

Explanation: SSH Protocol Version 1 key exchange failed because the difference between the number of bits in the host's public key and the number of bits of the server key was not greater than *bits*. The host key length and server key length need to differ by at least *bits* bits.

System action: The program ends.

User response: Try a different authentication method.

FOTS1355 respond_to_rsa_challenge: server_key *serverbits* **< host_key** *hostbits* **+ SSH_KEY_BITS_RESERVED** *bits*

Explanation: SSH Protocol Version 1 key exchange failed because the difference between the number of bits in the host's public key and the number of bits of the server key was not greater than *bits*. The host key length and server key length need to differ by at least *bits* bits.

System action: The program ends.

User response: Try a different authentication method.

FOTS1356 Selected cipher type *cipher* **not supported by server.**

Explanation: The cipher *cipher* is not supported by the remote sshd. Note that cipher "des" is not supported by IBM z/OS sshd.

System action: The program ends.

User response: Reissue **ssh** client with a remotely-supported cipher.

FOTS1357 ssh_userauth1: server supports no auth methods

Explanation: The server doesn't support any authentication methods for SSH Protocol Version 1.

System action: The program ends.

User response: Try using Protocol Version 2.

FOTS1358 Permission denied.

Explanation: All authentication methods have failed.

System action: The program ends.

User response: Verify your setup is correct.

FOTS1359 input_userauth_pk_ok: type mismatch for decoded key (received *keytype*, **expected** *keytype2***)**

Explanation: The key from across the network claimed to be a key of type *keytype2*, but the decoded key was actually key type *keytype*.

System action: The program continues.

User response: Check that your public key on the remote host is correct.

FOTS1361 ssh_keysign: no installed: *system error*

Explanation: Could not stat() /usr/lib/ssh/ssh-keysign.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1362 ssh_keysign: fflush: *system error*

Explanation: A call to fflush() failed for stdout. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1363 ssh_keysign: pipe: *system error*

Explanation: A call to pipe() failed for stdout. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1364 ssh_keysign: couldn't send request

Explanation: The ssh client could not successfully send a message to ssh-keysign.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that ssh-keysign exists. Verify your setup is correct. If unable to resolve, contact your system programmer.

FOTS1365 ssh_keysign: fork: *system error*

Explanation: A call to fork() failed for stdout. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1366 ssh_keysign: no reply

Explanation: The ssh client did not receive a response from ssh-keysign.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that ssh-keysign exists. Verify your setup is correct. If unable to resolve, contact your system programmer.

FOTS1367 ssh_keysign: bad version

Explanation: The version of ssh-keysign does not match that of the ssh client.

System action: The program continues.

System programmer response: Verify that the ssh-keysign and ssh clients installed are those provided by IBM. Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1368 userauth_hostbased: cannot get local ipaddr/name

Explanation: During hostbased authentication, ssh could not find a name for the local host.

System action: The program continues.

System programmer response: Verify that the DNS setup on the local system is correct. Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1369 key_sign failed

Explanation: The ssh client was unable to authenticate using RSA-based host authentication because ssh-keysign failed.

System action: The program continues.

System programmer response: Verify that ssh-keysign exists. Verify that the setup is correct. Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1370 Host key verification failed.

Explanation: The ssh client was unable to authenticate using hostbased authentication because it could not verify the host key.

System action: The program ends.

System programmer response: Verify that the SSH setup is correct. Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1371 denied SSH2_MSG_SERVICE_ACCEPT: *type*

Explanation: During user authentication, ssh expected a packet of type SSH2_MSG_SERVICE_ACCEPT but instead received one of type *type*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the remote server is working properly. If unable to resolve, contact your system programmer.

FOTS1372 ssh_userauth2: internal error: cannot send userauth none request

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1373 Permission denied (*authentication_list*).

Explanation: You were refused access to the system after all the authentication methods in *authentication_list* were attempted.

System action: The program ends.

System programmer response: None.

User response: Verify you typed your password and/or passphrase correctly. Verify with remote system security administrator whether or not they intended you have access. Your user may be listed as part of DenyUsers or DenyGroups on the remote server.

FOTS1374 input_userauth_error: bad message during authentication: type *type*

Explanation: During user authentication, ssh received a packet type it did not expect.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1375 input_userauth_success: no authentication context

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1376 input_userauth_failure: no authentication context

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1377 input_userauth_pk_ok: no authentication context

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1378 input_userauth_passwd_changereq: no authentication context

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1379 userauth_pubkey: internal error

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1380 input_userauth_info_req: no authentication context

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1381 ssh_keysign: dup2: *system error*

Explanation: A call to dup2() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1382 Server denied authentication request: *type*

Explanation: During user authentication, ssh expected a packet of type SSH2_MSG_SERVICE_ACCEPT but instead received one of type *type*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the remote server is working properly. If unable to resolve, contact your system programmer.

FOTS1383 ssh_keysign: exec(*keysignpath***):** *system error*

Explanation: A call to exec() failed when trying to execute ssh-keysign.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1385 tcsetattr

Explanation: A call to tcsetattr() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1386 tcgetattr

Explanation: A call to tcgetattr() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1388 *filename***: line** *line number***: Bad configuration option:** *configuration option*

Explanation: An option specified in an ssh configuration file is invalid.

System action: The program ends.

System programmer response: None.

User response: Check *line number* of the ssh configuration file *filename* for the invalid option.

FOTS1389 **Privileged ports can only be forwarded by root.**

Explanation: While ssh was attempting to add a locally forwarded port, the port number specified is privileged but the user isn't authorized to use a privileged port.

System action: The program ends.

System programmer response: None.

User response: Reissue the ssh command with a valid port (either in ssh configuration file or on command line.)

FOTS1390 **Too many local forwards (max** *max forwards***).**

Explanation: The user attempted to specify more local forwards than are allowed by ssh. ssh currently allows *max forwards*.

System action: The program ends.

System programmer response: None.

User response: Reissue **ssh** without a locally forwarded port.

FOTS1391 **Too many remote forwards (max** *max_forwards***).**

Explanation: The user attempted to specify more remote forwards than are allowed by ssh. ssh currently allows a maximum of *max_forwards*.

System action: The program ends.

System programmer response: None.

User response: Reissue **ssh** without a remotely forwarded port.

FOTS1392 *filename* **line** *line number***: Missing yes/no argument.**

Explanation: While parsing the configuration file *filename*, ssh expected a yes/no argument but it is missing.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1393 *filename* **line** *line number***: Bad yes/no argument.**

Explanation: While parsing the configuration file *filename*, ssh expected a yes/no argument but instead encountered a syntax error.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1394 *filename* **line** *line number***: Missing yes/no/ask argument.**

Explanation: While parsing the configuration file *filename*, ssh expected a yes/no/ask argument with the StrictHostKeyChecking option, but it is missing.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1395 *filename* **line** *line number***: Bad yes/no/ask argument.**

Explanation: While parsing the configuration file *filename*, ssh expected a yes/no/ask argument with the StrictHostKeyChecking option, but instead encountered a syntax error.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1396 *filename* **line** *line_number***: Missing argument.**

Explanation: A ssh_config keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that a value for the ssh_config keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config keywords. If unable to resolve, contact your system programmer.

FOTS1397 *filename* **line** *line number***: Too many identity files specified (max** *max***).**

Explanation: The maximum number of authentication identity files and key ring certificates (*max*) that can be specified in configuration files or command line has been exceeded.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Reissue the command with a smaller number of identity files or key ring certificates. Check the number of times the IdentityFile or IdentityKeyRingLabel configuration options were specified in the configuration files.

FOTS1398 *filename* **line** *line number***: missing time value.**

Explanation: The ssh configuration file *filename* or command line has a configuration option which expects a time value, but the corresponding time value is missing. Options which expect time values include ConnectTimeout.

System action: The program ends.

User response: Check *line number* of the ssh configuration file *filename* for the failing option, add a time value and reissue ssh.

FOTS1399 *filename* **line** *line number***: invalid time value.**

Explanation: The ssh configuration file *filename* has a configuration option which expects a time value, but the corresponding time value is invalid. Options which expect time values include ConnectTimeout.

System action: The program ends.

User response: Check *line number* of the ssh configuration file *filename* for the failing option, correct the time value and reissue **sshd**.

FOTS1401 *filename* **line** *line number***: Bad number "***number***"**

Explanation: While parsing *filename*, ssh encountered an invalid number.

- With option NumberOfPasswordPrompts or ConnectionAttempts, *number* must be an integer between 0 and 2147483647(LONG_MAX).
- With option CompressionLevel, *number* must be an integer between 1 and 9.
- With option Port, *number* must be an integer between 1 and 65535(USHRT_MAX).

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure number is valid. Contact your system administrator if the configuration file is global.

FOTS1404 *filename* **line** *line number***: Bad cipher '***cipher***'.**

Explanation: While parsing *filename*, ssh encountered an invalid *cipher* after the Cipher option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure the cipher is valid. Contact your system administrator if the configuration file is global.

FOTS1405 **Unsupported AddressFamily "***argument***"**

Explanation: The argument supplied with the ssh configuration option AddressFamily is invalid. Valid arguments include "inet", "inet6", or "any".

System action: The program ends.

User response: Reissue the command with a valid value for AddressFamily.

FOTS1406 *filename* **line** *line number***: Bad SSH2 cipher spec '***ciphers***'.**

Explanation: While parsing *filename*, ssh encountered invalid *ciphers* after the Ciphers option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure ciphers are valid. Contact your system administrator if the configuration file is global.

FOTS1407 *filename* **line** *line number***: Unsupported option "***keyword***"**

Explanation: The ssh configuration option *keyword* is not supported.

System action: The program continues.

User response: Remove the unsupported option from the specified line in the ssh configuration file *filename*.

FOTS1408 *filename* **line** *line number***: Bad SSH2 Mac spec '***MAC algorithms***'.**

Explanation: While parsing *filename*, ssh encountered invalid *MAC algorithms* after the MACs option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure the *MAC algorithms* are valid. Contact your system administrator if the configuration file is global.

FOTS1410 *filename* **line** *line number***: Bad protocol 2 host key algorithms '***algorithms***'.**

Explanation: While parsing *filename*, ssh encountered invalid protocol 2 host key algorithms after the HostKeyAlgorithms option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure the protocol 2 host key *algorithms* are valid. Contact your system administrator if the configuration file is global.

FOTS1412 *filename* **line** *line number***: Bad protocol spec '***protocol***'.**

Explanation: While parsing *filename*, ssh encountered an invalid *protocol* version after the Protocol option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid protocol version. Contact your system administrator if the configuration file is global.

FOTS1413 *filename* **line** *line number***: unsupported log level '***level***'**

Explanation: While parsing *filename*, ssh encountered an invalid log *level* after the LogLevel option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid log level. Contact your system administrator if the configuration file is global.

FOTS1414 *filename* **line** *line number***: Missing port argument.**

Explanation: While parsing *filename*, ssh encountered a syntax error for a configuration option. The configuration option requires an argument after the keyword.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1415 *filename* **line** *lineno***: Bad listen port.**

Explanation: While parsing *filename*, ssh encountered an invalid argument for either the LocalForward or RemoteForward configuration option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid argument for the configuration option in error. Contact your system administrator if the configuration file is global.

FOTS1416 *filename* **line** *lineno***: Missing target argument.**

Explanation: While parsing *filename*, the target argument for either the LocalForward or RemoteForward configuration option is missing.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid argument for the configuration option in error. Contact your system administrator if the configuration file is global.

FOTS1417 *filename* **line** *lineno***: Bad forwarding specification.**

Explanation: While parsing *filename*, ssh encountered an invalid argument for either the LocalForward, RemoteForward or DynamicForward configuration option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid argument for the configuration option in error. Contact your system administrator if the configuration file is global.

FOTS1418 *filename* **line** *lineno***: Bad forwarding port.**

Explanation: One of the port numbers specified with ssh configuration options LocalForward or RemoteForward is invalid. A port number should be greater than zero and less than or equal to 65535.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid argument for the configuration option in error. Contact your system administrator if the configuration file is global.

FOTS1420 *filename* **line** *lineno***: Badly formatted port number.**

Explanation: While parsing *filename*, ssh encountered an invalid argument for the DynamicForward configuration option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file to make sure you have a valid argument for the configuration option in error. Contact your system administrator if the configuration file is global.

FOTS1422 *filename* **line** *line number***: Bad escape character.**

Explanation: You specified an invalid escape character in the ssh configuration file.

System action: The program ends.

System programmer response: None

User response: An escape character can be either a single character or a control character. Reissue the command with a valid escape character.

FOTS1423 **process_config_line: Unimplemented opcode** *opcode*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS1424 *filename* **line** *line number***: garbage at end of line; "***text***".**

Explanation: The extra text *text* was found after a configuration option. Please check the specified filename.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1425 *filename*: **terminating,** *options* **bad configuration options**

Explanation: ssh has encountered at least one invalid configuration option.

System action: The program ends.

System programmer response: Check the specified line number in the file for syntax errors.

User response: Check the specified filename for syntax errors. Contact your system administrator if the configuration file is global.

FOTS1426 **fork:** *system error*

Explanation: A call to fork() failed. The system error is displayed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1427 **client_channel_closed: id** *id1* **!= session_ident** *id2*

Explanation: The ssh client is closing a channel with *id1* but the current session id is *id2*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1428 **Write failed flushing stdout buffer.**

Explanation: A call to write() failed when attempting to write to stdout.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1429 **Write failed flushing stderr buffer.**

Explanation: A call to write() failed when attempting to write to stderr.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1430 **Warning: ssh server tried X11 forwarding.**

Explanation: The ssh configuration option ForwardX11 was disabled but the server requested an X11 channel.

System action: The program continues.

System programmer response: Follow local procedures for handling security problems.

User response: Contact your system programmer.

FOTS1431 **Warning: this is probably a break–in attempt by a malicious server.**

Explanation: The ssh client detected the server attempting to bypass some ssh setup. This error message is usually displayed with another message describing what ssh sees in error.

System action: The program continues.

System programmer response: Follow local procedures for handling security problems.

User response: Contact your system programmer.

FOTS1432 Warning: ssh server tried agent forwarding.

Explanation: The ssh configuration option ForwardAgent was disabled but the server requested an X11 channel.

System action: The program continues.

System programmer response: Follow local procedures for handling security problems.

User response: Contact your system programmer.

FOTS1434 client_input_channel_req: no channel *session channel identifier*

Explanation: The server wanted to request a new channel, but no session channel exists for the client.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1435 client_input_channel_req: channel *session channel identifier***: wrong channel:** *requested channel*

Explanation: The server wanted to request a new channel, but the channel requested by the server doesn't match that of the client's session.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1436 client_input_channel_req: channel *requested channel***: unknown channel**

Explanation: The channel identifier sent by the server is not recognized by the client.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1437 Killed by signal *signal number***.**

Explanation: The ssh client was killed by signal *signal number*.

System action: The program ends.

System programmer response: None.

User response: Determine what caused a signal to be sent to your process.

FOTS1438 Could not load host key: *host key file*

Explanation: The file *host key file* could not be loaded. The file may not exist or is not readable. The permissions on the file may be incorrect. The passphrase may have been entered incorrectly.

System action: The program continues.

System programmer response: None.

User response: Check that *host key file* exists and has the proper permissions. Verify that the correct passphrase was used.

FOTS1439 getnameinfo failed: *system error*

Explanation: ssh was unable to get the name information for the current host.

System action: The program continues.

System programmer response: Check that all the specified addresses for the host are valid.

FOTS1440 listen_sock O_NONBLOCK: *system error*

Explanation: A call to fcntl() to set O_NONBLOCK failed for the listening socket.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1441 setsockopt SO_REUSEADDR: *system error*

Explanation: A call to setsockopt() to set SO_REUSEADDR failed for the listening socket. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1442 Bind to port *port* **on** *host* **failed:** *system error*

Explanation: sshd was unable to bind the socket to the desired port. A call to bind() failed and the system error is displayed.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1443 select: *system error*

Explanation: sshd is waiting in a select() call until there is a connection. This call to select() failed. The system error is displayed.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1444 accept: *system error*

Explanation: A call to accept() failed. The system error is displayed.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1445 newsock del O_NONBLOCK: *system error*

Explanation: A call to fcntl() failed. The system error is displayed.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1446 __poe() failed for accepted socket: *system error*

Explanation: A call to __poe() failed. The system error is displayed.

System action: The daemon handling the connection ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1447 setsid: *system error*

Explanation: While sshd was attempting to create a new session and process group, a call to setsid() failed. The system error is displayed.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1448 setsockopt SO_KEEPALIVE: *system error*

Explanation: A call to setsockopt() to set SO_KEEPALIVE failed for the listening socket. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1449 do_ssh1_kex: bad session key len from *remote_ip***: session_key_int** *length* **> sizeof(session_key)** *session_key_length*

Explanation: During key exchange, the remote host's session key (*length*) is larger than what this daemon supports (*session_key_length*).

System action: The program continues.

User response: Follow local procedures for reporting problems to IBM.

FOTS1450 Timeout before authentication for *remote_ip*

Explanation: sshd timed-out before the user authenticated itself. The sshd administrator may have configured too low a value for the login grace time. The sshd -g option or sshd_config keyword LoginGraceTime controls this value.

System action: The program ends.

System programmer response: Follow local procedures for handling user authentication timeouts.

FOTS1451 Privilege separation user *user_name* **does not exist**

Explanation: The user *user_name* must exist when privilege separation is enabled via the sshd_config UsePrivilegeSeparation keyword.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on privilege separation setup and the sshd_config UsePrivilegeSeparation keyword.

FOTS1452 chroot("*chroot_dir***"):** *system error*

Explanation: sshd attempted to chroot() to *chroot_dir*, which is the chroot directory used by sshd during privilege separation.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1453 chdir("/"): *system error*

Explanation: sshd failed while attempting to chdir() to "/". The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1454 setgid failed for *groupid*

Explanation: A call to setgid() failed for the privilege separation user's group id.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1455 setgroups: *system error*

Explanation: A call to setgroups() failed for the privilege separation user's group id. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1456 fork of unprivileged child failed: *system error*

Explanation: While sshd was attempting to set up the unprivileged child process, a call to fork() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1457 TCP/IP TERMINATED. Will attempt to restart every *seconds* **seconds.**

Explanation: TCP/IP has gone down or has not been started yet. sshd will sleep for *seconds* seconds, and try again. This message will only be displayed once, not for each restart attempt.

System action: The program continues.

System programmer response: Wait until sshd recognizes the new stack.

FOTS1458 setibmsockopt SO_EioIfNewTP : *error_code*

Explanation: The setibmsockopt() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1459 Missing privilege separation directory: *chroot_dir*

Explanation: The directory used by sshd during privilege separation is missing or is not a directory.

System action: The program ends.

System programmer response: Check that *chroot_dir* exists and is a directory. It should also be owned by uid 0, and not be group or world-writable.

FOTS1460 Bad owner or mode for *chroot_dir*

Explanation: The directory used by sshd during privilege separation is not owned by uid 0 or is group or world-writable.

System action: The program ends.

System programmer response: *chroot_dir* should also be owned by uid 0, and not be group or world-writable.

FOTS1461 Couldn't create pid file "*filename***":** *system error*

Explanation: The sshd pid file *filename* could not be opened. A call to fopen() failed when attempting to open the file. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1462 Too many listen sockets. Enlarge MAX_LISTEN_SOCKS

Explanation: The number of sockets for which sshd is attempting to listen is greater than what it can currently handle. The current value is 16.

System action: The program ends.

System programmer response: Verify less than 16 addresses are specified with configuration option ListenAddress.

FOTS1463 listen: *system error*

Explanation: sshd attempted to listen on a port, and a call to listen() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Check the log information for the failing port number. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1464 Cannot bind any address.

Explanation: sshd was not able to bind to any of the addresses listed by configuration option ListenAddress.

System action: The program ends.

System programmer response: Check sshd log output for specific bind failures.

FOTS1465 *directory* **must be owned by root and not group or world-writable.**

Explanation: The chroot directory *directory* used by sshd during privilege separation is either not owned by root, or is group or world-writable.

System action: The program ends.

System programmer response: Check the permissions and ownership of the directory.

FOTS1466 do_connection: *remote_ip***: server_key** *server_num_bits* **< host_key** *host_num_bits* **+ SSH_KEY_BITS_RESERVED** *ssh_key_bits_reserved*

Explanation: The host key length *host_num_bits* and the server key length *server_num_bits* should differ by the number of bits specified by *ssh_key_bits_reserved*.

System action: The program ends.

System programmer response: Invoke **sshd** (using the -b option) with a larger number of bits for the server key.

FOTS1467 do_connection: *remote_ip***: host_key** *host_num_bits* **< server_key** *server_num_bits* **+ SSH_KEY_BITS_RESERVED** *ssh_key_bits_reserved*

Explanation: The host key length *host_num_bits* and the server key length *server_num_bits* should differ by the number of bits specified by *ssh_key_bits_reserved*.

System action: The program ends.

System programmer response: Make the host key and the server key conform to this property.

FOTS1468 do_ssh1_kex: BN_new failed

Explanation: During key exchange, a call to the OpenSSL function BN_new() failed. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for handling user authentication timeouts.

FOTS1487 TCP/IP TERMINATED, or new stack started.

Explanation: sshd has received an error which is interpreted as indicating that TCP/IP has terminated or that a new stack has been started. This message is preceded by one or more other messages indicating what error was received. Typically, a call to accept() will have failed with a system error of EIO.

System action: The program continues. sshd attempts to reinitialize the sockets for the services in the configuration file. If that fails, sshd attempts to reinitialize the sockets in repeated intervals.

System programmer response: Wait until sshd recognizes a new TCP/IP stack.

FOTS1488 too many ports.

Explanation: The **sshd** -p option was specified more times than it can handle. The maximum number of ports allowed by sshd is 256.

System action: The program ends.

System programmer response: Reissue **sshd** with a valid number of ports.

FOTS1489 Bad port number.

Explanation: The port number specified with sshd -p is invalid. It should be a number greater than 0 and less than or equal to 65535.

System action: The program ends.

System programmer response: Reissue **sshd** with a valid port number.

FOTS1490 Invalid login grace time.

Explanation: The login grace time specified with sshd –g is invalid.

System action: The program ends.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on sshd –g.

FOTS1491 Invalid key regeneration interval.

Explanation: The key regeneration interval specified with sshd –k is invalid.

System action: The program ends.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on sshd –k.

FOTS1492 too many host keys.

Explanation: The maximum number of host key files and host key ring certificates that can be specified in configuration files or the command line has been exceeded.

System action: The program ends.

System programmer response: Reissue **sshd** with a smaller number of host keys. See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the maximum allowed.

FOTS1493 Invalid utmp length.

Explanation: The length specified with sshd -u is larger than what can be stored in the utmpx database.

System action: The program ends.

System programmer response: Reissue **sshd** with a smaller value for the -u option.

FOTS1494 Extra argument *argument***.**

Explanation: sshd was specified with too many arguments.

System action: The program ends.

System programmer response: Reissue **sshd** with the proper syntax.

FOTS1495 Bad server key size.

Explanation: The number of bits specified for the server key is invalid. The server key bits (controlled by configuration option ServerKeyBits) must be between 512 and 32768 inclusive.

System action: The program ends.

System programmer response: Reissue **sshd** with a valid number of bits for the server key.

FOTS1496 do_authloop: BN_new failed

Explanation: During RSA authentication in sshd, a call to the OpenSSL function BN_new() failed. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1497 INTERNAL ERROR: authenticated invalid user *username*

Explanation: The user *username* is not a valid user, but was successfully authenticated.

System action: The program ends.

System programmer response: Follow local procedures for handling security problems.

FOTS1498 Port of Entry information not retained. uname() failed : *system error*

Explanation: A call to uname() failed. If there is a system error, it is displayed. Because of this failure, the port of entry information has not been retained. Access to the system by the attempting user may fail.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1499 Port of Entry information not retained. strtol() failed : *system error*

Explanation: A call to strtol() failed. If there is a system error, it is displayed with this message. Because of this failure, the port of entry information has not been retained. Access to the system by the attempting user may fail.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1501 *function***: no authctxt**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1502 INTERNAL ERROR: authenticated invalid user *user*

Explanation: The user *username* is not a valid user, but was successfully authenticated.

System action: The program ends.

System programmer response: Follow local procedures for handling security problems.

FOTS1503 __passwd: *system error*

Explanation: A call to __passwd() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Check that you entered the right password. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1504 userauth_hostbased: cannot decode key: *keytype*

Explanation: During hostbased authentication, sshd was unable to decode the public key of type *keytype* which was sent from across the network.

System action: The program continues.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1505 userauth_hostbased: type mismatch for decoded key (received *keytype1***, expected** *keytype2***)**

Explanation: The key sshd received across the network declared it's type to be *keytype2*, but was actually *keytype1* when decoded.

System action: The program continues.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1506 userauth_pubkey: cannot decode key: *keytype*

Explanation: During public key authentication, sshd was unable to decode the public key of type *keytype* which was sent from across the network.

System action: The program continues.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1507 userauth_pubkey: type mismatch for decoded key (received *keytype1*, expected *keytype2*)

Explanation: The key sshd received across the network declared it's type to be *keytype2*, but was actually *keytype1* when decoded.

System action: The program continues.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1508 get_challenge: numprompts < 1

Explanation: Challenge-response authentication failed because the number of prompts to the user was exceeded.

System action: The program ends.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1509 input_userauth_info_response: no authctxt

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1510 input_userauth_info_response: no kbdintctxt

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1511 input_userauth_info_response: no device

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1512 input_userauth_info_response: wrong number of replies

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1513 input_userauth_info_response: too many replies

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1514 Bugs in auth-options.c option processing.

Explanation: sshd encountered an error while parsing authorization options in the authorized_keys file.

System action: The program ends.

System programmer response: Notify the user of errors in their authorized keys file.

FOTS1529 auth_rsa_verify_response: RSA modulus too small: *bits* **< minimum** *minbits* **bits**

Explanation: During RSA authentication, the number of bits *bits* in the key was found to be too small. It needs to be bigger than *minbits*.

System action: The program continues.

System programmer response: Notify the user their key is too small.

FOTS1530 auth_rsa_generate_challenge: BN_new() failed

Explanation: During RSA authentication in sshd, a call to the OpenSSL function BN_new() failed. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1531 auth_rsa_generate_challenge: BN_CTX_new failed

Explanation: During RSA authentication in sshd, a call to the OpenSSL function BN_CTX_new() failed. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1532 auth_rsa_verify_response: bad challenge length *length*

Explanation: During RSA authentication in sshd, the challenge length was found to be too short. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1533 auth_rsa_challenge_dialog: BN_new() failed

Explanation: During RSA authentication in sshd, a call to the OpenSSL function BN_new() failed. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1555 __tcsetcp() failed: *system error*

Explanation: A call to __tcsetcp() failed while sshd was trying to set the code set for the master pty. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1556 *ttyname***:** *system error*

Explanation: A call to open() failed for *ttyname*. The system error is displayed with this message.

System action: The program ends if a pty is required.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1557 chown *ttyname* **0 0 failed:** *system error*

Explanation: A call to chown() failed while sshd was trying to release the pty and return ownership to uid 0. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1558 chmod *ttyname* **0666 failed:** *system error*

Explanation: A call to chmod() failed while sshd was trying to release the pty and make the permissions 666.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1562 setsid: *system error*

Explanation: A call to setsid() failed while sshd was trying to make the tty the process controlling tty. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1563 Failed to disconnect from controlling tty.

Explanation: A call to open() failed while sshd was tried to open the controlling tty with O_RDWR and O_NOCTTY. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1567 open /dev/tty failed – could not set controlling tty: *system error*

Explanation: A call to open() failed for /dev/tty. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1568 chown(*ttyname***,** *userid***,** *groupid***) failed:** *system error*

Explanation: sshd is attempting to change the owner and group of the tty *ttyname* to that of *userid* and *groupid* respectively. The call to chown() failed because the file system is read-only. The current owner of the tty is already that of *userid* or of a superuser.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1569 chmod(*ttyname***,** *mode***) failed:** *system error*

Explanation: sshd is attempting to change the permissions of the tty *ttyname* to that of *mode*. The call to chmod() failed because the file system is read-only. The current permissions allow read access for group and other.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1572 stat(*ttyname*) failed: *system error*

Explanation: A call to stat() failed for *ttyname*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1573 chown(*ttyname*, *userid*, *groupid*) failed: *system error*

Explanation: sshd is attempting to change the owner and group of the tty *ttyname* to that of *userid* and *groupid* respectively. A call to chown() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1574 chmod(*ttyname*, *mode*) failed: *system error*

Explanation: sshd is attempting to change the permissions of the tty *ttyname* to that of *mode*. The call to chmod() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1575 login_get_lastlog: Cannot find account for uid *uid*

Explanation: A call to getpwuid() failed for UID *uid*.

System action: The program ends.

System programmer response: Verify there is a user account for *uid*. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1576 login_init_entry: Cannot find user "*userid*"

Explanation: sshd was unable to find the definition for user id *userid*. A call to getpwuid() failed.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1577 This platform does not support both privilege separation and compression

Explanation: The configuration options Compression and UsePrivilegeSeparation were both enabled. IBM z/OS does not support both privilege separation and compression.

System action: Compression is disabled and the program continues.

System programmer response: Determine if compression is necessary for your network.

FOTS1578 Compression disabled

Explanation: The configuration options Compression and UsePrivilegeSeparation were both enabled. IBM z/OS does not support both privilege separation and compression, so compression is disabled.

System action: The program continues.

System programmer response: Determine if compression is necessary for your network.

FOTS1579 *filename***: line** *line number***: Bad configuration option:** *configuration option*

Explanation: An option specified in an sshd configuration file is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the invalid option.

FOTS1581 **bad addr or host:** *address* **(***system error***)**

Explanation: The sshd daemon failed when trying to get the address information for *address*. The system error is displayed with this message.

System action: The program ends.

User response: Verify *address* is valid.

FOTS1582 *filename* **line** *line number***: ports must be specified before ListenAddress.**

Explanation: In the sshd configuration file, the Port option was not specified before the ListenAddress option.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the option which caused this error. Change the order of these options in the sshd configuration file and reissue **sshd**.

FOTS1583 *filename* **line** *line number***: too many ports.**

Explanation: The sshd Port option was specified more times than sshd supports. The maximum number of ports allowed by sshd is 256.

System action: The program ends.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Port option which caused this error. Reissue sshd with a valid number of ports.

FOTS1584 *filename* **line** *line number***: missing port number.**

Explanation: The sshd configuration file *filename* has the Port option, but is missing the corresponding port number.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Port option, add a port number, and reissue sshd.

FOTS1585 *filename* **line** *line number***: Badly formatted port number.**

Explanation: The sshd configuration file *filename* has the Port option, but the corresponding port number has caused a syntax error.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Port option, correct the port number, and reissue sshd.

FOTS1586 *filename* **line** *line number***: missing integer value.**

Explanation: The sshd configuration file *filename* has a configuration option which expects an integer argument, but the argument is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the failing configuration option, add an integer argument, and reissue **sshd**.

FOTS1587 *filename* **line** *line number***: missing time value.**

Explanation: The sshd configuration file *filename* has a configuration option which expects a time value, but the corresponding time value is missing. Options which expect time values include LoginGraceTime, KeyRegenerationInterval, and ClientAliveInterval.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the failing option, add a time value and reissue sshd.

FOTS1588 *filename* **line** *line number***: invalid time value.**

Explanation: The sshd configuration file *filename* has a configuration option which expects a time value, but the corresponding time value is invalid. Options which expect time values include LoginGraceTime, KeyRegenerationInterval, and ClientAliveInterval.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the failing option, correct the time value and reissue **sshd**.

FOTS1589 *filename* **line** *line number***: missing address**

Explanation: The sshd configuration file *filename* has the ListenAddress option, but the corresponding internet address on which to listen is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the ListenAddress option, add an internet address, and reissue **sshd**.

FOTS1590 *filename* **line** *line number***: bad ipv6 inet addr usage.**

Explanation: The sshd configuration file *filename* has the ListenAddress option. The corresponding ipv6 internet address on which to listen is the wrong syntax. A left-bracket is missing a corresponding right bracket.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the ListenAddress option, correct the internet address, and reissue **sshd**.

FOTS1591 *filename* **line** *line number***: bad address:port usage.**

Explanation: The sshd configuration file *filename* has the ListenAddress option. The corresponding internet address on which to listen is the wrong syntax. A port number should follow the colon.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the ListenAddress option, correct the internet address, and reissue **sshd**.

FOTS1592 *filename* **line** *line number***: bad port number.**

Explanation: The port number specified with sshd configuration option ListenAddress is invalid. It should be a number greater than 0 and less than or equal to 65535.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the ListenAddress option, correct the port specification, and reissue **sshd**.

FOTS1593 *filename* **line** *line number***: bad inet addr usage.**

Explanation: The sshd configuration file *filename* has the ListenAddress option. The corresponding internet address or host on which to listen is the wrong syntax. Invalid data appears where a port specification might be.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the ListenAddress option, correct the port specification, and reissue **sshd**.

FOTS1594 *filename* **line** *line number***: too many host keys specified (max** *hostkeys***).**

Explanation: The maximum number of host keys and host key ring certificates that can be specified in configuration files or the command line has been exceeded.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the HostKey or HostKeyRingLabel keywords which caused this error. Reissue **sshd** with a valid number of HostKey or HostKeyRingLabel keywords.

FOTS1595 *filename* **line** *line number***: missing file name.**

Explanation: The sshd configuration file *filename* has a configuration option specified which expects a filename argument. The filename argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the configuration option which caused this error, and add a filename. Reissue **sshd**.

FOTS1596 *filename* **line** *line number***: missing yes/without–password/forced–commands–only/no argument.**

Explanation: The sshd configuration file *filename* has the PermitRootLogin option specified. The argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the PermitRootLogin option which caused this error, and add an argument. Reissue **sshd**.

FOTS1597 *filename* **line** *line number***: Bad yes/without–password/forced–commands–only/no argument:** *arg*

Explanation: The sshd configuration file *filename* has the PermitRootLogin option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the PermitRootLogin option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1598 *filename* **line** *line number***: missing yes/no argument.**

Explanation: The sshd configuration file *filename* has a configuration option specified which expects a yes/no argument. The argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the configuration option which caused this error, and add an argument. Reissue **sshd**.

FOTS1599 *filename* **line** *line number***: Bad yes/no argument:** *arg*

Explanation: The sshd configuration file *filename* has a configuration option specified which expects a yes/no argument. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the configuration option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1601 *filename* **line** *line number***: unsupported log facility '***arg***'**

Explanation: The sshd configuration file *filename* has the SyslogFacility option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the SyslogFacility option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1602 *filename* **line** *line number***: unsupported log level '***arg***'**

Explanation: The sshd configuration file *filename* has the LogLevel option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the LogLevel option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1603 *filename* **line** *line number***: too many allow users.**

Explanation: The sshd AllowUsers option was specified more times than sshd supports. The maximum number of AllowUsers specifications allowed by sshd is 256.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the AllowUsers option which caused this error. Reissue **sshd** with a valid number of AllowUsers options.

FOTS1604 *filename* **line** *line number***: too many deny users.**

Explanation: The sshd DenyUsers option was specified more times than sshd supports. The maximum number of DenyUsers specifications allowed by sshd is 256.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the DenyUsers option which caused this error. Reissue sshd with a valid number of DenyUsers options

FOTS1605 *filename* **line** *line number***: too many allow groups.**

Explanation: The sshd AllowGroups option was specified more times than sshd supports. The maximum number of AllowGroups specifications allowed by sshd is 256.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the AllowGroups option which caused this error. Reissue **sshd** with a valid number of AllowGroups options.

FOTS1606 *filename* **line** *line number***: too many deny groups.**

Explanation: The sshd DenyGroups option was specified more times than sshd supports. The maximum number of DenyGroups specifications allowed by sshd is 256.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the DenyGroups option which caused this error. Reissue **sshd** with a valid number of DenyGroups options.

FOTS1607 *filename* **line** *line number*: **Missing argument.**

Explanation: The sshd configuration file *filename* has the Ciphers, MACs, or Protocol option specified. The argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the option which caused this error, and add an argument. Reissue **sshd**.

FOTS1608 *filename* **line** *line number*: **Bad SSH2 cipher spec '***arg***'.**

Explanation: The sshd configuration file *filename* has the Ciphers option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Ciphers option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1610 *filename* **line** *line number*: **Bad SSH2 mac spec '***arg***'.**

Explanation: The sshd configuration file *filename* has the MACs option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the MACs option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1611 *filename* **:** *message*

Explanation: A call to fopen() failed on file *filename*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1612 *filename* **line** *line number*: **Bad protocol spec '***arg***'.**

Explanation: The sshd configuration file *filename* has the Protocol option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Protocol option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1613 *filename* **line** *line number*: **too many subsystems defined.**

Explanation: The sshd Subsystem option was specified more times than sshd supports. The maximum number of Subsystem specifications allowed by sshd is 256.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Subsystem option which caused this error. Reissue sshd with a valid number of Subsystem options.

FOTS1614 *filename* **line** *line number***: Missing subsystem name.**

Explanation: The sshd configuration file *filename* has the Subsystem option specified. The argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the option which caused this error, and add an argument. Reissue **sshd**.

FOTS1615 *filename* **line** *line number***: Subsystem '***name***' already defined.**

Explanation: The sshd configuration file *filename* has the Subsystem option specified. The subsystem *name* is already defined.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Subsystem option which caused the error.

FOTS1616 *filename* **line** *line number***: Missing subsystem command.**

Explanation: The sshd configuration file *filename* has the Subsystem option specified. The command argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the Subsystem option which caused the error.

FOTS1617 *filename* **line** *line number***: Missing MaxStartups spec.**

Explanation: The sshd configuration file *filename* has the MaxStartups option specified. The argument for this option is missing.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the option which caused this error, and add an argument. Reissue **sshd**.

FOTS1618 *filename* **line** *line number***: Illegal MaxStartups spec.**

Explanation: The sshd configuration file *filename* has the MaxStartups option specified. The argument *arg* for this option is invalid.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the MaxStartups option which caused this error, and correct the argument. Reissue **sshd**.

FOTS1619 **server_input_global_request: no/invalid user**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1620 *filename* **line** *line number***: Missing handler for opcode** *arg* **(***opcode***)**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1621 *filename* **line** *line number***: garbage at end of line; "***arg***".**

Explanation: The sshd configuration file *filename* contains the invalid data *arg*.

System action: The program ends.

System programmer response: Check *line number* of the sshd configuration file *filename* for the data which caused this error, and correct the argument. Reissue **sshd**.

FOTS1622 *filename***: terminating,** *options* **bad configuration options**

Explanation: sshd encountered too many bad configuration options in *filename*.

System action: The program ends.

System programmer response: Check the sshd configuration file *filename* for the data which caused this error, and correct the argument. Reissue **sshd**.

FOTS1623 **pipe(notify_pipe) failed** *system error*

Explanation: A call to pipe() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1624 **fcntl(notify_pipe, F_SETFD) failed** *system error*

Explanation: A call to fcntl() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1625 **select:** *system error*

Explanation: A call to select() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1626 **Strange, wait returned pid** *pid1***, expected** *pid2*

Explanation: A call to waitpid() returned *pid1* but sshd expected *pid2*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1627 **server_input_global_request: no user**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1628 **authentication forwarding requested twice.**

Explanation: The remote ssh client has requested agent forwarding twice.

System action: The program continues.

System programmer response: Follow local procedures for handling multiple agent forwarding requests.

FOTS1629 setsid failed: *system error*

Explanation: A call to setsid() failed while sshd was trying to create a new session and process group. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1630 dup2 stdin: *system error*

Explanation: A call to dup2() failed for stdin. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1631 dup2 stdout: *system error*

Explanation: A call to dup2() failed for stdout. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1632 dup2 stderr: *system error*

Explanation: A call to dup2() failed for stderr. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1633 passwd

Explanation: A attempt to exec the passwd utility failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1634 setlogin failed: *system error*

Explanation: A call to setlogin() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1635 no more sessions

Explanation: Too many session channels were attempted to be opened in sshd. The maximum number of session channels allowed by sshd is 10.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1636 session_by_pid: unknown pid *pid*

Explanation: ssh attempted to get a session id from the pid number *pid*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1637 session_pty_req: session *sessionid* **alloc failed**

Explanation: While sshd was requesting a pty for the session *sessionid*, a pty could not be allocated.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1638 subsystem: cannot stat *command***:** *system error*

Explanation: While sshd was attempting to run a subsystem, the command for the subsystem failed. Specifically, a call to stat() failed for the command. The system error is displayed with this message.

System action: The program continues.

System programmer response: Verify that the command specified for the subsystem (in the sshd configuration file) is in the search order specified by PATH. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1639 session_pty_cleanup: no session

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1640 close(s->ptymaster/*ptynum***):** *system error*

Explanation: While sshd was attempting to close the pty, a call to close() failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1641 no user for session *sessionid*

Explanation: sshd cannot find a user associated with session *sessionid*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1642 Can't get IP address for X11 DISPLAY.

Explanation: While ssh was attempting to set up X11 forwarding, a call to gethostbyname() failed.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1643 dup2 stdin

Explanation: A call to dup2() failed for stdin. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer. Follow local procedures for reporting problems to IBM.

FOTS1644 dup2 stdout

Explanation: A call to dup2() failed for stdout. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1645 dup2 stderr

Explanation: A call to dup2() failed for stderr. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact

FOTS1646 *shell_program* **:** *message*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1647 *shell_program* **:** *message*

Explanation: A call to execve() failed on executing *shell_program*. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1650 setgid: *GID***:** *error_message*

Explanation: The setgid() system call was unable to set the group id to *GID*.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact

FOTS1651 initgroups

Explanation: A call to initgroups() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact

FOTS1652 login

Explanation: An error occurred while sshd tried to execute the login program. A call to execl() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1657 do_exec_no_pty: no session

Explanation: An internal error occurred while sshd was attempting to execute a command with no tty.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1658 do_exec_pty: no session

Explanation: An internal error occurred while sshd was attempting to execute a command with a tty.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1659 child_set_env: too many env vars, skipping: *varname*

Explanation: sshd could not set the environment variable *varname* because the maximum allowed (1000) to be set has be reached.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1660 Too many lines in environment file *filename*

Explanation: sshd failed while reading the user's environment file because the file has exceeded the maximum number of lines (1000) supported by sshd.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1661 Failed to set uids to *uid***.**

Explanation: sshd failed to set the uid of the process to *uid*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1662 no user for session *sessionid*

Explanation: sshd could not find a user id associated with the session *sessionid*. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1663 child_set_env: too many env vars

Explanation: sshd could not set an environment variable because the maximum allowed (1000) to be set has been reached.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1664 **session_set_fds: called for proto != 2.0**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1665 **no channel for session** *sessionid*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1666 **session_exit_message: session** *sessionid***: no channel** *channel*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1667 **gethostname:** *system error*

Explanation: A call to gethostname() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1668 **WARNING: Your password has expired.**

Explanation: Your password has expired. You will be prompted to change it.

System action: The program ends.

User response: Enter your new password, and login again.

FOTS1669 **Password change required but no TTY available.**

Explanation: Your password has expired, but your session does not have a tty available from which to read the password.

System action: The program ends.

User response: Run a ssh session with a tty allocated, then change your password.

FOTS1671 **Bad line** *line number* **in** *filename*

Explanation: sshd failed while reading the user's environment file because it encountered a line with an invalid syntax.

System action: The program continues.

System programmer response: Notify the user their environment file has a syntax error on line *line number*.

FOTS1675 **Could not run** *filename*

Explanation: While sshd was running the user's startup files, a call to popen() failed while attempting to run *filename*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1679 Could not run *command*

Explanation: While sshd was running the user's startup files, a call to popen() failed while attempting to run *command*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1681 Could not chdir to home directory *dir*: *system error*

Explanation: A call to chdir() failed while sshd was attempting to change to the user's home directory *dir*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1687 mm_make_entry(*address***): double address** *pointer***->***address2***(***size***)**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1688 mmap(*size***):** *system error*

Explanation: While sshd was attempting to create a shared memory space, a call to mmap() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1689 munmap(*address***,** *size***):** *system error*

Explanation: While sshd was attempting to create a shared memory space, a call to munmap() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1690 mm_memvalid: address too large: *address*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1691 *function***: mm_malloc(***size***)**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1692 mm_malloc: try to allocate 0 space

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1693 mm_malloc: size too big

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1694 mm_free(*address1***): can not find** *address2*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1695 mm_free(*address1***): double address** *address2*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1696 mm_free: memory corruption: *addr1***(***size***) >** *addr2*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1697 mm_free: memory corruption: *addr1* **<** *addr2***(***size***)**

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1698 mm_memvalid: address too small: *address*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1699 mm_memvalid: end < address: *address1* **<** *address2*

Explanation: An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS1702 *function***: fd0** *file_descriptor* **!= 0**

Explanation: open() system call on /dev/null did not return 0.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1703 *function*: **unexpected authentication from** *reqtype*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1704 *function*: **authenticated invalid user**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1705 *function*: **unpermitted request** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1706 *function*: **unsupported request:** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1707 *function*: **bad parameters:** *min want max*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1708 *function*: **data length incorrect:** *data_len*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1709 *function*: **no hostkey from index** *keyid*

Explanation: Internal error

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1710 *function*: **key_sign failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1711 *function*: **multiple attempts for getpwnam**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1712 *function*: **no bsd auth session**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1713 *function*: **key type and protocol mismatch**

Explanation: Key type does not match protocol being used.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key is correct type. If error persists contact your system programmer to report the problem.

FOTS1714 *function*: **unknown key type** *type*

Explanation: Unknown key type.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key type. If error persists contact your system programmer to report the problem.

FOTS1715 *function*: **bad key, not previously allowed**

Explanation: Bad key.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key is correct. If error persists contact your system programmer to report the problem.

FOTS1716 *function*: **bad public key blob**

Explanation: Public key data is bad.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify public key file is correct. If error persists contact your system programmer to report the problem.

FOTS1717 *function*: **bad signature data blob**

Explanation: Key signature data is bad.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key file is correct. If error persists contact your system programmer to report the problem.

FOTS1718 *function*: **dup2**

Explanation: dup2() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1719 *function*: **open(/dev/null):** *error_message*

Explanation: open() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1720 *function*: **BN_new**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1721 *function*: **bad ssh1 session id**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1723 *function*: **key_to_blob failed**

Explanation: Key error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key file is correct. If error persists contact your system programmer to report the problem.

FOTS1724 *function*: **authctxt not valid**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1725 *function*: **bad key, not previously allowed**

Explanation: Key error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key file is correct. If error persists contact your system programmer to report the problem.

FOTS1726 *function*: **key type mismatch**

Explanation: Key error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key file is correct. If error persists contact your system programmer to report the problem.

FOTS1727 *function*: **received bad key**

Explanation: Key error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key file is correct. If error persists contact your system programmer to report the problem.

FOTS1729 *function*: **no ssh1_challenge**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1730 **ssh–keysign not enabled in** *filename*

Explanation: EnableSSHKeysign is not enabled in the ssh configuration file *filename*.

System action: The program ends.

User response: Change the ssh configuration file to enable EnableSSHKeysign.

FOTS1731 **ssh_msg_send failed**

Explanation: A read or write failed during ssh-keysign processing.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS1733 *function*: **received bad response to challenge**

Explanation: Communication error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS1734 *function***: auth too large**

Explanation: Communication error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS1735 **mm_get_get: internal error: bad session id**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1736 *function***: bad request size**

Explanation: Communication error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS1738 *function***: mm_zalloc(***ncount***,** *size***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1739 **fcntl(***file_descriptor***, F_SETFD)**

Explanation: The fcntl() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1740 *function***: socketpair**

Explanation: socketpair() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1742 *filename***: skipping, filename contains a newline**

Explanation: Filename contains a newline character.

System action: The command continues.

User response: Verify that the filename specified is correct.

FOTS1743 **pipe:** *error_message*

Explanation: pipe() system call failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1744 *filename***:** *error_message*

Explanation: A file operation failed on the specified file.

System action: The command continues.

System programmer response: If specified file does not appear to have any problems, follow local procedures for reporting the problem to IBM.

User response: Verify that the file exists and has proper access permissions. If error persists contact your system programmer.

FOTS1745 **unknown user** *userid*

Explanation: getpwuid() system call failed to return a user.

System action: The command ends.

User response: Verify that the specify user exists.

FOTS1748 *pathname***: not a regular file**

Explanation: File specified is not a regular file.

System action: The command continues.

User response: Only specify regular files.

FOTS1750 *name***/***filename***: name too long**

Explanation: Filename is too long.

System action: The command continues.

User response: Specify a filename less than 1100 characters long.

FOTS1753 **ambiguous target**

Explanation: Target specified on the command line is ambiguous.

System action: The command ends.

User response: Specify a nonambiguous target.

FOTS1754 *message*

Explanation: Connection error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connection and remote host status. If error persists contact your system programmer to report the problem.

FOTS1755 *user name*: **invalid user name**

Explanation: Invalid user name specified.

System action: The program continues.

User response: Specify a valid username.

FOTS1756 **RSA_blinding_on failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1757 **Hostbased authentication not enabled in** *config_file*

Explanation: The user attempted Hostbased authentication, but it is not enabled.

System action: The program ends.

User response: Enable host based authentication in configuration file.

FOTS1758 **could not open any host key**

Explanation: Could not open any host keys.

System action: The program ends.

User response: Verify that host keys exist, and that access permissions are properly set.

FOTS1759 **getpwuid failed**

Explanation: getpwuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1760 **no hostkey found**

Explanation: No host key found.

System action: The program ends.

User response: Verify that host keys exist, and that access permissions are properly set.

FOTS1761 **ssh_msg_recv failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1762 bad version

Explanation: SSH version is not correct.

System action: The program end.

User response: Verify that you are running the proper version of SSH.

FOTS1763 bad fd

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1764 cannot get sockname for fd

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1765 not a valid request

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1766 no matching hostkey found

Explanation: No matching host key found.

System action: The program ends.

User response: Verify that the host keys exist, and access permissions are properly set.

FOTS1767 key_sign failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1768 *pathname***: set times:** *error_message*

Explanation: utimes() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1770 *program* **:** *message*

Explanation: A call to execvp() failed. The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1771 *path***: truncate:** *error_messages*

Explanation: ftruncate() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1772 *path***: set mode:** *error_message*

Explanation: chmod() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1776 **protocol error:** *error_message*

Explanation: scp error.

System action: The program ends.

User response: This is a catchall for a number of scp errors. See the error message at the end of this message for the specific error that occurred.

FOTS1778 **fstat:** *error_message*

Explanation: fstat() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1779 **unexpected <newline>**

Explanation: Unexpected newline in buffer read from socket.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1780 lost connection

Explanation: Connection Lost.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1781 mtime.sec not delimited

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1782 mtime.usec not delimited

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1783 atime.sec not delimited

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1784 atime.usec not delimited

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1785 expected control record

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1786 bad mode

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1787 mode not delimited

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1788 size not delimited

Explanation: Buffer read from socket is not in proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If problem persists contact your system programmer to report the problem.

FOTS1789 setenv failed for _BPXK_SUID_FORK: *error_message*

Explanation: The setenv system call failed and sshd could not set _BPXK_SUID_FORK. This may cause the user's session to have incorrect properties, including jobname, region size, and SMF accounting information.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1790 error: unexpected filename: *filename*

Explanation: The buffer read from socket is not in the proper format.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If the problem persists contact your system programmer.

FOTS1791 received directory without –r

Explanation: The buffer read from socket did not have the expected –r recursive option.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If the problem persists contact your system programmer.

FOTS1793 **cannot get local name for fd**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1801 **Couldn't create socket:** *error_message*

Explanation: socket() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1802 **Couldn't connect to PRNGD port** *tcp_port*: *error_message*

Explanation: connect() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1803 **Couldn't connect to PRNGD socket "***path***":** *error_message*

Explanation: connect() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1804 **Couldn't write to PRNGD socket:** *error_message*

Explanation: write() system call inside atomicio() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1805 **Couldn't read from PRNGD socket:** *error_message*

Explanation: read() system call inside atomicio() failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1806 Couldn't wait for child '*cmd_string*' completion: *error_message*

Explanation: waitpid() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1807 bad entropy command, *cmd_filename* **line** *line*

Explanation: Error in ssh_prng_cmds file.

System action: The program continues.

User response: Make sure the ssh_prng_cmds file is set up properly. See the **ssh–rand–helper** man page for information.

FOTS1808 missing or bad command string, *cmd_filename* **line** *linenum* **-- ignored**

Explanation: Error in ssh_prng_cmds file.

System action: The program continues.

User response: Make sure the ssh_prng_cmds file is set up properly. See the **ssh–rand–helper** man page for information.

FOTS1809 missing command path, *cmd_filename* **line** *linenum* **-- ignored**

Explanation: Error in ssh_prng_cmds file.

System action: The program continues.

User response: Make sure the ssh_prng_cmds file is set up properly. See the **ssh–rand–helper** man page for information.

FOTS1810 missing entropy estimate, *cmd_filename* **line** *linenum* **-- ignored**

Explanation: Error in ssh_prng_cmds file.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Make sure the ssh_prng_cmds file is set up properly. See the **ssh–rand–helper** man page for information.

FOTS1811 garbage at end of line *linenum* **in** *cmd_filename*

Explanation: Error in ssh_prng_cmds file.

System action: The program continues.

User response: Make sure the ssh_prng_cmds file is set up properly. See the **ssh–rand–helper** man page for information.

FOTS1812 ignored extra commands (max *maximum***),** *filename* **line** *linenum*

Explanation: Error in ssh_prng_cmds file *filename*. The maximum number of command-line arguments passed to a command in the ssh_prng_cmds file has exceeded the internal limit of *maximum*.

System action: The program continues.

User response: Make sure the ssh_prng_cmds file is set up properly. See the **ssh–rand–helper** man page for information.

FOTS1813 Invalid commandline option

Explanation: Invalid command line option.

System action: The program continues.

User response: Enter a valid command line option.

FOTS1814 You must specify a port or a socket

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1815 Random pool path is too long

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1816 Too many bytes to read from PRNGD

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1817 Couldn't gettimeofday: *error_message*

Explanation: gettimeofday() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1818 Couldn't open /dev/null: *error_message*

Explanation: open() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1819 Couldn't open pipe: *error_message*

Explanation: pipe() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1820 Couldn't fork: *error_message*

Explanation: fork() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1821 PRNG seedfile *filename* **is not a regular file**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1822 Couldn't get password entry for current user (*uid***):** *error_message*

Explanation: getpwuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1823 problem writing PRNG seedfile *filename* **(***error_message***)**

Explanation: write() system call within atomicio() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1824 PRNG seed extraction failed

Explanation: A call to the OpenSSL function RAND_bytes failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1825 could not open PRNG seedfile *filename* **(***error_message***)**

Explanation: open() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1826 couldn't read entropy commands file *cmdfilename***:** *error_message*

Explanation: fopen() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1827 Invalid number of output bytes

Explanation: Invalid number of bytes specified with -b option on the command line.

System action: The program ends.

User response: Specify a valid number of bytes. See man page for assistance.

FOTS1829 Entropy collection failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1830 PRNG initialisation failed -- exiting.

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1831 Not enough entropy in RNG

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try reissuing the command. If error persists contact your system programmer to report the problem.

FOTS1838 Couldn't fork: *error_message* **reason code =** *reasoncode*

Explanation: fork() system call failed.

System action: The program ends.

System programmer response: Take appropriate action based on reason code.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1840 mkdir *dirname***:** *error_message*

Explanation: The directory *dirname* could not be created. The mkdir() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1841 PRNG seed filename too long

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1842 problem renaming PRNG seedfile from *filename1* **to** *filename2* **(***error_message***)**

Explanation: The seedfile *filename1* could not be renamed. The rename() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1843 Couldn't extract entropy from PRNG

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS1901 channel *channel***: protocol error: rcvd_oclose for istate** *istate*

Explanation: Invalid input from channel.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1902 channel *channel***: chan_read_failed for istate** *istate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1903 channel *channel***: chan_ibuf_empty for non empty buffer**

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1904 **channel** *channel***: chan_ibuf_empty for istate** *istate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1905 **channel** *channel***: protocol error: rcvd_ieof for ostate** *ostate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1906 **channel** *channel***: chan_write_failed for ostate** *ostate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1907 **channel** *channel***: chan_obuf_empty for non empty buffer**

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1908 **channel** *channel***: internal error: obuf_empty for ostate** *ostate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1909 **channel** *channel***: cannot send ieof for istate** *istate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1910 **channel** *channel***: cannot send oclose for ostate** *ostate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1911 **channel** *channel***: protocol error: close rcvd twice**

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1912 **rsa_public_encrypt: BN_bin2bn failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1913 **channel** *channel***: cannot send eof for istate** *istate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1914 **channel** *channel***: cannot send close for istate/ostate** *istate***/***ostate*

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1915 **channel** *channel***: already sent close**

Explanation: Channel error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1916 **channel** *channel***: chan_shutdown_read: shutdown() failed for fd***socket* **[i***istate* **o***ostate***]:** *error_code*

Explanation: Channel error

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1917 **chan_set_istate: bad state** *ostate* **->** *next_state*

Explanation: Channel error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1918 chan_set_ostate: bad state *ostate* **->** *next_state*

Explanation: Channel error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1919 fcntl O_NONBLOCK: *error_message*

Explanation: The fcntl() system call failed. The system error is displayed with the message.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1920 rsa_private_decrypt: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1921 setsockopt IPTOS_LOWDELAY: *error_code*

Explanation: setsockopt() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1922 setsockopt IPTOS_THROUGHPUT: *error_code*

Explanation: setsockopt() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1923 packet_set_connection: cannot load cipher 'none'

Explanation: Error loading ciphers.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1924 packet_set_seqnr: bad mode *mode*

Explanation: Packet error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1925 Compression already enabled.

Explanation: Program attempted to enable compression when it is already active.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1926 packet_set_encryption_key: unknown cipher number *number*

Explanation: Cipher error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1927 packet_set_encryption_key: keylen too small: *keylen*

Explanation: Key length is less than 20.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1928 packet_set_encryption_key: keylen too big: *keylen*

Explanation: Key length is greater than SSH_SESSION_KEY_LENGTH.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1929 newkeys: no keys for mode *mode*

Explanation: Packet error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1930 Read from socket failed: *error_code*

Explanation: read() function call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1931 padding error: need *size_needed* **block** *block_size* **mod** *modulus*

Explanation: The needed size is not a multiple of the block size.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1932 **packet_disconnect called recursively.**

Explanation: Recursive invocation of packet_disconnect.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1933 **Write failed:** *error_code*

Explanation: write() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1934 **put_host_port: asprintf:** *error_message*

Explanation: The asprintf() call failed. The error is displayed with the message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS1935 **addargs: argument too long**

Explanation: The vasprintf() call failed. An argument was too long and could not be added to the argument string.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS1936 **replacearg: argument too long**

Explanation: The vasprintf() call failed. An argument was too long and could not be replaced in the argument string.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS1937 **replacearg: tried to replace invalid arg** *argument_number* **>=** *total_arguments*

Explanation: Argument *argument_number* does not identify a valid argument to replace.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1938 tilde_expand_filename: ~username too long

Explanation: Unable to complete tilde expansion for the specified filename. The user name is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the user name is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS1939 tilde_expand_filename: No such user *user_name*

Explanation: Unable to complete tilde expansion for the specified filename. The user name *user_name* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the user name is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS1940 tilde_expand_filename: No such uid *UID*

Explanation: Unable to complete tilde expansion for the specified filename. The UID *UID* is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the UID is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS1941 Couldn't open /dev/null: *error_message*

Explanation: The open() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1942 tilde_expand_filename: Path too long

Explanation: The expanded filename is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1943 rsa_generate_additional_parameters: BN_sub/mod failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS1944 Couldn't read from ssh-rand-helper: *error_message*

Explanation: read() system call failure from **ssh–rand–helper**.

System action: The program ends.

System programmer response: Verify all ssh components are installed and configured correctly. If error persists follow local procedures for reporting problems to IBM.

User response: Verify all ssh components are installed and configured correctly. Refer to the *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1945 ssh-rand-helper child produced insufficient data

Explanation: Error with pseudo-random number generating functions.

System action: The program ends.

System programmer response: Verify all ssh components are installed and configured correctly. If error persists follow local procedures for reporting problems to IBM.

User response: This error often occurs due to errors in installation and setup of ssh. Verify all ssh components are installed and configured correctly. If error persists contact your system programmer to report the error.

FOTS1946 Couldn't wait for ssh–rand–helper completion: *error_message*

Explanation: waitpid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1947 ssh-rand-helper terminated abnormally

Explanation: Error with pseudo-random number generating functions.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1948 ssh-rand-helper exit with exit status *exit_status*

Explanation: Error with pseudo-random number generating functions.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1949 PRNG is not seeded. Please activate the Integrated Cryptographic Service Facility (ICSF).

Explanation: Unable to obtain secure random data from /dev/random.

System action: The program ends.

System programmer response: Ensure that ICSF is started and configured to support the CSFRNG service and that the user has the necessary SAF/RACF resource access. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on configuring ICSF for random number support. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1950 OpenSSL version mismatch. Built against *req_version***, you have** *cur_version*

Explanation: OpenSSL error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1951 getuid: *error_message*

Explanation: getuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1952 geteuid: *error_message*

Explanation: geteuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1953 (rand child) setuid(*orig_uid***):** *error_message*

Explanation: setuid() or seteuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1954 (rand child) Couldn't exec '*path***':** *error_message*

Explanation: execl() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1955 ssh_askpass: fflush: *error_message*

Explanation: fflush() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1956 ssh_askpass: pipe: *error_message*

Explanation: pipe() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1957 ssh_askpass: fork: *error_message*

Explanation: fork() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1958 internal error: askpass undefined

Explanation: Internal error

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1959 ssh_askpass: dup2: *error_message*

Explanation: dup2() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1960 ssh_askpass: exec(*path***):** *error_message*

Explanation: execlp() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1961 rsa_private_decrypt() failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1962 rsa_public_encrypt() exponent too small or not odd

Explanation: RSA exponent value is bad.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1963 rsa_public_encrypt() failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1964 rsa_generate_additional_parameters: BN_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS1965 rsa_generate_additional_parameters: BN_CTX_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2003 ssh_dss_sign: no DSA key

Explanation: DSA key not found or wrong type.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify DSA key. If error persists contact your system programmer to report the problem.

FOTS2004 ssh_dss_sign: sign failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2005 bad sig size *rlen slen*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2006 ssh_dss_verify: no DSA key

Explanation: DSA key not found or wrong type.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify DSA key. If error persists contact your system programmer to report the problem.

FOTS2007 ssh_dss_verify: cannot handle type *ktype*

Explanation: DSA key type error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify DSA key. If error persists contact your system programmer to report the problem.

FOTS2008 ssh_dss_verify: remaining bytes in signature *rlen*

Explanation: DSA key signature error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify DSA key. If error persists contact your system programmer to report the problem.

FOTS2009 bad sigbloblen *len* **!= SIGBLOB_LEN**

Explanation: Key signature error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify DSA key. If error persists contact your system programmer to report the problem.

FOTS2010 ssh_dss_verify: DSA_SIG_new failed

Explanation: Error generating DSA signature.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2011 ssh_dss_verify: BN_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2012 ssh_dss_verify: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2013 ssh_rsa_sign: no RSA key

Explanation: RSA key not found or wrong type.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify RSA key exists and is correct type. If problem persists contact your system programmer to report the problem.

FOTS2014 ssh_rsa_sign: EVP_get_digestbynid *nid* **failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2015 ssh_rsa_sign: RSA_sign failed: *error_message*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2016 ssh_rsa_sign: slen *len1* **slen2** *len2*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2017 ssh_rsa_verify: no RSA key

Explanation: RSA key not found or wrong type.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify RSA key exists and is the correct type. If error persists contact your system programmer to report the problem.

FOTS2018 ssh_rsa_verify: RSA modulus too small: *key_modulus* **< minimum** *rsa_min_modulus* **bits**

Explanation: Modulus for RSA key is too small.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the RSA key was properly generated. If the error persists contact your system programmer to report the problem.

FOTS2019 ssh_rsa_verify: cannot handle type *key_type*

Explanation: The RSA key is not the proper type.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify RSA key exists and is the correct type. If error persists contact your system programmer to report the problem.

FOTS2020 ssh_rsa_verify: remaining bytes in signature *rlen*

Explanation: RSA key signature error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify RSA key exists and is the correct type. If error persists contact your system programmer to report the problem.

FOTS2021 ssh_rsa_verify: len *len* **> modlen** *modlen*

Explanation: RSA key error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify RSA key exists and is the correct type. If error persists contact your system programmer to report the problem.

FOTS2022 ssh_rsa_verify: EVP_get_digestbynid *nid* **failed**

Explanation: RSA key error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify RSA key exists and is the correct type. If error persists contact your system programmer to report the problem.

FOTS2023 bad hashlen

Explanation: RSA key error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2024 bad siglen

Explanation: RSA key error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2025 RSA_public_decrypt failed: *error_string*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2026 bad decrypted len: *len* **!=** *hlen* **+** *oidlen*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2027 oid mismatch

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2028 hash mismatch

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2029 User name after tilde too long.

Explanation: User name is greater than 100 characters.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: User name must be less than 100 characters.

FOTS2030 Unknown user *user***.**

Explanation: Unknown user.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the user exists on the system. If error persists contact your system programmer to report the problem.

FOTS2031 Home directory too long (*len* **>** *maxpathlen***)**

Explanation: The pathlen of the home directory exceeds *maxpathlen*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Home directory cannot exceed *maxpathlen* characters.

FOTS2032 cfsetispeed failed for *baud*

Explanation: TTY error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2033 **cfsetospeed failed for** *baud*

Explanation: TTY error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2034 **getgroups:** *error_message*

Explanation: getgroups()system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2035 **initgroups:** *pw_name***:** *error_message*

Explanation: initgroups() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2036 *function***: was able to restore old [e]gid"**

Explanation: The function *function* failed because the process was able to switch back to its original group id. Internal error.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS2037 **setgroups:** *error_message*

Explanation: setgroups() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2038 **setegid** *gid***:** *error_message*

Explanation: setegid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2039 **seteuid** *uid***:** *error_message*

Explanation: seteuid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2040 **restore_uid: temporarily_use_uid not effective**

Explanation: Error restoring original uid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2041 *function***: egid incorrect gid:***gid* **egid:***egid* **(should be** *newgid***)**

Explanation: The function *function* failed because the process was able to switch back to its original group id. Internal error. *gid* is the current group id of the process. *egid* is the current effective group id of the process. *newgid* is the group id the process should be running as.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS2042 *function***: was able to restore old [e]gid"**

Explanation: The function *function* failed because the process was able to switch back to its original user id. Internal error.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS2043 *function***: euid incorrect uid:***uid* **euid:***euid* **(should be** *newuid***)**

Explanation: The function *function* failed because the process was able to switch back to its original user id. Internal error. *uid* is the current user id of the process. *euid* is the current effective user id of the process. *newuid* is the user id the process should be running as.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS2044 **permanently_set_uid: temporarily_use_uid effective**

Explanation: Error setting uid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2045 **setgid** *gid***:** *error_message*

Explanation: setgid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2046 setuid *UID*: *error_message*

Explanation: The setuid() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2047 xmalloc: zero size

Explanation: Call to xmalloc specified zero size.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2048 xmalloc: out of memory (allocating *size* **bytes)**

Explanation: Unable to allocate requested number of bytes.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2049 xrealloc: zero size

Explanation: Call to xrealloc specified zero size.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2050 xrealloc: out of memory (new_size *size* **bytes)**

Explanation: Unable to allocate requested number of bytes.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2051 xfree: NULL pointer given as argument

Explanation: NULL pointer given as argument to xfree.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2052 **newkeys_from_blob: remaining bytes in blob** *len*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2053 *function***: newkey == NULL**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2054 **close(s–>ptymaster):** *error_message*

Explanation: close() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2055 *function***: write**

Explanation: Failure writing to a socket.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2056 **xcalloc: zero size**

Explanation: The call to xcalloc() specified size of zero.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS2057 *function***: read:** *return_value*

Explanation: Could not read from a socket.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2058 *function***: read: bad msg_len** *msg_len*

Explanation: Message read from socket is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS2059 *function*: **read:** *ret_value* **!= msg_len**

Explanation: Number of bytes read from socket is incorrect.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote machine status. If error persists contact your system programmer to report the problem.

FOTS2060 *function*: **read: rtype** *rtype* **!= type** *type*

Explanation: Type read from socket does not match type expected.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS2061 *function*: **MONITOR_ANS_MODULI failed**

Explanation: Response received is not correct.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS2062 *function*: **BN_new failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2063 **xcalloc: nmemb * size > SIZE_T_MAX**

Explanation: The call to xcalloc() specified a size that is too large.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS2064 *function*: **struct passwd size mismatch**

Explanation: passwd structure received is not the correct size.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists contact your system programmer to report the problem.

FOTS2065 *function***: bad ivlen: expected** *block_size* **!=** *len*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2066 *function***: bad cipher name** *name* **or pointer** *cipher*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2067 *function***: can not setup mac** *mac_name*

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2068 *function***: bad mac key length:** *len* **>** *mac_len*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2069 *function***: conversion of newkeys failed**

Explanation: Error converting keys.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2070 key_from_blob: can't read key type

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2071 *function***: key_from_blob failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2072 key_from_blob: can't read rsa key

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2073 *function***: key_to_blob failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2074 key_from_blob: can't read dsa key

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2075 *function***: reply from monitor too large**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2076 *function***: sendmsg(***fd***):** *error_message*

Explanation: sendmsg() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2077 *function***: sendmsg: expected sent 1 got** *len*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2078 *function***: UsePrivilegeSeparation=yes not supported**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2079 *function*: **recvmsg:** *system error*

Explanation: recvmsg() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2080 *function*: **recvmsg: expected received 1 got** *len*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2082 *function*: **expected type** *SCM_RIGHTS* **got** *cmsg_type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2083 **percent_expand: NULL replacement**

Explanation: Unable to expand escape characters. A NULL escape character was found.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the escape characters are valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS2084 **input_gssapi_response: no authentication context**

Explanation: A protocol violation occurred. The ssh client has not created an authentication context for GSSAPI authentication.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2085 **Server returned different OID than expected**

Explanation: A protocol violation occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2088 *function*: **too many keys**

Explanation: Unable to expand escape characters. Too many escape characters were specified.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the escape characters are valid and don't exceed the limit, and try the request again. If unable to resolve, contact your system programmer.

FOTS2089 *function*: **string too long**

Explanation: Unable to expand escape characters. The resulting string is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the escape characters are valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS2090 **XXX too many packets with same key**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2091 **setsockopt IP_TOS** *tos*: *message*:

Explanation: setsockopt() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2092 *function*: **unknown key** %*escape_key*

Explanation: Unable to expand escape character. An unknown escape character %*escape_character* was specified.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the escape characters are valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS2093 **xcalloc: out of memory (allocating** *size* **bytes)**

Explanation: Unable to allocate the requested number of bytes *size*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS2094 **xasprintf: could not allocate memory**

Explanation: Unable to allocate the requested number of bytes.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS2095 xrealloc: nmemb * size > SIZE_T_MAX

Explanation: The call to xrealloc() specified a size that is too large.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS2096 WARNING: ***filename*** **does not exist, using fixed modulus**

Explanation: The fopen() system call failed to open file *filename*. Fixed modulus will be used.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the file *filename* exists, and try the request again. If unable to resolve, contact your system programmer.

FOTS2097 WARNING: no suitable primes in *filename*

Explanation: No suitable primes were found in file *filename*. Fixed modulus will be used.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the contents of file *filename* are valid, and try the request again. If unable to resolve, contact your system programmer.

FOTS2098 Warning: *filename*, **line** *line_number*: **keysize mismatch for host** *host_name*: **actual** *actual_keysize* **vs. announced** *announced_keysize*.

Explanation: The keysize *announced_keysize* on line *line_number* in file *filename* is incorrect. The correct keysize is *actual_keysize*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the keysize, and try the request again. If unable to resolve, contact your system programmer.

FOTS2099 Warning: replace *announced_keysize* **with** *actual_keysize* **in** *filename*, **line** *line_number*.

Explanation: The keysize *announced_keysize* on line *line_number* in file *filename* is incorrect. The correct keysize is *actual_keysize*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the keysize, and try the request again. If unable to resolve, contact your system programmer.

FOTS2101 No key to look up!

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2102 Error calculating host key fingerprint.

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2103 *function***: unsupported algorithm and/or digest_type**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2104 Too many bits: *bits* > *TEST_MAXIMUM*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2105 Too few bits: *bits* < *TEST_MINIMUM*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2106 Insufficient memory for tiny sieve: need *bytes* **bytes**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2107 Insufficient memory for small sieve: need *bytes* **bytes**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS2108 Error writing to modulus candidate file: *error_message*

Explanation: A call to fflush() failed on file *filename* The system error is displayed with this message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2109 BN_new failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2110 BN_copy: failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2111 BN_set_bit: failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2112 BN_set_word failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2113 BN_add failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2114 *function*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2115 BN_hex2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2116 kexdh_client: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2117 *function***: set_nonblock(***file_descriptor***)**

Explanation: Unable to set file descriptor *file_descriptor* to non–blocking. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2118 channel_add_adm_permitted_opens: too many forwards

Explanation: Too many port forwarding destinations specified for the sshd_config PermitOpen keyword.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid sshd_config PermitOpen keyword values, and try the request again.

FOTS2119 channel_prepare_select: max_fd (*maximum_file_descriptor***) is too large**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2120 reverse mapping checking getaddrinfo for *host_name* **[***ipaddr***] failed – POSSIBLE BREAK–IN ATTEMPT!**

Explanation: When **sshd** attempted to map *host_name* back to an IP address, a call to getaddrinfo() failed. **sshd** will use the socket IP address rather than the returned hostname from the Domain Name System (DNS) server.

System action: The program continues.

System programmer response: Verify that the entries in the Domain Name System (DNS) database are correct.

FOTS2121 get_socket_address: getnameinfo *flag* **failed:** *system error*

Explanation: A call to getnameinfo() failed with system error *system error*. *flag* is the argument of getnameinfo().

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2122 get_sock_port: getnameinfo NI_NUMERICSERV failed: *system error*

Explanation: A call to getnameinfo() failed with system error *system error*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of argument NI_NUMERICSERV. Contact your system programmer.

FOTS2123 BN_rand failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2124 buffer_consume_ret: trying to get more bytes than in buffer

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2125 buffer_get: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2126 buffer_put_bignum: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2127 buffer_get_bignum_ret: invalid length

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2128 buffer_get_bignum_ret: BN_bin2bn failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2129 buffer_get_bignum_ret: buffer_consume failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2130 buffer_get_bignum: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2131 buffer_put_bignum2: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2132 buffer_get_bignum2_ret: invalid bignum

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2133 buffer_get_bignum2_ret: negative numbers not supported

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2134 buffer_get_bignum2_ret: BN_bin2bn failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2135 buffer_get_bignum2: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2136 BN_lshift failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2137 BN_add_word failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2138 BN_rshift failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2139 ssh_msg_recv: read: header

Explanation: Internal error. Partial data was read into an internal buffer.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2140 ssh_msg_recv: read: *error_message*

Explanation: Internal error. Partial data was read into an internal buffer. The system error is displayed with the message.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2142 buffer_get_int: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2143 buffer_get_string_ret: buffer_get failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2144 buffer_get_string: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2145 buffer_get_char_ret: buffer_get_ret failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2146 buffer_get_char: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2147 buffer_get_string_bin: buffer error

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2148 buffer_get_string_bin_ret: buffer_get_ret failed

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2149 buffer_put_cstring_bin: s == NULL

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2150 RESTART FAILED: av[0]='*arg0*', error: *system error***.**

Explanation: A SIGHUP signal was sent to sshd, but sshd was unable to restart. A call to execv() with the argument *argv0* failed.

System action: The program ends.

System programmer response: Attempt to run *arg0* manually. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2151 Could not write ident string to *ipaddr*

Explanation: A write to the socket failed while sshd was trying to send the SSH protocol version identification string to the peer.

System action: The daemon handling the connection ends.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2152 Did not receive identification string from *ipaddr*

Explanation: sshd could not read the remote system's version identification.

System action: The daemon handling the connection ends.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2153 Bad protocol version identification '*versionstring***' from** *ipaddr*

Explanation: The local SSH daemon discovered a version incompatibility. sshd discovered that the remote system's version of SSH is not compatible with this version of SSH. The remote system is *ipaddr*. The version of SSH on the remote system is *versionstring*.

System action: The program ends.

System programmer response: Upgrade the SSH client on the remote system. Verify that the version on the remote system works properly.

FOTS2154 probed from *remote_ip* **with** *version***. Don't panic.**

Explanation: During version identification exchange, sshd discovered that the remote system's version of SSH indicates it is a probe. The remote system is *remote_ip*. The version string of SSH that attempted a connection is *version*.

System action: The daemon handling the connection ends.

System programmer response: Follow local procedures for handling probes.

FOTS2155 scanned from *remote_ip* **with** *version***. Don't panic.**

Explanation: During version identification exchange, sshd discovered that the remote system's version of SSH indicates it is a scanner, such as what might be sent by a ScanSSH program. The remote system is *remote_ip*. The version string of SSH that attempted a connection is *version*.

System action: The daemon handling the connection ends.

System programmer response: Follow local procedures for handling SSH scans.

FOTS2156 Protocol major versions differ for *remoteip***:** *sversion* **vs.** *cversion*

Explanation: During version identification exchange, sshd discovered that the remote system's version of SSH, *cversion*, is not compatible with the local version of SSH, *sversion*. The remote system is *remote_ip*.

System action: The daemon handling the connection ends.

System programmer response: Verify that the remote version of SSH is compatible with the local version being run by the daemon. If compatible, follow local procedures for reporting problems to IBM.

FOTS2157 sshd: no hostkeys available -- exiting.

Explanation: During initialization, sshd could not find any host keys for either Protocol Version 1 or Protocol Version 2.

System action: The program ends.

System programmer response: Generate the host keys. See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on setting up the host keys for sshd.

FOTS2158 User *username* not allowed because shell *shell* does not exist

Explanation: sshd refused access to user *username* because the user's default program is set to *shell*, and *shell* does not exist.

System action: The program continues.

System programmer response: Follow local procedures for setting up user accounts.

FOTS2159 User *username* not allowed because shell *shell* is not executable

Explanation: sshd refused access to user *username* because the user's default program is set to *shell*, and *shell* is not marked as executable.

System action: The program continues.

System programmer response: If the intent is to allow access to the user, change the POSIX permissions of *shell* to make it executable. See the "chmod" command in *z/OS UNIX System Services Command Reference* for more information.

FOTS2160 User *username* not allowed because listed in DenyUsers

Explanation: sshd refused access to user *username* because the user was denied access through the DenyUsers keyword in the sshd_config file.

System action: The program continues.

System programmer response: None.

FOTS2161 User *username* not allowed because not listed in AllowUsers

Explanation: sshd refused access to user *username* because the username is not listed with the AllowUsers keyword in the sshd_config file.

System action: The program continues.

System programmer response: None.

FOTS2162 User *username* not allowed because not in any group

Explanation: sshd refused access to user *username* because the user does not have any groups associated with it.

System action: The program continues.

System programmer response: Follow local procedures for setting up user accounts.

FOTS2163 User *username* not allowed because a group is listed in DenyGroups

Explanation: sshd refused access to user *username* because the user belongs to a group which was denied access through the DenyGroups keyword in the sshd_config file.

System action: The program continues.

System programmer response: None.

FOTS2164 User *username* not allowed because none of user's groups are listed in AllowGroups

Explanation: sshd refused access to user *username* because the user belongs to a group which is not listed with the AllowGroups keyword in the sshd_config file.

System action: The program continues.

System programmer response: None.

FOTS2165 ROOT LOGIN REFUSED FROM *ipaddr*

Explanation: sshd refused access to a superuser due to the setting of the PermitRootLogin keyword in the sshd_config file.

System action: The program continues.

System programmer response: None.

FOTS2166 Authentication refused for *username***: bad owner or modes for** *filename*

Explanation: sshd refused access to a user *username* because either the permissions on the user's hostfile *filename* are too open, the file is not owned by *username*, or a call to stat() failed for *filename*.

System action: The program continues.

System programmer response: Instruct the user to correct their setup.

FOTS2167 User *username* **from** *ipaddr* **not valid**

Explanation: sshd refused access to a user *username* because sshd does not recognize *username* as a valid user on the local system. Specifically, a call to getpwnam() for *username* failed.

System action: The program continues.

System programmer response: None.

FOTS2168 Authentication tried for *username* **with correct key but not from a permitted host (host=***hostname***, ip=***hostip***).**

Explanation: sshd refused access to a user *username* because the user's authorized_keys file has a "from=" option specification which does not permit *hostname* or *hostip*.

System action: The program continues.

System programmer response: None.

FOTS2169 Bad options in *authfile* **file, line** *linenum***:** *options*

Explanation: sshd refused access to a user because the user's authorized_keys file *authfile* has a bad options specification string *options* on line *linenum* of the file.

System action: The program continues.

System programmer response: None.

FOTS2170 Client on *hostname* **failed to respond correctly to host authentication."**

Explanation: sshd refused access to a user during RhostsRSAAuthentication because the ssh client on *hostname* did not respond correctly to the challenge.

System action: The program continues.

System programmer response: Check that the public host key for *hostname* is valid in the system-wide known hosts file. Instruct the user to verify that the public host key for *hostname* is valid in their known hosts file.

FOTS2171 Rhosts authentication refused for *username***: no home directory** *dirname*

Explanation: sshd refused access to user *username* because the user's HOME directory *dirname* does not exist or is inaccessible. A call to stat() for *dirname* failed.

System action: The program continues.

System programmer response: Follow local procedures for setting up user accounts.

FOTS2172 Rhosts authentication refused for *username***: bad ownership or modes for home directory.**

Explanation: sshd refused access to user *username* because the user's HOME directory is writable by others, or is not owned by the user.

System action: The program continues.

System programmer response: Follow local procedures for setting up user accounts.

FOTS2173 Rhosts authentication refused for *username***: bad modes for** *filename*

Explanation: sshd refused access to user *username* because the user's rhosts file *filename* is writable by others, or is not owned by the user.

System action: The program continues.

System programmer response: Instruct the user to correct the file modes and/or ownership.

FOTS2174 Authentication refused: *errortext*

Explanation: sshd refused access to a user because the user's authorized keys file, or some component of the pathname, is not secure. The text *errortext* explains further the cause of the problem.

System action: The program continues.

System programmer response: Instruct the user to take action based on *errortext*.

FOTS2175 Nasty PTR record "*name***" is set up for** *ipaddr***, ignoring**

Explanation: When sshd performed a reverse lookup for *ipaddr*, it received a numeric hostname *name*. sshd will use the IP address rather than the returned hostname.

System action: The program continues.

System programmer response: Verify that the entries in the Domain Name System (DNS) database are correct.

FOTS2176 reverse mapping checking getaddrinfo for *hostname* **failed – POSSIBLE BREAKIN ATTEMPT!**

Explanation: When sshd attempted to map *hostname* back to an IP address, a call to getaddrinfo() failed. sshd will use the socket IP address rather than the returned hostname from the Domain Name System (DNS) server.

System action: The program continues.

System programmer response: Verify that the entries in the Domain Name System (DNS) database are correct.

FOTS2177 Address *ipaddr* **maps to** *hostname***, but this does not map back to the address – POSSIBLE BREAK–IN ATTEMPT!**

Explanation: When sshd attempted to map *hostname* back to an IP address using DNS, the returned IP address *ipaddr* differed from that associated with the socket. sshd will use the socket IP address rather than the returned hostname from the Domain Name System (DNS) server.

System action: The program continues.

System programmer response: Verify that the entries in the Domain Name System (DNS) database are correct.

FOTS2178 Connection from *ipaddr* **with IP options:***options*

Explanation: A call to getsockopt() failed for the IP address *ipaddr* with options *options*.

System action: The program ends.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2179 Invalid command.

Explanation: The ssh user attempted to open a command line using the escape character with "C". Only -L and -R (to add port forwardings) are supported commands, but the user entered something else.

System action: The program continues.

User response: Only use the -L or -R options with the command line escape.

FOTS2180 Not supported for SSH protocol version 1.

Explanation: The ssh user attempted to open a command line and specify local port forwarding (using -L) using the escape character with "C". This is not supported for SSH Protocol Version 1.

System action: The program continues.

User response: Use -L in an open command line with SSH Protocol Version 2.

FOTS2181 Bad forwarding port(s)."

Explanation: One of the port numbers specified with ssh options -R or -L are invalid. A port number should be greater than zero and less than or equal to 65535.

System action: The program continues.

User response: Reissue **ssh** with valid port numbers.

FOTS2182 Port forwarding failed.

Explanation: ssh was unable to set up port forwarding. Another error message describes the problem.

System action: The program continues.

User response: If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2183 User *username* **not allowed because** *progname* **exists**

Explanation: User *username* was not allowed to log in because the nologin program, *progname*, exists.

System action: The program ends.

System programmer response: None.

FOTS2184 No user exists for uid *UID*

Explanation: A call to getpwuid() failed for the current running user id.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS2185 Packet integrity error (*length* **bytes remaining) at** *filename***:***linenum*

Explanation: An internal error occurred.

System action: The program ends.

User response: Follow local procedures for reporting problems to IBM.

FOTS2186 tcgetattr: *error_message*

Explanation: The tcgetattr() system call failed. The daemon is unable to set the terminal modes for the child session. The system error is displayed with the message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2187 **Setting tty modes failed:** *system error*

Explanation: A call to tcsetattr() failed. The daemon is unable to set the terminal modes for the child session.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2188 *type* **host key for IP address '***ipaddr***' not in list of known hosts.**

Explanation: ssh found the user has an old-style user known_hosts file, known_hosts2, and checked that file for the host key for *ipaddr*. ssh was unable to find the host key of type *type* for *ipaddr*. The IP address is being checked because CheckHostIP is enabled.

System action: The program continues.

User response: Verify you really meant to use the known_hosts2 file. If so, add the correct host key for *ipaddr*. It is possible the host key just changed.

FOTS2189 **Failed to add the** *type* **host key for IP address '***ipaddr***' to the list of known hosts (***hostfile***).**

Explanation: ssh attempted to add the host key for *ipaddr* to the user hostfile *hostfile*, but failed. The host key attempted is of type *type*. The IP address is being checked because CheckHostIP is enabled.

System action: The program continues.

User response: Verify that the user hostfile *hostfile* is writable by the user.

FOTS2190 **Failed to add the host to the list of known hosts (***hostfile***).**

Explanation: ssh detected a new host key and attempted to add it to the user hostfile *hostfile*, but failed.

System action: The program continues.

User response: Verify that the user hostfile *hostfile* is writable by the user.

FOTS2191 **WARNING: Encryption is disabled! Password will be transmitted in clear text.**

Explanation: The user is using ssh with Protocol Version 1 and password authentication. ssh detected a cipher is not getting used for encryption. This should not occur, since in Protocol Version 1 if "none" is specified, 3des should be used.

System action: The program continues.

User response: Follow local procedures for reporting problems to IBM.

FOTS2192 **Warning: privilege separation user should not be UID 0.**

Explanation: The privilege separation user (SSHD) is defined to be UID 0, but it should be defined to an unprivileged (non-UID 0) user ID. Defining this user as UID 0 may decrease the effectiveness of privilege separation. This may also cause problems with some security products.

System action: The program continues.

System programmer response: Redefine the SSHD privilege separation user to be a non-UID 0 user ID.

FOTS2193 Failed to change code sets to convert between "*from_codeset*" and "*to_codeset*".

Explanation: The OpenSSH daemon attempted to change the internal code sets used for data conversion. This occurs if the remote process changes the code sets of the terminal. For example, a user issuing the **chcp** command from the remote shell could initiate this processing.

System action: The daemon will continue to use the previous setting for data conversion. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that conversion is possible between the code sets specified by the user. If unable to resolve, contact your system programmer.

FOTS2194 __tcgetcp() failed: *system error*

Explanation: A call to __tcgetcp() failed while **sshd** was trying to obtain the code set information for the master pty. The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2195 *function* **failed :** *system error*

Explanation: A call to *function* failed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2196 iconv failed. Conversion stopped at 0x*hexbyte*. System Error: *system error*

Explanation: A call to iconv() failed indicating that a byte did not have a representation in the destination codeset. Conversion failed at byte *hexbyte*. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that conversion is possible between the code sets specified by the user. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2197 *function_name***: read only partial extended packet data. len:***bytes* **data:***packet flag* **System Error:***system error*

Explanation: A call to read() expected at least four bytes of extended packet data and received only *bytes* bytes, shown in *packet flag*. If an application attempted to change the code sets for the allocated terminal, this action may not have been performed. The system error is displayed with this message.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that conversion is possible between the code sets specified by the user. If applicable, reissue the **chcp** command. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2198 kexgex_client: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2199 X11 connection rejected because of wrong authentication.

Explanation: An X11 connection has been rejected because of incorrect authentication information.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the authentication information for the X11 connection is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS2201 ssh_kex: BN_set_word failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2202 ssh_kex: BN_lshift failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2203 ssh_kex: BN_add_word failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2204 ssh: connect to host *host_name* **port** *port***:** *error_message*

Explanation: Connection to host *host_name* on port *port* could not be established. The system error is displayed with the message.

System action: The program continues.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that a server is listening for connections on the specified host and port, and try the request again. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2205 Connection timed out during banner exchange

Explanation: The connection timed out while exchanging banner information.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a server is listening for connections on the specified host and port, and try the request again. If unable to resolve, contact your system programmer.

FOTS2206 ssh_exchange_identification: select: *error_message*

Explanation: The select() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2207 ssh_exchange_identification: No banner received

Explanation: The connection failed to complete the banner exchange. No banner was received.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that a server is listening for connections on the specified host and port, and try the request again. If unable to resolve, contact your system programmer.

FOTS2208 Tunnel forwarding is disabled to avoid man–in–the–middle attacks.

Explanation: Strict host key checking (refer to the ssh_config StrictHostKeyChecking keyword) has not been requested, so the connection is allowed, but tunnel forwarding is disabled.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: The ssh_config Tunnel keyword is not supported on z/OS UNIX. Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config keywords. If unable to resolve, contact your system programmer.

FOTS2209 Couldn't execute *shell_path* **–c "***shell_arguments***":** *error_message*

Explanation: The execl() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2210 Couldn't wait for child: *error_message*

Explanation: The waitpid() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2211 PRIV_START: seteuid: *error_message*

Explanation: The seteuid() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error. Also, verify that the **ssh** command has the noshareas extended attribute set.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2212 PRIV_END: seteuid: *error_message*

Explanation: The seteuid() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error. Also, verify that the ssh program has the noshareas extended attribute set. The attribute can be set via the **extattr** command.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2213 Warning: No xauth data; using fake authentication data for X11 forwarding.

Explanation: Unable to generate xauth key data for X11 forwarding. Fake data will be used.

System action: The program continues.

User response: Verify that the location of the xauth program is valid and that the program is capable of generating the required xauth key data, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config XAuthLocation keyword.

FOTS2214 Timeout, server not responding.

Explanation: The **ssh** sesssion ended because the server did not respond within the time allowed. The number of server alive messages sent exceeded the value set by the ssh_config ServerAliveCountMax keyword.

System action: The program ends.

User response: Verify that the server is active, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config ServerAliveCountMax keyword.

FOTS2215 Could not request tunnel forwarding.

Explanation: The tunnel forwarding request has failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Tunnel forwarding is not supported on z/OS UNIX. Remove the tunnel forwarding request, and try again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on tunnel forwarding. If unable to resolve, contact your system programmer.

FOTS2216 Could not request tunnel forwarding.

Explanation: The tunnel forwarding request has failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Tunnel forwarding is not supported on z/OS UNIX. Remove the tunnel forwarding request, and try again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on tunnel forwarding. If unable to resolve, contact your system programmer.

FOTS2217 Error: remote port forwarding failed for listen port *listen_port*

Explanation: A remote forwarding request failed for listen port *listen_port*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: The server failed to complete the remote forwarding request. Verify that the remote forwarding request is valid on the server, and try the request again. If unable to resolve, contact your system programmer.

FOTS2218 ControlPath too long

Explanation: The control path is too long.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the control path is valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config ControlPath keyword. If unable to resolve, contact your system programmer.

FOTS2219 *function* **socket():** *error_message*

Explanation: The socket() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2220 Not supported.

Explanation: Cancel local forwarding –KL is not a supported **ssh** command line option.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2221 Bad forwarding close port

Explanation: Bad port specified for the –KR **ssh** command line option.

System action: The program continues.

User response: Verify that a valid port is specified, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2222 Bad forwarding specification.

Explanation: Bad forwarding specification for a **ssh** command line option.

System action: The program continues.

User response: Verify that a valid forwarding specification was specified, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2224 ControlSocket *control_path* **already exists**

Explanation: The control socket for the control path *control_path* already exists.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the control path does not exist, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config ControlPath keyword. If unable to resolve, contact your system programmer.

FOTS2225 *function* **bind():** *error_message*

Explanation: The bind() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2226 client_input_channel_req: request for channel –1

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2227 client_input_channel_req: unexpected channel *session_id*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2228 Warning: untrusted X11 forwarding setup failed: xauth key data not generated

Explanation: Untrusted X11 forwarding could not be set up because xauth key data could not be generated.

System action: The program continues.

User response: Verify that the location of the xauth program is valid and that the program is capable of generating the required xauth key data, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config XAuthLocation keyword.

FOTS2229 *function***: no channel for id** *channel_id*

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2230 **Request failed on channel** *channel_id*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2231 *function*: **cctx == NULL**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2232 *function* **accept:** *error_message*

Explanation: The accept() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2233 *function* **getpeereid failed:** *error_message*

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2234 **control mode uid mismatch: peer euid** *peer_effective_UID* **!= uid** *real_UID*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2235 *function*: **client msg_recv failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2236 *function*: **wrong client version** *version*

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2237 *function***: client msg_send failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2238 **Unsupported command** *command_value*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2239 **Refused control connection**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2240 **client_session2_setup: channel** *channel_id***: unknown channel**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2241 *function***: failed to receive fd** *file_descriptor* **from slave**

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2242 *function***: tcgetattr:** *error_message*

Explanation: The tcgetattr() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2243 Tunnel forwarding is not supported for protocol 1

Explanation: Tunnel forwarding is not supported for SSH protocol version 1.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: The ssh_config Tunnel keyword is not supported on z/OS UNIX. Remove the keyword from the ssh_config file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config Tunnel keyword. If unable to resolve, contact your system programmer.

FOTS2244 Tunnel device open failed.

Explanation: The tunnel device failed to open.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: The ssh_config Tunnel keyword is not supported on z/OS UNIX. Remove the keyword from the ssh_config file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config Tunnel keyword. If unable to resolve, contact your system programmer.

FOTS2245 *filename* **line** *line_number***: Bad number.**

Explanation: The value for the ssh_config keyword in file *filename* at line *line_number* contains a bad number.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for the ssh_config keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config keywords. If unable to resolve, contact your system programmer.

FOTS2246 *filename* **line** *line_number***: Invalid RekeyLimit suffix**

Explanation: The ssh_config RekeyLimit keyword in file *filename* at line *line_number* is set to a value that contains an invalid suffix.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for the ssh_config RekeyLimit keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config RekeyLimit keyword. If unable to resolve, contact your system programmer.

FOTS2247 *filename* **line** *line_number***: RekeyLimit too large**

Explanation: The ssh_config RekeyLimit keyword in file *filename* at line *line_number* is set to a value that is too large.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for the ssh_config RekeyLimit keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config RekeyLimit keyword. If unable to resolve, contact your system programmer.

FOTS2248 *filename* **line** *line_number***: RekeyLimit too small**

Explanation: The ssh_config RekeyLimit keyword in file *filename* at line *line_number* is set to a value that is too small.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for the ssh_config RekeyLimit keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config RekeyLimit keyword. If unable to resolve, contact your system programmer.

FOTS2249 *filename* **line** *line_number***: missing address family.**

Explanation: The ssh_config AddressFamily keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that a value for the ssh_config AddressFamily keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config AddressFamily keyword. If unable to resolve, contact your system programmer.

FOTS2250 *filename* **line** *line_number***: Invalid environment name.**

Explanation: The sshd_config SendEnv keyword in file *filename* at line *line_number* is set to a value that contains an invalid environment variable name.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for the ssh_config SendEnv keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config SendEnv keyword. If unable to resolve, contact your system programmer.

FOTS2251 *filename* **line** *line_number***: too many send env.**

Explanation: Too many environment variables have been specified by the ssh_config SendEnv keywords.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the ssh_config SendEnv keywords do not specify too many environment variables, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config SendEnv keyword. If unable to resolve, contact your system programmer.

FOTS2252 *filename* **line** *line_number***: Missing ControlMaster argument.**

Explanation: The ssh_config ControlMaster keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that a value for the ssh_config ControlMaster keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config ControlMaster keyword. If unable to resolve, contact your system programmer.

FOTS2253 *filename* **line** *line_number***: Bad ControlMaster argument.**

Explanation: The ssh_config ControlMaster keyword in file *filename* at line *line_number* is set to an unsupported value.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for the ssh_config ControlMaster keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config ControlMaster keyword. If unable to resolve, contact your system programmer.

FOTS2254 *filename* **line** *line_number***: Missing yes/point–to–point/ethernet/no argument.**

Explanation: The ssh_config Tunnel keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: The ssh_config Tunnel keyword is not supported on z/OS UNIX. Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config Tunnel keyword. If unable to resolve, contact your system programmer.

FOTS2255 *filename* **line** *line_number***: Bad yes/point–to–point/ethernet/no argument:** *value*

Explanation: The ssh_config Tunnel keyword in file *filename* at line *line_number* is set to an unsupported value *value*.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: The ssh_config Tunnel keyword is not supported on z/OS UNIX. Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config Tunnel keyword. If unable to resolve, contact your system programmer.

FOTS2256 *filename* **line** *line_number***: Bad tun device.**

Explanation: The ssh_config TunnelDevice keyword in file *filename* at line *line_number* is set to an unsupported value.

System action: The program ends.

System programmer response: If file *filename* refers to the system–wide ssh_config file then correct the error in the file, and have the user try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: The ssh_config TunnelDevice keyword is not supported on z/OS UNIX. Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the ssh_config TunnelDevice keyword. If unable to resolve, contact your system programmer.

FOTS2257 fstat *filename***:** *error_message*

Explanation: The fstat() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2258 Bad owner or permissions on *filename*

Explanation: The owner or access permissions on file *filename* are set to values that are not secure.

System action: The program ends.

User response: Verify that you own the file and that write access permission is only granted to the owner, and try the request again.

FOTS2259 Commands:

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2260 –L[bind_address:]port:host:hostport Request local forward

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2261 –R[bind_address:]port:host:hostport Request remote forward

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2262 –KR[bind_address:]port Cancel remote forward

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2263 !args Execute local command

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2264 No support for tunnel device forwarding.

Explanation: The **ssh** –w option is not supported on z/OS UNIX.

System action: The program continues.

User response: Verify that the **ssh** –w option is not specified, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –w option.

FOTS2265 Warning: Could not request remote forwarding.

Explanation: A remote forwarding request has failed.

System action: The program continues.

System programmer response: Take appropriate action based on the error messages displayed with this message. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Check for additional error messages displayed with this message, and take appropriate action. If unable to resolve, contact your system programmer.

FOTS2266 Warning: remote port forwarding failed for listen port *listen_port*

Explanation: A remote forwarding request failed for listen port *listen_port*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: The server failed to complete the remote forwarding request. Verify that the remote forwarding request is valid on the server, and try the request again. If unable to resolve, contact your system programmer.

FOTS2267 Pseudo–terminal will not be allocated because stdin is not a terminal.

Explanation: A pseudo–terminal will not be allocated because stdin is not a terminal.

System action: The program continues.

User response: If a pseudo–terminal must be allocated then use the **ssh** –t option to force the allocation of a pseudo–terminal. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** –t option.

FOTS2268 Warning: Remote host refused compression.

Explanation: The compression request sent to the server failed or was denied.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the server is set up to allow compression, and try the request again. If unable to resolve, contact your system programmer.

FOTS2269 Warning: Remote host failed or refused to allocate a pseudo tty.

Explanation: The pseudo tty request sent to the server failed or was denied.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the server is set up to allow pseudo tty allocation, and try the request again. If unable to resolve, contact your system programmer.

FOTS2270 Warning: Remote host denied X11 forwarding.

Explanation: The X11 forwarding request sent to the server failed or was denied.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the server is set up to allow X11 forwarding, and try the request again. If unable to resolve, contact your system programmer.

FOTS2271 Warning: Remote host denied authentication agent forwarding.

Explanation: The agent forwarding request sent to the server failed or was denied.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the server is set up to allow agent forwarding, and try the request again. If unable to resolve, contact your system programmer.

FOTS2272 Agent forwarding disabled for protocol 1.3

Explanation: Agent forwarding not supported with SSH protocol version 1.3.

System action: The program continues.

User response: Use SSH protocol version 2, and try the request again.

FOTS2273 Warning: Permanently added the *key_type* **host key for IP address '***ip_address***' to the list of known hosts.**

Explanation: The *key_type* host key for IP address *ip_address* was added to your known hosts file.

System action: The program continues.

User response: Verify that the added host key matches the server's actual host key. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on setting up server authentication.

FOTS2274 Warning: Permanently added '*host_name***' (***key_type***) to the list of known hosts.**

Explanation: The *key_type* host key for host *host_name* was added to your known hosts file.

System action: The program continues.

User response: Verify that the host key added matches the server's actual host key. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on setting up server authentication.

FOTS2275 WARNING: *key_type* **key found for host** *host_name* **in** *filename***:***line_number key_type* **key fingerprint** *key_fingerprint***.**

Explanation: The *key_type* host key for host *host_name* was found in file *filename* at line *line_number*.

System action: The program continues.

User response: Verify that the host key found matches the server's actual host key. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on setting up server authentication.

FOTS2276 Warning: the *key_type* **host key for '***host_name***' differs from the key for the IP address '***ip_address***' Offending key for IP in**
*filename***:***line_number*

Explanation: The host key found for host name *host_name* differs from the key found for IP address *ip_address*. The offending IP address key was found in file *filename* at line *line_number*.

System action: The program continues.

User response: Correct the host keys, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on setting up server authentication.

FOTS2277 Matching host key in *filename***:***line_number*

Explanation: The host key found for the host name differs from the key found for the IP address. The offending host name key was found in file *filename* at line *line_number*.

System action: The program continues.

User response: Correct the host key, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on setting up server authentication.

FOTS2278 *function***: no channel for id** *channel_id*

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2279 *function***: stat("***filename***") failed:** *error_message*

Explanation: The stat() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2280 *function***: fstat(***file_descriptor***) failed:** *error_message*

Explanation: The fstat() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2281 *function***: open("***filename***") failed:** *error_message*

Explanation: The open() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2282 *function***: open("/dev/zero") not valid**

Explanation: The /dev/zero file opened is not valid. The error occurred in *function*.

System action: The program continues.

System programmer response: Verify that the /dev/zero file is a valid character special file. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2283 *function*: **dup2(***file_descriptor1*, *file_descriptor2***) failed:** *error_message*

Explanation: The dup2() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2284 *function*: **unknown alg** *host_key_algorithm*

Explanation: One of the host keys for a hostname specified a *host_key_algorithm* algorithm that was not recognized. The error occurred in *function*.

System action: The program ends.

System programmer response: Check the host keys for errors. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2285 *function*: **no authentication context**

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2286 **Unexpected authentication success during** *auth_method*

Explanation: During user authentication, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2287 **Authenticated with partial success.**

Explanation: During user authentication, an authentication method required by the AuthenticationMethods option was successful, but one or more authentication methods are required and will be attempted.

System action: The program continues.

FOTS2288 **ssh_keysign: not installed:** *error_message*

Explanation: The ssh-keysign command was not found.

System action: The program continues.

System programmer response: Verify that ssh-keysign is properly installed. Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2289 Certificate for *host* contains unsupported critical options(s)

Explanation: The *host* certificate contains a critical option that is not recognized.

System action: The program continues.

System programmer response: Correct the OpenSSH host certificate and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2290 @ WARNING: REVOKED HOST KEY DETECTED! The *keytype* host key for *host* is marked as revoked. This could mean that a stolen key is being used to impersonate this host.

Explanation: ssh has detected that the remote host key was revoked.

System action: The program continues unless strict host key checking is enabled.

User response: Check that you have a valid host key for the remote host.

FOTS2294 *key type* host key for *host* was revoked and you have requested strict checking.

Explanation: Strict host key checking (ssh configuration option StrictHostKeyChecking) is enabled which causes ssh to exit if the host key has been revoked.

System action: The program ends.

System programmer response: None.

User response: Edit the key in your user known hosts file.

FOTS2295 Error: forwarding disabled due to host key check failure

Explanation: Forwarding has been disabled because host key check failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the host keys are valid.

FOTS2296 Couldn't drop certificate

Explanation: An attempt to downgrade a certificate to a raw key failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the host certificates are valid.

FOTS2297 Cannot specify multiplexing command with -W

Explanation: An attempt to send a command to the multiplexing master process was failed because the -W option (forwarding stdio over the secure channel) was also specified. These options are mutually exclusive.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Remove the -W option and retry.

FOTS2298 Multiplexing command already specified

Explanation: Multiple multiplexing command options (-O) were supplied, but only one is allowed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Remove the additional -O options and retry.

FOTS2299 Unsupported query "*query_type*"

Explanation: The -Q option was specified with an unsupported *query_type*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Respecify the *query_type* and retry.

FOTS2306 User *user_name* from *host_name* not allowed because listed in DenyUsers

Explanation: Access denied for user *user_name*. The user was denied access through the sshd_config DenyUsers keyword.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config DenyUsers keyword.

FOTS2307 User *user_name* from *host_name* not allowed because not listed in AllowUsers

Explanation: Access denied for user *user_name*. The user was not listed with the sshd_config AllowUsers keyword.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config AllowUsers keyword.

FOTS2308 User *user_name* from *host_name* not allowed because not in any group

Explanation: Access denied for user *user_name*. The user does not have any groups associated with it.

System action: The program continues.

System programmer response: Follow local procedures for setting up user accounts.

FOTS2309 User *user_name* from *host_name* not allowed because a group is listed in DenyGroups

Explanation: Access denied for user *user_name*. The user belongs to a group that was denied access through the sshd_config DenyGroups keyword.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config DenyGroups keyword.

FOTS2310 User *user_name* from *host_name* not allowed because none of user's groups are listed in AllowGroups

Explanation: Access denied for user *user_name*. The user belongs to groups that were not listed with the sshd_config AllowGroups keyword.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config AllowGroups keyword.

FOTS2311 expand_authorized_keys: path too long

Explanation: The pathname for the user's authorized_keys file is too long.

System action: The program ends.

System programmer response: Verify that the value of the sshd_config AuthorizedKeysFile keyword is valid. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2312 auth_rsa_generate_challenge: BN_rand failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2313 auth_rsa_generate_challenge: BN_mod failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2314 kexdh_server: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2315 *function***: Unexpected KEX type** *KEX_type*

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2316 DH_compute_key: failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2317 kexgex_server: BN_bin2bn failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2318 *function***: Cannot find account for uid** *UID*

Explanation: The getpwuid() system call failed to get information about a user with UID *UID*. The failure occurred in *function*.

System action: The program ends.

System programmer response: Verify that the UID is valid. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2319 *function***: Cannot find user "***user_name***"**

Explanation: The getpwnam() system call failed to get information about user *user_name*. The failure occurred in *function*.

System action: The program ends.

System programmer response: Verify that the user name *user_name* is valid. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2323 *function*: **authentication method name unknown**

Explanation: A client attempted an unknown authentication method. The failure occurred in *function*.

System action: The program ends.

System programmer response: Verify that the client is requesting valid authentication methods. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2324 *function*: **send fds failed**

Explanation: Failed to send terminal file descriptors to the unprivileged child process. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2326 *function*: **write:** *error_message*

Explanation: The write() system call failed. The system error is displayed with the message. The failure occurred in *function*.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error and take the appropriate action. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2327 *function*: **read:** *error_message*

Explanation: The read() system call failed. The system error is displayed with the message. The failure occurred in *function*.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error and take the appropriate action. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2328 *function*: **option block size mismatch**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2329 *function*: **receive fds failed**

Explanation: Failed to receive terminal file descriptors from the monitor process. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2330 **listen on [***host_name***]:***port***:** *error_message*

Explanation: The sshd daemon failed to listen on port *port*. The listen() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2331 reexec socketpair: *error_message*

Explanation: The socketpair() system call failed. The system error is displayed with the message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2332 *function***: ssh_msg_send failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2333 *function***: ssh_msg_recv failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2334 *function***: rexec version mismatch**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2335 sshd re–exec requires execution with an absolute path

Explanation: The **sshd** command was called without using an absolute path.

System action: The program ends.

System programmer response: Call the **sshd** command using an absolute path, and try the request again.

FOTS2336 rexec of *filename* **failed:** *error_message*

Explanation: The execv() system call failed. The system error is displayed with the message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2337 session_x11_req: session *session_id***: x11 forwarding already active**

Explanation: The client requested X11 forwarding for session *session_id* when X11 forwarding is already active.

System action: The program continues.

System programmer response: Verify that the client requests X11 forwarding only when it's not already active. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2338 chroot path does not begin at root

Explanation: The chroot directory pathname does not begin at the current root directory ('/').

System action: The program ends.

System programmer response: Verify that the value of the sshd_config ChrootDirectory keyword is valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2339 chroot path too long

Explanation: The chroot directory pathname is too long.

System action: The program ends.

System programmer response: Verify that the value of the sshd_config ChrootDirectory keyword is valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2340 *function***: stat("***pathname_component***"):** *error_message*

Explanation: The stat() system call failed. The system error is displayed with the message. The failure occurred in *function* while processing pathname component *pathname_component* of the chroot directory pathname.

System action: The program ends.

System programmer response: Verify that the value of the sshd_config ChrootDirectory keyword is valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword and to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2341 bad ownership or modes for chroot directory *string***"***pathname_component***"**

Explanation: The pathname component *pathname_component* of the chroot directory pathname has incorrect ownership or mode settings.

System action: The program ends.

System programmer response: Verify that the ownership and mode settings of the chroot directory pathname components are valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2342 chroot path *string***"***pathname_component***" is not a directory**

Explanation: The pathname component *pathname_component* of the chroot directory pathname is not a directory.

System action: The program ends.

System programmer response: Verify that all pathname components of the chroot directory pathname are directories, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2343 Unable to chdir to chroot path "*pathname***":** *error_message*

Explanation: The chdir() system call failed to change the working directory to the chroot directory pathname *pathname*. The system error is displayed with the message.

System action: The program ends.

System programmer response: Verify that the value of the sshd_config ChrootDirectory keyword is valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2344 chroot("*pathname***"):** *error_message*

Explanation: The chroot() system call failed to change the root directory to the chroot directory pathname *pathname*. The system error is displayed with the message.

System action: The program ends.

System programmer response: Verify that the value of the sshd_config ChrootDirectory keyword is valid, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2345 *function***: chdir(/) after chroot:** *error_message*

Explanation: The chdir() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2346 **session_close_single_x11: no x11 channel** *channel_id*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2347 **You must change your password now and login again!**

Explanation: Your password has expired and must be changed.

System action: The program continues.

User response: Change your password and login again.

FOTS2348 *function***: no message header**

Explanation: No message header found while attempting to receive a file descriptor. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Try the request again. If unable to resolve, contact your system programmer.

FOTS2349 *filename* **line** *line_number***: Directive '***keyword***' is not allowed within a Match block**

Explanation: The keyword *keyword* in file *filename* at line *line_number* is not allowed within a Match block specified by the Match keyword.

System action: The program ends.

System programmer response: Verify that the keywords within the Match block are correct, and try the request again. Refer to the OpenSSH daemon configuration files information in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the Match keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2350 *filename* **line** *line_number***: missing address family.**

Explanation: The sshd_config AddressFamily keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: Verify that a value for the sshd_config AddressFamily keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config AddressFamily keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2351 *filename* **line** *line_number***: address family must be specified before ListenAddress.**

Explanation: The sshd_config AddressFamily keyword in file *filename* at line *line_number* must be specified before the sshd_config ListenAddress keyword.

System action: The program ends.

System programmer response: Specify the sshd_config AddressFamily keyword before the sshd_config ListenAddress keyword in the file *filename*, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config keywords. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2352 *filename* **line** *line_number***: unsupported address family "***value***".**

Explanation: The sshd_config AddressFamily keyword in file *filename* at line *line_number* is set to an unsupported value *value*.

System action: The program ends.

System programmer response: Verify that the value for the sshd_config AddressFamily keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config AddressFamily keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2353 *filename* **line** *line_number***: missing yes/no/delayed argument.**

Explanation: The sshd_config Compression keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: Verify that a value for the sshd_config Compression keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config Compression keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2354 *filename* **line** *line_number***: Bad yes/no/delayed argument:** *value*

Explanation: The sshd_config Compression keyword in file *filename* at line *line_number* is set to an unsupported value *value*.

System action: The program ends.

System programmer response: Verify that the value for the sshd_config Compression keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config Compression keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2355 *filename* **line** *line_number***: missing yes/no/clientspecified argument.**

Explanation: The sshd_config GatewayPorts keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: Verify that a value for the sshd_config GatewayPorts keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config GatewayPorts keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2356 *filename* **line** *line_number***: Bad yes/no/clientspecified argument:** *value*

Explanation: The sshd_config GatewayPorts keyword in file *filename* at line *line_number* is set to an unsupported value *value*.

System action: The program ends.

System programmer response: Verify that the value for the sshd_config GatewayPorts keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config GatewayPorts keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2357 *filename* **line** *line_number***: Invalid environment name.**

Explanation: The sshd_config AcceptEnv keyword in file *filename* at line *line_number* is set to a value that contains an invalid environment variable name.

System action: The program ends.

System programmer response: Verify that the value for the sshd_config AcceptEnv keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config AcceptEnv keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2358 *filename* **line** *line_number***: too many allow env.**

Explanation: Too many environment variables have been specified by the sshd_config AcceptEnv keywords.

System action: The program ends.

System programmer response: Verify that the sshd_config AcceptEnv keywords do not specify too many environment variables, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config AcceptEnv keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2359 *filename* **line** *line_number***: Missing yes/point–to–point/ethernet/no argument.**

Explanation: The sshd_config PermitTunnel keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: The sshd_config PermitTunnel keyword is not supported on z/OS UNIX. Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config PermitTunnel keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2360 *filename* **line** *line_number***: Bad yes/point–to–point/ethernet/no argument:** *value*

Explanation: The sshd_config PermitTunnel keyword in file *filename* at line *line_number* is set to an unsupported value *value*.

System action: The program ends.

System programmer response: The sshd_config PermitTunnel keyword is not supported on z/OS UNIX. Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config PermitTunnel keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2361 **Match directive not supported as a command–line option**

Explanation: The Match keyword is not supported as a command–line option.

System action: The program ends.

System programmer response: Specify the Match keyword in the appropriate configuration file, and try the request again. Refer to the OpenSSH daemon configuration files information in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the Match keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2362 *filename* **line** *line_number***: Bad Match condition**

Explanation: The Match keyword in file *filename* at line *line_number* is set to a bad Match condition.

System action: The program ends.

System programmer response: Verify that the value for the Match keyword is correct, and try the request again. Refer to the OpenSSH daemon configuration files information in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the Match keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2363 *filename* **line** *line_number***: missing PermitOpen specification**

Explanation: The sshd_config PermitOpen keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: Verify that a value for the sshd_config PermitOpen keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config PermitOpen keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2364 *filename* **line** *line_number***: missing host in PermitOpen**

Explanation: The sshd_config PermitOpen keyword in file *filename* at line *line_number* is missing the host value.

System action: The program ends.

System programmer response: Verify that the value for the sshd_config PermitOpen keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config PermitOpen keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2365 *filename* **line** *line_number***: bad port number in PermitOpen**

Explanation: The sshd_config PermitOpen keyword in file *filename* at line *line_number* contains a bad port number.

System action: The program ends.

System programmer response: Verify that the value for the sshd_config PermitOpen keyword is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config PermitOpen keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2366 *filename* **line** *line_number***: Missing argument.**

Explanation: The sshd_config ForceCommand keyword in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: Verify that a value for the sshd_config ForceCommand keyword is set, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config ForceCommand keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2368 **line** *line_number***: too many groups in Match Group**

Explanation: The Match keyword at line *line_number* contains too many values for the Group Match criteria.

System action: The program continues.

System programmer response: Verify that the value for the Match keyword is correct, and try the request again. Refer to the OpenSSH daemon configuration files information in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the Match keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2369 **Missing Match criteria for** *match_criteria*

Explanation: The Match keyword is missing the value for the Match criteria *match_criteria*.

System action: The program continues.

System programmer response: Verify that a value for the Match keyword is set, and try the request again. Refer to the OpenSSH daemon configuration files information in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the Match keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2370 **Unsupported Match attribute** *value*

Explanation: The Match keyword is set to an unsupported criteria value *value*.

System action: The program continues.

System programmer response: Verify that the criteria value for the Match keyword is correct, and try the request again. Refer to the OpenSSH daemon configuration files information in *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the Match keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2371 permanently_set_uid: no user given

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2372 password change not supported

Explanation: A user requested a password change during password authentication. The password change is not supported.

System action: The program continues.

System programmer response: Inform the user that a password change must be requested after password authentication.

FOTS2373 wrong user name passed to monitor: expected *expected_user_name* **!=** *user_name*

Explanation: The wrong user name *user_name* was passed to the monitor process during authentication. The monitor process expected user name *expected_user_name*.

System action: The program continues.

System programmer response: Verify that the client passed a valid user name. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2374 *filename* **line** *line_number***: Deprecated option** *keyword*

Explanation: The keyword *keyword* in file *filename* at line *line_number* is no longer supported.

System action: The program continues.

System programmer response: Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config keywords. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2375 *filename* **line** *line_number***: Unsupported option** *keyword*

Explanation: The keyword *keyword* in file *filename* at line *line_number* is not supported.

System action: The program continues.

System programmer response: Remove the keyword from the file, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config keywords. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2376 subsystem request for *subsystem* **failed, subsystem not found**

Explanation: Subsystem request failed. The subsystem *subsystem* was not found.

System action: The program continues.

System programmer response: Verify that the subsystem requested by the client is valid and is supported by the sshd_config Subsystem keyword. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config Subsystem keyword. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2377 Disabling protocol version 1. Could not load host key

Explanation: Protocol version 1 was disabled because one or more host keys could not be loaded.

System action: The program continues.

System programmer response: Verify that a host key for protocol version 1 exists. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config HostKey keyword. Host keys specified by the HostKeyRingLabel keyword are not supported for protocol 1. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2378 Disabling protocol version 2. Could not load host key

Explanation: Protocol version 2 was disabled because one or more host keys could not be loaded.

System action: The program continues.

System programmer response: Verify that a host key specification for protocol version 2 exists. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide*

Alternatively, enable GSSAPIAuthentication and GSSAPIKeyExchange which can be run without a host key.

If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2379 Attempt to write login records by non–root user (aborting)

Explanation: The **sshd** daemon attempted to write login records under a user with a UID not equal to zero.

System action: The program continues.

System programmer response: Verify that the **sshd** daemon was started with a user with a UID of zero.

FOTS2380 *function*: **utmp_write_library() failed**

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2381 *function*: **invalid type field**

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2382 Warning: *filename*, **line** *line_number*: **keysize mismatch: actual** *actual_keysize* **vs. announced** *announced_keysize*.

Explanation: The keysize *announced_keysize* on line *line_number* in file *filename* is incorrect. The correct keysize is *actual_keysize*.

System action: The program continues.

System programmer response: Correct the keysize, and try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2383 Timeout, client not responding.

Explanation: The number of client alive messages sent without response from the client exceeded the threshold set by the sshd_config ClientAliveCountMax keyword.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the sshd_config ClientAliveCountMax keyword.

FOTS2384 *function*: **open("/dev") failed:** *error_message*

Explanation: The open() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2385 *function*: **Unable to set the controlling tty.**

Explanation: The controlling tty could not be set because /dev/tty is not accessible. The error occurred in *function*.

System action: The program continues.

System programmer response: Verify that SSH protocol version 2 is being used, and try the request again. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2386 *function*: **fchdir(***file_descriptor***) failed:** *error_message*

Explanation: The fchdir() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2387 *function*: **chdir("***filename***") failed:** *error_message*

Explanation: The chdir() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2388 *function*: **stat("***filename***") failed:** *error_message*

Explanation: The stat() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2389 *function*: **stat("***filename***") mismatch:** *expected_st_ino actual_st_ino expected_st_dev actual_st_dev*

Explanation: The stat() system call returned unexpected stat information. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2390 *function*: **close(***file_descriptor***) failed:** *error_message*

Explanation: The close() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program ends.

System programmer response: Take appropriate action based on the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2391 Invalid environment variable "*environment_variable*"

Explanation: The environment variable includes equal sign.

System action: The program continues.

System programmer response: Verify the environment variable. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2392 Certificate options corrupt

Explanation: The OpenSSH certificate was missing options.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Verify that the certificate file has not been corrupted. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2393 Certificate constraint *constraint_name* corrupt

Explanation: The OpenSSH certificate specified a constraint without a value.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Verify that the certificate file has not been corrupted. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2394 Certificate has multiple *option_name* options

Explanation: The OpenSSH certificate specified an option that appeared more than once.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Verify that the certificate file has not been corrupted. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2395 Certificate option *option_name* corrupt (extra data)

Explanation: The OpenSSH certificate option contained extra recognized data.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Verify that the certificate file has not been corrupted. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2396 Authentication tried for *userid* with valid certificate but not from a permitted host (ip=*ipaddr*).

Explanation: The user attempted to authenticate with an OpenSSH certificate from a source address that is not allowed in the certificate.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Verify that the correct OpenSSH certificate is being used for this source ip address. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2397 Certificate source-address contents invalid

Explanation: The user attempted to authenticate with an OpenSSH certificate that contained a source-address that was not valid.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Correct the OpenSSH certificate source-address option and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2398 Certificate critical option *option_name* **is not supported**

Explanation: The user attempted to authenticate with an OpenSSH certificate that contained a critical option that was not recognized.

System action: Authentication fails for this certificate; the program continues.

System programmer response: Correct the OpenSSH certificate and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2399 Certificate extension *option_name* **is not supported**

Explanation: The user attempted to authenticate with an OpenSSH certificate that contained a extension option that was not recognized.

System action: The extension is ignored and the program continues.

System programmer response: Correct the OpenSSH certificate and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS2401 do_local_cmd: no arguments

Explanation: Internal error. No arguments for the local command.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2402 do_local_cmd: fork: *error_message*

Explanation: The fork() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2403 *function***: waitpid:** *error_message*

Explanation: The waitpid() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2502 *function***: offset < 0**

Explanation: Internal error. Unexpected file offset was calculated. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2503 no stat information for *filename*

Explanation: sftp ls performed a stat() system call on *filename*, but no information was returned.

System action: The file is not added to the ls result and the program continues.

FOTS2504 **Too many arguments.**

Explanation: sftp encountered an error processing a command.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Re-enter the command and retry.

FOTS2505 **Resume is not supported for uploads**

Explanation: An sftp put command specified the resume flag (-a) which is only supported for get operations.

System action: The program continues.

User response: Remove the -a flag and retry the command.

FOTS2506 **Server sent suspect path "*path*" during readdir "*directory*"**

Explanation: During **sftp ls** processing, a directory entry containing one or more slashes (/) was returned by the server, which is not allowed.

System action: The directory entry is skipped and the program continues.

FOTS2507 **Server does not support hardlink@openssh.com extension**

Explanation: **sftp** issued a hardlink request, but the remote server does not support the operation.

System action: The hardlink command is ignored and the program continues.

FOTS2508 **Couldn't link file "*oldpath*" to "*newpath*":** *error_message*

Explanation: **sftp** issued a hardlink request, but it failed on remote server.

System action: The hardlink command is ignored and the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2509 **Server does not support statvfs@openssh.com extension**

Explanation: **sftp** issued a **df** command, but the remote server does not support the operation.

System action: The command is ignored and the program continues.

FOTS2510 **Unable to stat local file "*local_file*":** *error_message*

Explanation: **sftp** issued a **get** request with the resume option (-a), but the information about the local file could not be obtained.

System action: The get command fails and the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to make sure that the "*local_file*" exists and that you have permission to write to it, then retry the command.

FOTS2511 **Unable to resume download of "*file*": local file is larger than remote**

Explanation: **sftp** issued a **get** request with the resume option (-a), but the local file is already larger than the remote file.

System action: The get command fails and the program continues.

FOTS2512 Unable to resume download of "*file*": server reordered requests

Explanation: **sftp** issued a **get** request with the resume option (-a), but the remote server changed the request packet sequence.

System action: The get command fails and the local file is truncated at its current position. The program continues.

FOTS2513 Maximum directory depth exceeded: ***max_directory*** **levels**

Explanation: **sftp** issued a **get** or **put** request with the recursive option (-r) that exceeded the maximum number of allowed levels.

System action: The command fails. The program continues.

FOTS2514 Unable to stat remote directory "*directory*"

Explanation: **sftp** issued a **get** request with the recursive option (-r) but the remote *directory* could not be accessed.

System action: The get command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to make sure that you have permission permission to *directory*, then retry the command.

FOTS2515 "*name*" is not a directory

Explanation: **sftp** issued a **get** or **put** request with the recursive option (-r) but the remote *name* was not a directory.

System action: The command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2516 mkdir ***directory*****:** ***system error***

Explanation: **sftp** issued a **get** request with the recursive option (-r) but the local mkdir command for *directory* failed.

System action: The get command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2517 ***directory*****: Failed to get directory contents**

Explanation: **sftp** issued a **get** request with the recursive option (-r) but the remote *directory* could not be read.

System action: The get command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check to make sure that you have permission permission to *directory*, then retry the command. If unable to resolve, contact your system programmer.

FOTS2518 Download of file ***remote*** **to** ***local*** **failed**

Explanation: **sftp** issued a **get** request with the recursive option (-r) but the *remote* was not successfully downloaded.

System action: The get command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check for related messages. If unable to resolve, contact your system programmer.

FOTS2519 Unable to canonicalise path "*path*"

Explanation: **sftp** issued a **get** or **put** request with the recursive option (-r) but the *path* could not be processed.

System action: The command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS2520 Couldn't stat directory "*directory*": *system error*

Explanation: **sftp** issued a **put** request with the recursive option (-r) but the local *directory* could not be accessed.

System action: The put command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2521 Failed to open dir "*directory*": *system error*

Explanation: **sftp** issued a **put** request with the recursive option (-r) but the local *directory* could not be opened with opendir().

System action: The put command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2522 *filename*: lstat failed: *system error*

Explanation: **sftp** issued a **put** request but the local *filename* could not be accessed.

System action: The put command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2523 Uploading of file *local* to *remote* failed!

Explanation: **sftp** issued a **put** request with the recursive option (-r) but the *local* was not successfully uploaded.

System action: The put command fails. The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check for related messages. If unable to resolve, contact your system programmer.

FOTS2701 *filename* line *line_number*: keyword *keyword* is not allowed in file *filename*.

Explanation: The z/OS–specific keyword *keyword* can not be specified in file *filename*.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information about *keyword*, and try the request again.

FOTS2702 *filename* line *line_number*: missing *keyword* value.

Explanation: The keyword *keyword* in file *filename* at line *line_number* is missing its value.

System action: The program ends.

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for *keyword* is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the *keyword* keyword. If unable to resolve, contact your system programmer.

FOTS2703 *filename* **line** *line_number***: unsupported** *keyword* **value '***value***'.**

Explanation: The keyword *keyword* in file *filename* at line *line_number* is set to an unsupported value *value*.

System action: The program ends

System programmer response: If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Verify that the value for *keyword* is correct, and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about the *keyword* keyword. If unable to resolve, contact your system programmer.

FOTS2704 *filename1* **line** *line_number***: keyword** *keyword* **is only allowed in file** *filename2***.**

Explanation: The z/OS–specific keyword *keyword* can only be specified in the file *filename2*.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information about *keyword*, and try the request again.

FOTS2705 *filename* **line** *line_number***: keyword** *keyword* **is not allowed in a z/OS–specific configuration file.**

Explanation: The keyword *keyword* is not a valid z/OS–specific client configuration keyword.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid z/OS client configuration keywords, and try the request again.

FOTS2707 *function***:** *system_call***:** *system error*

Explanation: The *system_call* call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2708 *filename* **line** *line_number***: keyword** *keyword* **is not allowed in a z/OS–specific per–user client configuration file**

Explanation: The keyword *keyword* can not be specified in file *filename*.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information about *keyword*, and try the request again.

FOTS2709 *file_name* **line** *line_number***:** *keyword* **value** *value* **requires additional system setup.**

Explanation: The support provided by *keyword value* requires additional system setup.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on setting up OpenSSH to collect SMF records.

FOTS2710 *function*: *callable_service* **failed with message number** *number*.

Explanation: Language Environment callable service failed. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS Language Environment Programming Reference* for an explanation of the message number. If unable to resolve, contact your system programmer.

FOTS2711 *filename* **line** *line_number*: **keyword** *keyword* **is not allowed in a z/OS–specific daemon configuration file.**

Explanation: The keyword *keyword* is not a valid z/OS–specific daemon configuration keyword.

System action: The program ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid z/OS–specific daemon configuration keywords, and try the request again.

FOTS2801 *function*: **No SMF data received from master process. (***error_message***)**

Explanation: The master process of the specified multiplexed connection did not send the requested SMF data.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2802 *function*: **Error writing SMF record:** *system error*

Explanation: Failure occurred while writing an SMF record.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2803 *function*: **Error collecting SMF data.**

Explanation: Failure occurred while collecting data for an SMF record. The SMF record will not be written.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2804 *function*: **Error collecting SMF data for** *field_name*.

Explanation: Failure occurred while collecting SMF record data for the specified field. The SMF record will be written without valid data for that field.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2805 *function*: **Bad request size for SMF data length** *actual_data_length*, **expected** *expected_data_length*.

Explanation: Communication error occurred while collecting data for an SMF record. The SMF record will not be written.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and remote host status. If error persists, contact your system programmer to report the problem.

FOTS2806 *function***: unexpected server login failure reason.**

Explanation: An unexpected server login failure reason was identified. The problem occurred in *function*.

System action: The program continues.

User response: None.

FOTS2807 *function***: bad SMF global data length** *actual_data_length***, expected** *expected_data_length***.**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2808 *function***: unexpected SMF error for type** *SMF_record_type***, subtype** *SMF_record_subtype* **record:** *error_message***.**

Explanation: The __smf_record2() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: SMF records will not be recorded. The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2809 *function***: bad authentication method** *authentication_method***.**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2810 *function***: unable to resolve pathname** *pathname* **during SMF data collection:** *error_message***.**

Explanation: The realpath() system call failed. The SMF data may not contain an absolute pathname. The system error is displayed with the message. The error occurred in *function*.

System action: The program continues.

System programmer response: Take appropriate action based on the system error.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2811 *function***: Incorrect SMF** *request_type value***.**

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2812 *function*: **Unknown** *option value*.

Explanation: Internal error. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2813 *function*: **Incorrect data length** *length* **read from SMF pipe.**

Explanation: Failure occurred while collecting data for an SMF record. The SMF record will not be written.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2814 *function*: **ClientSMF keyword value** *value* **requires additional system setup.**

Explanation: The support provided by the zos_ssh_config file keyword ClientSMF *value* requires additional system setup.

System action: Some or all SMF records will not be recorded. The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on setting up OpenSSH to collect SMF records. If this message is immediately preceded by FOTS2815, then this error refers to an error writing a OpenSSH client connection started SMF record.

FOTS2815 *function*: **Caller not permitted to use __smf_record2():** *error_message*.

Explanation: The __smf_record2() system call failed. The system error is displayed with the message. The error occurred in *function*.

System action: The SMF record is not written. If the error occurs when attempting to write the OpenSSH client connection started SMF record, the program continues. Otherwise, the program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: If this message is followed by a FOTS2814 message, then refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on setting up OpenSSH to collect OpenSSH client conneciton started SMF records. Otherwise see this manual for information on what you need to verify before using OpenSSH. If unable to resolve, contact your system programmer.

FOTS2816 *function*: **__smf_record2() system call not supported.**

Explanation: The __smf_record2() system call is not supported. Additional system setup is required to use this system call. The error occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on what you need to verify before using OpenSSH. If unable to resolve, contact your system programmer.

FOTS2817 *function*: **Pathname** *pathname* **with resolved directory pathname** *dirname* **is too long.**

Explanation: Unable to resolve the pathname. The resulting pathname is too long. The SMF data may not contain an absolute pathname.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the pathname is correct, and try the request again. If unable to resolve, contact your system programmer.

FOTS2818 *function*: **Received SMF status** *status1*, **expected** *status2*.

Explanation: An unexpected SMF status value was read. The value does not match the SMF status set in the z/OS–specific client configuration file. The problem occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify connectivity and ssh server status. If unable to resolve, contact your system programmer to report the problem.

FOTS2901 *function*: **RSA_new failed**

Explanation: Internal error. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2902 *function*: **BN_bin2bn failed on** *component*

Explanation: Internal error. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2903 *function*: **RSA_blinding_on failed**

Explanation: Internal error. The failure occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2904 *function*: **gsk_factor_public_key_rsa failed (***return_code***).** *return_code_description*.

Explanation: The gsk_factor_public_key_rsa() system call failed when trying to read an RSA public key associated with a certificate in a key ring. The failure occurred in *function*. The *return_code_description* indicates the problem with the certificate.

System action: The program continues.

System programmer response: Take appropriate action based on the return code.

User response: If more information is needed about the error, refer to *z/OS Cryptographic Services System SSL Programming* for an explanation of the return code. If unable to resolve, contact your system programmer.

FOTS2905 *function*: **gsk_factor_private_key_rsa failed (***return_code***).** *return_code_description*.

Explanation: The gsk_factor_private_key_rsa() system call failed when trying to read an RSA private key associated with a certificate in a key ring. The failure occurred in *function*. The *return_code_description* indicates the problem with the certificate.

System action: The program continues.

System programmer response: Take appropriate action based on the return code.

User response: If more information is needed about the error, refer to *z/OS Cryptographic Services System SSL*

Programming for an explanation of the return code. If unable to resolve, contact your system programmer.

FOTS2906 *function*: **d2i_DSAparams on public key failed**

Explanation: The d2i_DSAparams() system call failed when trying to read a DSA public key associated with a certificate in a key ring. The failure occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2907 *function*: **ASN1_item_d2i on** *key_usage* **key failed**

Explanation: The ASN1_item_d2i() system call failed when trying to read a DSA key component from a key associated with a certificate in a key ring. The failure occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2908 *function*: **unexpected algorithm ID** *algorithm_ID*, **key ring '***key_ring***' label '***certificate_label***'**

Explanation: The algorithm type of the keys associated with the certificate is neither RSA nor DSA. The failure occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS2909 *function*: **Value '***value***' is not valid, leading double quote not found**

Explanation: Either the format of the value is not correct, or unmatched double quotes were found in the string. The failure occurred in *function*.

System action: The program continues.

User response: Correct the value and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on the correct format when specifying a key ring or certificate label.

FOTS2910 *function*: **Certificate label found when not expecting one in '***value***'**

Explanation: The value should only contain a key ring identification. The failure occurred in *function*.

System action: The program continues.

User response: Correct the value and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on the correct format when specifying a key ring.

FOTS2911 *function*: **Certificate label is missing but is required in '***value***'**

Explanation: The value should contain a key ring identification followed by a certificate label. The failure occurred in *function*.

System action: The program continues.

User response: Correct the value and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on the correct format when specifying a key ring and certificate label.

FOTS2912 *function*: **Could not get key from key ring '***key_ring***' label '***certificate_label***'**

Explanation: A valid key could not be extracted from the certificate. The failure occurred in *function*.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the certificate label correctly identifies a valid certificate and try the request again. There may be other error messages preceding this message that provide more details about the problem. If unable to resolve the problem, contact your system programmer.

FOTS2913 *function*: **Could not get all keys from key ring '***key_ring***'**

Explanation: Valid keys could not be extracted from the certificates associated with *key_ring*. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify that the key ring correctly identifies the key ring containing valid certificates with keys to be used on this **ssh–add** request and try the request again. There may be other error messages preceding this message that provide more details about the problem. If unable to resolve the problem, contact your system programmer.

FOTS2914 *function*: **Certificate validation for key ring '***key_ring***' label '***certificate_label***' failed (***return_code***).** *return_code_description***.**

Explanation: The *return_code_description* indicates the problem with the certificate. If more information is needed about the error, then refer to *z/OS Cryptographic Services System SSL Programming* for an explanation of the return code. If unable to resolve, contact your system programmer. The failure occurred in *function*.

System action: The program continues if a key is found in a different certificate available to the program.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the condition causing the certificate to fail validation, and try the request again. If unable to resolve the problem, contact your system programmer.

FOTS2915 *function*: **gsk_open_keyring on '***key_ring***' failed (***return_code***).** *return_code_description***.**

Explanation: The gsk_open_keyring() system call failed when trying to open the key ring. The failure occurred in *function*. The *return_code_description* indicates the problem.

System action: The program continues.

System programmer response: Take appropriate action based on the return code.

User response: If more information is needed about the error, refer to *z/OS Cryptographic Services System SSL Programming* for an explanation of the return code. If unable to resolve, contact your system programmer.

FOTS2916 *function*: **gsk_get_record_by_label from key ring '***key_ring***' for label '***certificate_label***' failed (***return_code***).** *return_code_description***.**

Explanation: The gsk_get_record_by_label() system call failed when trying to obtain the data base record for the certificate. The failure occurred in *function*. The *return_code_description* indicates the problem.

System action: The program continues.

System programmer response: Take appropriate action based on the return code.

User response: If more information is needed about the error, refer to *z/OS Cryptographic Services System SSL Programming* for an explanation of the return code. If unable to resolve, contact your system programmer.

FOTS2917 *function***: gsk_get_record_by_index from key ring '***key_ring***' for index '***record_index***' failed (***return_code***).** *return_code_description***.**

Explanation: The gsk_get_record_by_index() system call failed when trying to obtain the data base record for the certificate. The failure occurred in *function*. The *return_code_description* indicates the problem.

System action: The program continues.

System programmer response: Take appropriate action based on the return code.

User response: If more information is needed about the error, refer to *z/OS Cryptographic Services System SSL Programming* for an explanation of the return code. If unable to resolve, contact your system programmer.

FOTS2918 *function***: Value '***value***' is not valid, trailing double quote was found**

Explanation: Either the format of the value is not correct, or unmatched double quotes were found in the string. The failure occurred in *function*.

System action: The program continues.

User response: Correct the value and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on the correct format when specifying a key ring or certificate label.

FOTS2919 *function***: Value '***value***' is not valid, trailing double quote not found**

Explanation: Either the format of the value is not correct, or unmatched double quotes were found in the string. The failure occurred in *function*.

System action: The program continues.

User response: Correct the value and try the request again. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on the correct format when specifying a key ring or certificate label.

FOTS2920 *function***: Private key not available for certificate in key ring 'key_ring' with label 'certificate_label'**

Explanation: Either there is no private key associated with the certificate, or the user is not authorized to read the private key for the certificate. Only a certificate owner may read the private key for a certificate. The failure occurred in *function*.

System action: The program continues.

User response: If the program obtained a private key from another certificate, then this error may be ignored. If the program did not obtain a private key, then an alternate certificate needs to be specified when trying the request again.

FOTS3001 *function* **(***line_number***):** *callable_service* **failed: return code =** *return_code***, reason code =** *reason_code*

Explanation: The Integrated Cryptographic Service Facility (ICSF) *callable_service* callable service failed. The callable service return and reason codes are displayed with the message. The failure occurred in *function* at line *line_number*.

System action: The program ends.

System programmer response: See *z/OS Cryptographic Services ICSF Application Programmer's Guide* for an explanation of the ICSF callable service failure. Also, see *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3002 *function* **(***line_number***):** *callable_service* **failed: return code =** *return_code***, reason code =** *reason_code*

Explanation: The Integrated Cryptographic Service Facility (ICSF) *callable_service* callable service failed. The callable service return and reason codes are displayed with the message. The failure occurred in *function* at line *line_number*.

System action: The program continues.

System programmer response: See *z/OS Cryptographic Services ICSF Application Programmer's Guide* for an explanation of the ICSF callable service failure. Also, see *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3003 *function*: **support requires newer ICSF FMID, current ICSF FMID is '***ICSF_FMID***'**

Explanation: The ICSF ciphers and MAC algorithms support requires ICSF FMID HCR7770 or later installed. The problem occurred in *function*.

System action: The program continues.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3004 *function*: **ICSF is required but not available**

Explanation: The Integrated Cryptographic Service Facility (ICSF) was requested to implement the ciphers or MAC algorithms, however ICSF is not available or cannot be used. The problem occurred in *function*.

System action: The program ends.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. In addition, see any previously issued messages for more information.

User response: Contact your system programmer.

FOTS3005 *function*: **ICSF is not available, switching to OpenSSL source**

Explanation: The Integrated Cryptographic Service Facility (ICSF) is not available or cannot be used. All ciphers and MAC algorithms will be implemented using OpenSSL. The problem occurred in *function*.

System action: The program continues.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. In addition, see any previously issued messages for more information.

User response: Contact your system programmer.

FOTS3006 *function*: **unable to determine ICSF FMID**

Explanation: The ICSF ciphers and MAC algorithms support requires ICSF FMID HCR7770 or later installed. The ICSF FMID could not be verified against this requirement. The problem occurred in *function*.

System action: The program continues.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3007 *function*: **MAC algorithm length information not valid: key length =** *key_length*, **block length =** *block_length*

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3008 *function***: ICSF is required but not available or cannot be used to implement** *algorithm_name*

Explanation: The Integrated Cryptographic Service Facility (ICSF) was requested to implement the cipher or MAC algorithm *algorithm_name*, however ICSF is not available or cannot be used. The problem occurred in *function*.

System action: The program ends.

System programmer response: See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for the setup required to use ICSF ciphers and MAC algorithms. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3009 *function***: cipher information not valid: name =** *cipher_name***, block size =** *cipher_block_size*

Explanation: Internal error. The error occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3010 *function***: cannot fork into the background when using ICSF source**

Explanation: The **ssh** –f option was specified and the Integrated Cryptographic Service Facility (ICSF) was requested to implement the ciphers or MAC algorithms. The options cannot be specified together. The error occurred in *function*.

System action: The program ends.

User response: Do not request ICSF to implement the ciphers or MAC algorithms, and try the request again. See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about ICSF ciphers and MAC algorithms.

FOTS3011 *function***: cannot fork into the background when using ICSF source**

Explanation: The **ssh** & escape option was specified and the Integrated Cryptographic Service Facility (ICSF) was requested to implement the ciphers or MAC algorithms. The options cannot be specified together. The error occurred in *function*.

System action: The program continues.

User response: Do not request ICSF to implement the ciphers or MAC algorithms, and try the request again. See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about ICSF ciphers and MAC algorithms.

FOTS3012 *function***: support requires z/OS 1.13 or later, current is** *sysname version***.***release* **(uname rc =** *uname_rc***)**

Explanation: The Integrated Cryptographic Service Facility (ICSF) cannot be used because the current release is not z/OS 1.13 or later. All ciphers and MAC algorithms will be implemented using OpenSSL. The problem occurred in *function*.

System action: The program continues.

User response: Do not request ICSF to implement the ciphers or MAC algorithms, and try the request again. See *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information about ICSF ciphers and MAC algorithms.

FOTS3013 *function* **(***line_number***): zsshIcsfGetKeyObjectAttribute failed:** *failed_reason*

Explanation: The zsshIcsfGetKeyObjectAttribute failed with failed_reason. The failure occurred in function at line_number.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3101 buffer_get_cstring_ret: string contains \\0

Explanation: string contains \\0.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3102 buffer_get_cstring: buffer error

Explanation: buffer error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3103 Inconsistent mask length for network *network*

Explanation: The network specified an incorrect mask

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command or configuration file where this network is specfied and retry.

FOTS3104 addr_match_cidr_list: empty entry in list *networklist*

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command or configuration file where this network list is specfied and retry.

FOTS3105 addr_match_cidr_list: list entry *network* **too long**

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command or configuration file where this network is specfied and retry.

FOTS3106 addr_match_cidr_list: list entry *network* **contains invalid characters**

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command or configuration file where this network is specfied and retry.

FOTS3107 Invalid network entry *network*

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command or configuration file where this network is specfied and retry.

FOTS3108 *function***: vasprintf failed**

Explanation: The vasprintf system call failed while formatting auth_info for user public key authentication.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the public key or OpenSSH certification and retry.

FOTS3109 WARNING: revoked key for *host* attempted authentication

Explanation: The host key has been revoked and may not be used for HostbasedAuthentication or RhostsRSAAuthentication.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the host key and retry.

FOTS3110 User *userid file_type filepath* is not a regular file

Explanation: While trying to authenciate a user, the given file was found to be a non-regular file.

System action: Authentication fail, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the file and retry.

FOTS3111 Revoked keys file is unreadable: refusing public key authentication

Explanation: While trying to authenciate a user, the file specified by SSHD option RevokedKeys was not readable.

System action: Authentication fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the file and retry.

FOTS3112 WARNING: authentication attempt with a revoked *key_* key *key_fingerprint*

Explanation: While trying to authenciate a user, the given key was revoked.

System action: Authentication for this key fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Specify a non-revoked key and retry.

FOTS3113 Certificate invalid: not a host certificate

Explanation: While trying to authenciate a host using an OpenSSH certificate, the given certificate is not the correct type.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the host certificate and retry.

FOTS3114 Certificate invalid: not a user certificate

Explanation: While trying to authenciate a user using an OpenSSH certificate, the given certificate is not the correct type.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the user certificate and retry.

FOTS3115 Certificate invalid: not yet valid

Explanation: While trying to authenciate a user using an OpenSSH certificate, the given certificate is not valid at the current time.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS3116 Certificate invalid: expired

Explanation: While trying to authenciate a user using an OpenSSH certificate, the given certificate is not valid at the current time.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS3117 Certificate lacks principal list

Explanation: While trying to authenciate a user using an OpenSSH certificate, the given CA certificate does not include a required principals list.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS3118 Certificate invalid: name is not a listed principal

Explanation: While trying to authenciate a user using an OpenSSH certificate, the given certificate's principals list does not include the required host or user name.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS3119 Certificate does not contain an authorized principal

Explanation: While trying to authenciate a user using an OpenSSH certificate, the user does not appear in the AuthorizedPrincipalsFile specified in the SSHD configuration.

System action: Authentication for this certificate fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate or AuthorizedPrincipalsFile and retry.

FOTS3120 *function*: **BIO_new failed**

Explanation: The OpenSSL library function BIO_new() failed.

System action: The function fails; the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3121 *function*: **BIO_new_mem_buf failed**

Explanation: The OpenSSL library function BIO_new_mem_buf() failed.

System action: The function fails; the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3122 *function*: **bad ECDSA key**

Explanation: A error occurred while parsing an ECDSA private key file.

System action: The private key file is not used; the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3123 *function*: **cannot parse key type** *type_num*

Explanation: A error occurred while parsing a key.

System action: The private key is not used; the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3124 *function*: **unsupported key type**

Explanation: Unable to load private OpenSSH certificate with an unrecognized type.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3125 *function*: **certificate does not match private key** *file_name*

Explanation: The private OpenSSH certificate contains a key that does not match the certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate and retry.

FOTS3126 *function*: **buffer error**

Explanation: Command failed.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3127 *function*: **could not open keyfile** *file_name*: *system error*

Explanation: A system error occurred while opening a key file.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the keyfile and retry.

FOTS3128 **channel_register_expect:** *value***: bad id**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your systems programmer.

FOTS3129 **channel** *channel_id***: decode socks4a: len** *expected length* **> have** *actual length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3130 **channel** *channel_id***: hostname** *host* **too long**

Explanation: The hostname supplied on a SOCKS4A request was longer than the maximum allowed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry the request with a valid hostname.

FOTS3131 **channel** *channel_id***: socks5 hostname** *host* **too long**

Explanation: The hostname supplied on a SOCKS5 request was longer than the maximum allowed.

System action: Retry the request with a valid hostname.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3132 *function***: entered with !compat20**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3133 **multiplex uid mismatch: peer euid** *EUID* **!= uid** *UID*

Explanation: Internal error while accepting a connection on a control socket.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3134 **connect to** *host* **port** *port_number* **failed:** *system error*

Explanation: Error setting up port forwarder to remote host.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the host name or port and retry.

FOTS3135 *function***: authlen mismatch** *length*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your systems programmer.

FOTS3136 **buffer_get_string_ret: cannot extract length**

Explanation: Internal error. Received string length not available in buffer.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3138 **buffer_get_string_invariant_ret: bad string length** *number*

Explanation: Internal error. Received string too long.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3139 **buffer_get_string_invariant_ret: buffer_get failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3142 **buffer_get_cstring_ptr: bad string length** *number*

Explanation: Internal error. String found in buffer is too long

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3143 **buffer_get_string_ptr: buffer error**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3144 *function***: giant EC point: len =** *length* **(max** *max_length***)**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3145 *function*: **EC_POINT_point2oct length mismatch**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3146 *function*: **invalid point**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3147 *function*: **EC_POINT too long:** *length* **>** *max_length*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3148 *function*: **EC_POINT buffer is empty**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3149 *function*: **EC_POINT is in an incorrect form:** *found_byte* **(want** *expected_byte***)**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3150 *function*: **EVP_Cipher(aad) failed**

Explanation: A call to OpenSSL function EVP_Cipher() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_Cipher() for more information. If unable to resolve, contact your system programmer.

FOTS3151 *function*: **EVP_Cipher(final) failed**

Explanation: A call to OpenSSL function EVP_Cipher() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_Cipher() for more information. If unable to resolve, contact your system programmer.

FOTS3152 Decryption integrity check failed

Explanation: A call to OpenSSL function EVP_Cipher() to verify an encryption tag failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_Cipher() for more information. If unable to resolve, contact your system programmer.

FOTS3153 cipher_init: EVP_CTRL_GCM_SET_IV_FIXED failed for *cipher type*

Explanation: A call to OpenSSL function EVP_CIPHER_CTX_ctrl() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CIPHER_CTX_ctrl() for more information. If unable to resolve, contact your system programmer.

FOTS3154 *function***: EVP_CTRL_GCM_IV_GEN**

Explanation: A call to OpenSSL function EVP_CIPHER_CTX_ctrl() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CIPHER_CTX_ctrl() for more information. If unable to resolve, contact your system programmer.

FOTS3155 *function***: EVP_CTRL_GCM_SET_TAG**

Explanation: A call to OpenSSL function EVP_CIPHER_CTX_ctrl() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CIPHER_CTX_ctrl() for more information. If unable to resolve, contact your system programmer.

FOTS3156 *function***: EVP_CTRL_GCM_GET_TAG**

Explanation: A call to OpenSSL function EVP_CIPHER_CTX_ctrl() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check OpenSSL function EVP_CIPHER_CTX_ctrl() for more information. If unable to resolve, contact your system programmer.

FOTS3157 *function***: no ECDSA key**

Explanation: No key was found while trying to perform an ecdsa operation. The error occurred in *function*

System action: The ecdsa operation fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the key and retry.

FOTS3158 *function***: sign failed**

Explanation: Signature with and ecdsa key failed.

System action: Signature with this key fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Ensure that the key is valid and retry.

FOTS3159 *function***: cannot handle type** *key_type*

Explanation: Verification of an ecdsa key failed. The *key_type* is not supported.

System action: Verification of this key fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Ensure that the key is valid and retry.

FOTS3160 *function***: remaining bytes in signature** *remaining_bytes*

Explanation: Verification of an ecdsa key failed. The signature blob contained unexpected additional bytes.

System action: Verification of this key fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Ensure that the key is valid and retry.

FOTS3161 *function***: ECDSA_SIG_new failed**

Explanation: Verification of an ecdsa key failed. The signature could not be parsed.

System action: Verification of this key fails, the program fails.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Ensure that the key is valid and retry.

FOTS3162 *function***: remaining bytes in inner sigblob**

Explanation: Verification of an ecdsa key failed. The inner signature blob contained unexpected additional bytes.

System action: Verification of this key fails, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Ensure that the key is valid and retry.

FOTS3163 **basename** *path***:** *system error*

Explanation: System call basename() failed on *path* due to the displayed system error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3171 **key_read: type mismatch: EC curve mismatch**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3172 key_read: loaded key is not a cert

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3173 *function: no cert data*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3174 *function: no signed certificate blob*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3176 *function*: **DSA_new failed**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3179 *function*: **BN_CTX_new() failed**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3180 *function*: **EC_GROUP_new_by_curve_name failed**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3181 *function*: **EC_KEY_set_group**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3182 *function*: **invalid key length**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3183 *function*: **EC_KEY_generate_key failed**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3184 **key_generate: cert keys cannot be generated directly**

Explanation: Internal error.

System action: The program ends | continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3185 *function*: **nprincipals (***principals***) > CERT_MAX_PRINCIPALS (***max_principals***)**

Explanation: The OpenSSH certificate was invalid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3186 *function*: **parse error**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3187 **Unknown certificate type** *type*

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3188 *function*: **Too many principals**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3189 *function*: **Principals data invalid**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3190 *function*: **critical option data invalid**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3191 *function*: **extension data invalid**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3192 *function*: **Signature key invalid**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3193 *function*: **Invalid signature key type** *signature_key* **(***type***)**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3194 *function*: **Invalid signature on certificate**

Explanation: Internal error while parsing an OpenSSH certificate.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3195 *function*: **Certificate signature verification failed**

Explanation: The signature included with an OpenSSH certificate failed verification.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the certificate file. If unable to resolve, contact your system programmer to report the problem.

FOTS3196 **key_from_blob: can't read ecdsa curve**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3197 **key_from_blob: ecdsa curve doesn't match type**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3198 **key_from_blob: ECU_KEY_new_by_curve_name failed**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3199 *function*: **EC_POINT_new failed**

Explanation: Internal error in OpenSSL function.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3201 *function*: **waitpid:** *error_message*

Explanation: The waitpid() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3202 *function*: **preauth child exited with status** *status*

Explanation: The sshd process for authentication exited with a non-zero status code.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS3203 ***function*: preauth child terminated by signal *signal***

Explanation: The sshd process for authentication was terminated by a signal.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS3204 user, host and addr are all required when testing Match configs

Explanation: Extended test mode (-T) was requested, but one of the supplied connection parameters (-C) did not include all of the required keywords.

System action: The program ends.

User response: Specify a complete set of arguments for the connection_spec and run the command again.

FOTS3205 Config test connection parameter (-C) provided without test mode (-T)

Explanation: A connection_spec (-C) option was supplied, but extended test mode (-T) was not requested.

System action: The program ends.

User response: Specify the extended test mode option (-T) and run the command again.

FOTS3206 AuthorizedKeysCommand set without AuthorizedKeysCommandUser

Explanation: The AuthorizedKeysCommand is run for a user, but none was specified by an AuthorizedKeysCommandUser option.

System action: The program ends.

User response: Specify a user via the AuthorizedKeysCommandUser option and run the command again.

FOTS3207 AuthenticationMethods is not supported with SSH protocol 1

Explanation: The AuthenticationMethods option is only supported under SSH protocol 2, but protocol 1 was requested.

System action: The program ends.

User response: Specify protocol 2 or remove the AuthenticationMethods option and run the command again.

FOTS3208 AuthenticationMethods cannot be satisfied by enabled authentication methods

Explanation: The AuthenticationMethods option is specified, but not enough of the required authentication methods (e.g. publickey) are enabled for authentication to be successful.

System action: The program ends.

User response: Either respecify the AuthenticationMethods option to work with the enabled authentication methods, or enabled additional authentication methods and run the command again.

FOTS3209 Could not load host certificate: *certificate_file*

Explanation: The HostCertificate option specified a *certificate_file* that could not be loaded.

System action: The program continues.

User response: Check to make sure that *certificate_file* refers to a valid OpenSSH certificate and run the command again.

FOTS3210 Certificate file is not a certificate: *certificate_file*

Explanation: The HostCertificate option specified a *certificate_file* that does not contain an OpenSSH certificate.

System action: The program continues.

User response: Check to make sure that *certificate_file* refers to a valid OpenSSH certificate and run the command again.

FOTS3211 No matching private key for certificate: *certificate_file*

Explanation: The HostCertificate option specified a *certificate_file* that has no associated private key specified via the HostKey option.

System action: The program continues.

User response: Ensure that the HostKey option specifies a private key that is associated with the certificate(s) specified by the HostCertificate option and run the command again.

FOTS3212 chdir("/"): *system error*

Explanation: sshd failed while attempting to chdir() to "/". The system error is displayed with this message.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3214 *function*: **kill(***pid***):** *error_message*

Explanation: sshd attempted to kill the privilege separation child process, but the kill() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3215 No user for AuthorizedKeysCommand specified, skipping

Explanation: The AuthorizedKeysCommand sshd option was specified, but no AuthorizedKeysCommandUser option was found.

System action: The AuthorizedKeysCommand is ignored, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the sshd options and retry.

FOTS3216 AuthorizedKeysCommandUser *username* **not found:** *system error*

Explanation: sshd failed to locate the user specified by the AuthorizedKeysCommandUser option. The getpwnam() system error is displayed with this message.

System action: The AuthorizedKeysCommand is ignored, the program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the sshd options and retry.

FOTS3217 Could not stat AuthorizedKeysCommand *command***:** *system error*

Explanation: sshd failed to locate the command specified by the AuthorizedKeysCommand option. The stat() system call error is displayed with this message.

System action: The AuthorizedKeysCommand is ignored, the program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the sshd options and retry.

FOTS3218 Unsafe AuthorizedKeysCommand: *reason*

Explanation: The sshd AuthorizedKeysCommand option references a command pathname that is not owned by root or may be writable by others, as given by the reason associated with the message.

System action: The AuthorizedKeysCommand is ignored, the program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the sshd options and retry.

FOTS3219 AuthorizedKeysCommand *command* **exec failed:** *system error*

Explanation: sshd was unable to exec the AuthorizedKeysCommand option command. The exec() system error is displayed with the message.

System action: The AuthorizedKeysCommand is ignored, the program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the sshd options and retry.

FOTS3220 AuthorizedKeysCommand *command* **exited on signal** *signal number*

Explanation: sshd exececuted the AuthorizedKeysCommand option command, which in turn exited with a signal.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of signal number. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3221 AuthorizedKeysCommand *command* **returned status** *exit code*

Explanation: sshd exececuted the AuthorizedKeysCommand option command, which in turn exited with a non-zero exit code.

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of signal number. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3222 *function***: pipe:** *system error*

Explanation: A failure occurred due to an error in pipe() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3223 *function*: **fork:** *system error*

Explanation: A failure occurred due to an error in fork() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3224 *function*: **open** *pathname*: *system error*

Explanation: A failure occurred due to an error in open() system call while opening the file *pathname*. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3225 *function*: **dup2:** *system error*

Explanation: A failure occurred due to an error in dup2() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3226 *function*: **setresgid** *gid*: *system error*

Explanation: A failure occurred due to an error in setresgid() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3227 *function*: **setresuid** *uid*: *system error*

Explanation: A failure occurred due to an error in setresuid() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3228 *function*: **fdopen:** *system error*

Explanation: A failure occurred due to an error in fdopen() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3229 *function*: **waitpid:** *system error*

Explanation: A failure occurred due to an error in waitpid() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3230 INTERNAL ERROR: authenticated and postponed

Explanation: An internal error occurred in sshd during user authentication.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS3231 empty authentication method list

Explanation: An authentication method list specified on the sshd AuthenticationMethods option was empty.

System action: The program continues.

System programmer response: Correct the AuthenticationMethods option and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3232 Disabled method *auth_method* **in AuthenticationMethods list** *auth_method_list*

Explanation: An authentication method list specified on the sshd AuthenticationMethods option contained a disabled method.

System action: The program continues.

System programmer response: Correct the AuthenticationMethods option and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3233 Unknown authentication method *auth_method* **in list**

Explanation: An authentication method list specified on the sshd AuthenticationMethods option contained a unknown method.

System action: The program continues.

System programmer response: Correct the AuthenticationMethods option and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3234 Authentication methods list *auth_method_list* **contains disabled method, skipping**

Explanation: An authentication method list specified on the sshd AuthenticationMethods option contained a disabled method. This list will be ignored.

System action: The program continues.

System programmer response: Correct the AuthenticationMethods option and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3235 No AuthenticationMethods left after eliminating disabled methods

Explanation: A usuable list specified on the sshd AuthenticationMethods option could not be found after eliminating. lists containing disabled methods.

System action: User authentication fails and the program ends.

System programmer response: Correct the AuthenticationMethods option and retry. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3240 *function***: getcwd:** *system error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error.

If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3241 **Invalid LocalPort '*port*' on Match line.**

Explanation: The LocalPort configuration option is not valid.

System action: The program continues.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on this configuration option. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3242 *filename* **line** *line***: missing argument.**

Explanation: The **sshd** configuration file contains an error.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3243 *filename* **line** *line***: unsupported option "***option***".**

Explanation: The **sshd** configuration file contains an error.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3244 *filename* **line** *line***: missing socket name.**

Explanation: The **sshd** configuration file contains an error. A socket name is required with the HostKeyAgent option.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3245 *filename* **line** *line***: too many host certificates specified (max** *max_host_certs***).**

Explanation: The **sshd** configuration file contains an error. The maximum number of certificate names was exceeded on the HostCertificate option.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3246 *filename* **line** *line***: Bad number '***arg***':** *error_message*

Explanation: The **sshd** configuration file contains an error. The argument to the RekeyLimit option is invalid.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3247 *filename* **line** *line***: RekeyLimit too large**

Explanation: The **sshd** configuration file contains an error. The argument to the RekeyLimit option is invalid.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3248 *filename* **line** *line***: RekeyLimit too small**

Explanation: The **sshd** configuration file contains an error. The argument to the RekeyLimit option is invalid.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3249 *filename* **line** *line***: Bad SSH2 KexAlgorithms '***arg***'.**

Explanation: The **sshd** configuration file contains an error. The KexAlgorithms option contains an unknown algorithm name.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3250 *filename* **line** *line***: too many authorized keys files.**

Explanation: The **sshd** configuration file contains an error. The AuthorizedKeyFile option contains more file names than are allowed.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3251 *filename* **line** *line***: Bad IPQoS value:** *arg*

Explanation: The **sshd** configuration file contains an error. The IPQos option contains an unknown service/class.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3252 *filename* **line** *line*: **Invalid argument**

Explanation: The **sshd** configuration file contains an error.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3253 *filename* **line** *line*: **AuthorizedKeysCommand must be an absolute path**

Explanation: The **sshd** configuration file contains an error.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3254 *filename* **line** *line*: **too many authentication methods.**

Explanation: The **sshd** configuration file contains an error. The AuthenticationMethods option contains more than the maximum allowed authentication method names.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3255 *filename* **line** *line*: **invalid authentication method list.**

Explanation: The **sshd** configuration file contains an error. The AuthenticationMethods option is not valid.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3256 *filename* **line** *line* **too long**

Explanation: The **sshd** configuration file contains a line longer than the maximum allowed.

System action: The program

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3257 AuthenticationMethods is not supported with SSH protocol 1

Explanation: The **sshd** configuration file contains the AuthenticationMethods option, but this is not allowed when using SSH Protocol 1.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Correct the server configuration file. If unable to resolve, contact your system programmer to report the problem.

FOTS3258 *function***: log fd read:** *error_message*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3259 *function***: invalid log message length** *length*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3260 *function***: invalid log level** *level* **(corrupted message?)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3261 *function***: poll:** *error_message*

Explanation: Internal error.

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3262 *function***: ssh_agent_sign failed**

Explanation: The **sshd** program failed when trying to use an ssh agent to create a host key signature.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3263 *function*: **received bad key type** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3264 *function*: **pipe:** *system error*

Explanation: A failure occurred due to an error in pipe() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3265 *function*: **pubkey_sign failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3266 *function*: **no log channel**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3267 *function*: **cannot allocate fds for pty**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3268 *function*: **pipe in:** *error_message*

Explanation: A failure occurred due to an error in pipe() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3269 *function*: **pipe out:** *error_message*

Explanation: A failure occurred due to an error in pipe() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3270 *function***: pipe err:** *error_message*

Explanation: A failure occurred due to an error in pipe() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3271 *function***: fork:** *error_message*

Explanation: A failure occurred due to an error in fork() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3272 *function***: dup #1:** *error_message*

Explanation: A failure occurred due to an error in dup() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3273 *function***: dup #2:** *error_message*

Explanation: A failure occurred due to an error in dup() system call. The system error is displayed with the message. The failure occurred in *function*

System action: The program continues.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS3274 **server lacks privileges to chroot to ChrootDirectory**

Explanation: The server configuration does not specify ChrootDirectory.

System action: The program ends.

System programmer response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for information on configuring the server. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3275 *function***: insane session id** *id* **(max** *max_sessions* **nalloc** *nalloc***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3276 *function***: cannot allocate** *sessions* **sessions**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3277 *function***: insane first_unused** *first_unused* **max** *max_sessions* **nalloc** *nalloc*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3278 *function***: session** *id* **already used**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3279 *function***: key type mismatch:** *key_blobtype*

Explanation: Key error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Verify key file is correct. If error persists contact your system programmer to report the problem.

FOTS3301 stdio forward already specified

Explanation: Multiple stdio forwarding command options (-W) were supplied, but only one is allowed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Remove the additional -W options and retry.

FOTS3302 Cannot specify stdio forward with -O

Explanation: An attempt to forward stdio with the -W option failed because the -O option (multiplexing master process command option) was also specified. These options are mutually exclusive.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Remove the -O option and retry.

FOTS3303 Bad stdio forwarding specification '*forwarding_spec***'**

Explanation: An attempt to forward stdio with the -W option failed because the *forwarding_spec* was not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the *forwarding_spec* and retry.

FOTS3304 Can't specify both -y and -E

Explanation: The -y and -E options are mutually exclusive.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Remove one of the options and retry.

FOTS3305 Failed to connect to new control master

Explanation: The ssh program failed to connect as a client to the control master.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS3306 *function*: **dup2:** *system_error*

Explanation: A call to dup2() failed. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3307 Allocated port *allocated_port* **for remote forward to** *connect_host*:*connect_port*

Explanation: A remote forwarding request with port 0 (dynamic) was specified. The *allocated_port* is the port that was assigned by the *connect_host*.

System action: The program continues.

User response: The allocated port is now available for use.

FOTS3308 stdio forwarding require Protocol 2

Explanation: stdio forwarding (-W) was requested for a protocol 1 connection, which is not supported.

System action: The program ends.

User response: Remove the -W option or specify protocol 2 and retry.

FOTS3309 channel_connect_stdio_fwd: dup() in/out failed

Explanation: System call dup() failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3310 *function*: **channel_connect_stdio_fwd failed**

Explanation: stdio forwarding (-W) was requested but failed. The failure occurred in *function*.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

FOTS3311 DISPLAY '*value***' invalid, falling back to fake xauth data**

Explanation: Client X11 display forwarding was requested, but the format of the DISPLAY environment variable was not valid.

System action: The program continues with defaults for xauth data.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the DISPLAY environment variable and retry.

FOTS3312 *channel_request* **request failed**

Explanation: A channel request by the ssh command was rejected.

System action: If the error occurred on the primary session channel, the program ends. Otherwise, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct and retry the failing request and if unsuccessful contact your systems programmer.

FOTS3313 *channel_request* **request failed on channel** *id*

Explanation: A channel request by the ssh command was rejected.

System action: If the error occurred on the primary session channel, the program ends. Otherwise, the program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct and retry the failing request and if unsuccessful contact your systems programmer.

FOTS3314 *client_register_global_confirm: last_gc->ref_count = number*

Explanation: An internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your systems programmer.

FOTS3315 **–D[bind_address:] Request dynamic forward**

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS3316 **–KL[bind_address:] Cancel local forward**

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS3317 **–KD[bind_address:] Cancel dynamic forward**

Explanation: Help was requested for the **ssh** command line options.

System action: The program continues.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS3318 **Unknown port forwarding.**

Explanation: The user attempted to cancel a port forward that could not be found.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command and retry.

FOTS3319 Canceled forwarding.

Explanation: The user successfully canceled a port forwarder.

System action: The program continues.

FOTS3320 Forwarding port.

Explanation: The user successfully created a new port forwarder.

System action: The program continues.

FOTS3321 Server does not support re-keying

Explanation: The user entered an **ssh** 'R' interactive command to request re-keying, but the server does not support re-keying.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your systems programmer.

FOTS3322 Passwords may not be entered from 3270 terminals

Explanation: The user attempted an **ssh** function that required a password or pass phrase. These may not be entered from 3270 terminatls.

System action: The program end.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Use a non-3270 terminal or an authentication method that does not require a password.

FOTS3323 *filename* **line** *line***: Bad number '***arg***':** *error_message*

Explanation: An error occurred while processing the **ssh** client configuration file or command line option.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3324 *filename* **line** *line***: too many authorized keys files.**

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The GlobalKnownHostsFile option specifies more files than are allowed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3325 *filename* **line** *line***: Bad SSH2 KexAlgorithms '***arg***'.**

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The KexAlgorithms option specified an unknown algorithm.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3326 *filename* **line** *line***: Missing ControlPersist argument.**

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The ControlPersion option requires an argument.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3327 *filename* **line** *line***: Bad ControlPersist argument.**

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The argument to the ControlPersion option is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3328 *filename* **line** *line***: Bad IPQoS value:** *arg*

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The argument to the IPQoS option is not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3329 *filename* **line** *line***: missing argument.**

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The option specified requires an argument.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3330 **Unsupported RequestTTY "***arg***"**

Explanation: An error occurred while processing the **ssh** client configuration file or command line option. The RequestTTY option specified an illegal argument.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the configuration option and retry. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on the **ssh** configuration options. If unable to resolve, contact your systems programmer.

FOTS3335 *function***: open("/dev/null"):** *error_message*

Explanation: open() system call failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3336 *function*: **__ipDomainName:** *error_message*

Explanation: The __ipDomainName() system call failed. The system error is displayed with the message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3337 *function*: **hostname + domain >** *max_length*

Explanation: The fully qualified local hostname was larger than the maximum allowed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3338 **Could not create socketpair to communicate with proxy dialer:** *error_msg*

Explanation: In ProxyUseFDpass processing, a socketpair could not be created.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3339 **proxy dialer did not pass back a connection**

Explanation: In ProxyUseFDpass processing, the proxy program did not return an fd for the ensuing ssh connection.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check your configuration of the ProxyCommand option.

FOTS3401 **Certificate time** *time_spec* **cannot be represented**

Explanation: Invalid *validity_interval* specified.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS3402 **Invalid certificate time format** *time_spec*

Explanation: Invalid *validity_interval* specified.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS3403 **Invalid certificate time** *time_spec*

Explanation: Invalid *validity_interval* specified.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS3405 Invalid relative certificate life ***validity_interval***

Explanation: Invalid *validity_interval* specified.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS3406 Invalid certificate life specification ***validity_interval***

Explanation: Invalid *validity_interval* specified.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS3407 Empty certificate validity interval

Explanation: An empty *validity_interval* was specified.

System action: The command ends.

User response: Correct the *validity_interval* and try the command again.

FOTS3408 Empty force-command option

Explanation: The *command* for the option has not been specified.

System action: The command ends.

User response: Correct the *command* and try the command again.

FOTS3409 force-command already specified

Explanation: The option has already been specified.

System action: The command ends.

User response: Remove the duplicate option and try the command again.

FOTS3410 Empty source-address option

Explanation: The *address_list* for the option has not been specified.

System action: The command ends.

User response: Correct the *address_list* and try the command again.

FOTS3411 source-address already specified

Explanation: The option has already been specified.

System action: The command ends.

User response: Remove the duplicate option and try the command again.

FOTS3412 Invalid source-address list

Explanation: The *address_list* for the option is invalid.

System action: The command ends.

User response: Correct the *address_list* and try the command again.

FOTS3413 Unsupported certificate option "*option*"

Explanation: The *options* specified is not valid.

System action: The command ends.

User response: Correct the *option* and try the command again.

FOTS3414 Option corrupt: extra data at end

Explanation: A certificate option contains extra data.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the command option or the certificate. If unable to resolve, contact your system programmer.

FOTS3415 ***key_file*** **is not a public key**

Explanation: The key_file is not a public key.

System action: The command ends.

User response: Correct the *key_file* and try the command again.

FOTS3416 ***key_file*** **is not a certificate**

Explanation: The *key_file* is not a certificate.

System action: The command ends.

User response: Correct the *key_file* and try the command again.

FOTS3417 Unsupported conversion format "*key_format*"

Explanation: The *key_format* specified is not supported.

System action: The command ends.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for valid *key_format* values and try the command again.

FOTS3418 Checkpoint filename too long

Explanation: The *checkpt* filename specified is too long.

System action: The command ends.

User response: Correct the filename and try the command again.

FOTS3419 Invalid serial number "*serial_number*"

Explanation: An invalid *serial_number* was specified.

System action: The command ends.

User response: Correct the *serial_number* and try the command again.

FOTS3420 Must specify key id (-I) when certifying

Explanation: When -s *ca_key* is specified, -I is required.

System action: The command ends.

User response: Correct the options and try the command again.

FOTS3421 Could not stat ***directory*****:** ***message***

Explanation: A call to stat() failed on *directory*. The system error is displayed with this message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3422 Cannot use -l with -H or -R.

Explanation: You specified arguments that are mutually exclusive.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS3423 Too few arguments.

Explanation: When using the -s option, additional options are required.

System action: Command ends.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for a list of options.

FOTS3424 key_write failed

Explanation: The key information could not be written to either stdout or file.

System action: Command ends.

User response: If using options to create or change the key file, check that there is enough space to create a key file.

FOTS3501 *function***: strdup**

Explanation: The strdup() system call failed.

System action: The command ends.

System programmer response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3502 *function***: key_drop_cert**

Explanation: Failed to remove the certificate from the public key.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3503 *function***: insane bitmap gap**

Explanation: Failed to generate krl.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3505 *function*: **update failed**

Explanation: Command failed.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3506 *function*: **bitmap bits < 0**

Explanation: The BN_num_bits function failed.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3507 *function*: **bitmap wraps u64**

Explanation: An internal error occurred.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3508 *function*: **alloc failed**

Explanation: An internal error occurred.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3509 *function*: **KRL truncated**

Explanation: An internal error occurred while reading a KRL file.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3510 *function*: **invalid signature key**

Explanation: An error occurred parsing the KRL file.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3511 *function*: **bad SHA1 length**

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3512 Unsupported KRL certificate section *type*

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3513 KRL certificate section contains unparsed data

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3514 *function*: **KRL unsupported format version** *format version*

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3515 KRL contains non-signature section

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3516 bad signaure on KRL

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3517 KRL signed more than once with the same key

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3518 Unsupported KRL section *type*

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3519 KRL section contains unparsed data

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3520 All keys used to sign KRL were revoked

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3521 KRL not signed with any trusted key

Explanation: An error occurred parsing the KRL.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry with a valid KRL file. If unable to resolve, contact your system programmer to report the problem.

FOTS3522 open *krl_path*: *message*

Explanation: A call to open() failed on *krl_path*. The system error is displayed with this message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3523 Revoked keys file not accessible - refusing public key authentication

Explanation: An error occurred checking a krl file for a key.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3524 Revoked keys file not readable - refusing public key authentication

Explanation: An error occurred checking a krl file for a key.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3525 Invalid KRL, refusing public key authentication

Explanation: An error occurred checking a krl file for a key.

System action: The command continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3526 Unable to load KRL

Explanation: An error occurred loading the KRL.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try the command again.

FOTS3527 Invalid KRL file

Explanation: The KRL file is not valid.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try the command again.

FOTS3528 fopen *krl_path*: *message*

Explanation: A call to fopen() failed on *krl_path*. The system error is displayed with this message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3529 revoking certificated by serial number requires specification of a CA key

Explanation: Failed to revoke certificate.

System action: The command ends.

User response: Provide the required CA key and try the command again.

FOTS3530 *krl_path*:*line_number*: **invalid serial "***serial***"**

Explanation: Failed to revoke certificate due to the invalid serial number.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try the command again.

FOTS3531 *krl_path*:*line_number*: **serial out of range**

Explanation: Failed to revoke certificate due to a serial number out of range.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try the command again.

FOTS3532 *krl_path*:*line_number*: **invalid serial range** *serial*:*serial*

Explanation: Failed to revoke certificate due to an invalid serial number range.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try the command again.

FOTS3533 *function*: **revoke serial failed**

Explanation: Failed to revoke certificate by serial number.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3534 *function*: **revoke serial failed**

Explanation: Failed to revoke certificate.

System action: The command ends.

User response: Provide the required CA key and try the command again.

FOTS3535 *function*: **revoke key ID failed**

Explanation: Failed to revoke certificate by key ID.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3537 **key_new**

Explanation: An internal error occurred.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3538 *function*:*line_number*: **invalid key**

Explanation: Failed to revoke certificate due to an invalid key.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try the command again.

FOTS3539 *function*: **revoke key failed**

Explanation: Failed to revoke certificate by key.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3540 **KRL generation requires an output file**

Explanation: Failed to generate KRL.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Specify the required output file and try again.

FOTS3541 **Cannot access KRL "***krl_path***":** *message*

Explanation: A call to stat() failed on *krl_path*. The system error is displayed with this message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3542 **KRL "***krl_path***" does not exist**

Explanation: The KRL file specified by *krl_path* does not exist.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the *krl_path* and try the command again.

FOTS3543 **Cannot load CA public key** *key*

Explanation: The CA public key file could not be loaded.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the *key* and try the command again.

FOTS3544 **couldn't create KRL**

Explanation: Failed to create a new KRL.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3545 **Couldn't generate KRL**

Explanation: Failed to generate the KRL.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3546 open *krl_path*: *message*

Explanation: A call to write() failed on *krl_path*. The system error is displayed with this message.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3547 KRL checking requires an input file

Explanation: A KRL file must be provided when the -Q option is specified.

System action: The command ends.

User response: Provide a KRL file using the -f option and try again.

FOTS3548 Cannot load public key *krl_file*

Explanation: Failed to load the public key from the KRL file.

System action: The command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KRL file and try again.

FOTS3550 *function*: **BN_new**

Explanation: The BN_new function failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system administrator to report the problem.

FOTS3601 *function*: **channel_by_id(***cid***) == NULL**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3602 *function*: **channel** *channel* **missing control channel** *control_channel*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3603 *function*: **channel** *channel* **missing session channel** *session_channel*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3604 *function***: channel** *channel***: c->mux_ctx == NULL**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3605 *function***: HELLO received twice**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3606 *function***: malformed message**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3607 Unsupported multiplexing protocol version *version* **(expected** *version***)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3608 **>***number_of_vars* **environment variables received, ignoring additional**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3609 *function***: unknown forward type** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3610 *function***: unknown channel**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3611 *function*: *message*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3612 *function*: **mux_pause** *pause*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3613 *function*: **expected MUX_MSG_HELLO(***type***), received***type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3614 *function*: **unsupported mux message***type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3615 *function*: **channel** *channel* **missing mux channel** *channel*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3616 **ControlPath "***path***" too long for Unix domain socket**

Explanation: The path name given on the ControlPath option is longer than allowed by the system.

System action: The program continues, but mux support is disabled.

User response: Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for correct use of the ControlPath option.

FOTS3617 **ControlSocket** *control_path* **already exists, disabling multiplexing**

Explanation: The path specified by the ControlPath option already exists.

System action: The program continues, but mux support is disabled.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the ControlPath option to refer to a unique path. Refer to *IBM Ported Tools for z/OS: OpenSSH User's Guide* for correct use of the ControlPath option.

FOTS3618 *function*: **link mux listener** *control_path* **=>** *original_control_path*: *system error*

Explanation: The link() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3619 *function*: **channel** *id* **lacks control channel** *channel*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3620 *function*: **write packet:** *system error*

Explanation: The write() system call failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3621 *function*: **expected HELLO (***type***) received** *type*

Explanation: Internal error. An unexpected message type was received on the mux socket.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3622 *function*: **master returned error:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3623 *function*: **out of sequence reply: my id** *request_id* **theirs** *request_id*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3624 *function*: **read from master failed:** *system error*

Explanation: Internal error. A read() system call for the mux socket failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3625 **Master refused termination request:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3626 *function***: termination request failed:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3627 *function***: unexpected response from master** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3628 *function***: got MUX_S_REMOTE_PORT for cancel**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3629 **Master refused forwarding request:** *error*

Explanation: A client forwarding request to a ControlSocket socket was rejected.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3630 *function***: forwarding request failed:** *error*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3631 *function***: master alive request failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3632 **Master refused session request:** *error*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3633 *function***: session request failed:** *error*

Explanation: Internal error.

System action: The program ends | continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3634 *function***: tty alloc fail on unknown session: my id** *session_id* **theirs** *session_id*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3635 *function***: exit on unknown session: my id** *session_id* **theirs** *session_id*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3636 *function***: exitval sent twice**

Explanation: Internal error.

System action: The program ends | continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3637 **Master refused stdio forwarding request:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3638 *function*: **stdio forwarding request failed:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3639 *function*: **mux_client_read_packet:** *error_message*

Explanation: Internal error.

System action: The program ends | continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3640 *function*: **master returned unexpected message** *type*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3641 **Master refused stop listening request:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3642 *function*: **stop listening request failed:** *error*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3643 *function*: **master hello exchange failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3644 *function*: **master alive check failed**

Explanation: Internal error.

System action: The program ends | continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3645 *function*: **master forward request failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3646 *function*: **master cancel forward request failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Check *IBM Ported Tools for z/OS: OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster optiopns. If unable to resolve, contact your systems programmer.

FOTS3647 **unrecognised muxclient_command** *function*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3701 **key_from_blob: can't read ecdsa key point**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3702 **key_from_blob: EC_KEY_set_public_key failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3703 **key_from_blob: can't parse cert data**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3704 key_demote: EC_KEY_new_by_curve_name failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3705 key_demote: EC_KEY_set_public_key failed

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3706 *function***: legacy ECDSA certificates are not supported**

Explanation: EDCDSA keys are not supported in V00 OpenSSH certificates.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the key type or certificate version and retry your command. If unable to resolve, contact your system programmer to report the problem.

FOTS3707 *function***: key has incorrect type** *type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3708 *function***: key lacks cert info**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3709 *function***: certificate has unknown type** *type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3710 *function***: CA key has unsupported type** *type*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3711 *function*: **signature operation failed**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3712 *function*: **system clock lies before epoch**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3713 *function*: **unsupported EC curve nid** *nid*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3714 *function*: **invalid nid** *nid*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3715 *function*: **group is not a prime field**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3716 *function*: **received degenerate public key (infinity)**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3717 *function*: **BN_CTX_get failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3718 *function*: **EC_GROUP_get_order failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3719 *function*: **EC_POINT_get_affine_coordinates_GFp**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3720 *function*: **public key x coordinate too small: bits(x) =** *bits*, **bits(order)/2 =** *bits_order*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3721 *function*: **public key y coordinate too small: bits(y) =** *bits*, **bits(order)/2 =** *bits_order*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3722 *function*: **BN_CTX_tmp failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3723 *function*: **EC_GROUP_mul failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3724 *function*: **received degenerate public key (nQ != infinity)**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3725 *function*: **BN_sub failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3726 *function*: **public key x coordinate >= group order - 1**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3727 *function*: **public key y coordinate >= group order - 1**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3728 *function*: **private key too small: bits(y) =** *bits*, **bits(order)/2 =** *bit_order*

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3729 *function*: **private key >= group order - 1**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3730 **Unsupported KEX algorithm "***algorithm***"**

Explanation: A undefined KEX algorithm was specified.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Correct the KexAlgorithms option. If unable to resolve, contact your system programmer to report the problem.

FOTS3731 **unsupported kex alg** *algorithm*

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3732 *function*: **invalid client public key**

Explanation: The client provided public key used for key exchange was not valid.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3733 *function*: **ECDH_compute_key failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3734 *function*: **BN_bin2bn failed**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3735 **ECC support is not enabled**

Explanation: Internal error.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3736 *function*: **invalid server public key**

Explanation: The server public key presented for key exchange was not valid.

System action: The program ends.

System programmer response: Correct the server (host) public key. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3737 **Write connection closed**

Explanation: The socket connection was lost.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry the connection. If unable to resolve, contact your system programmer to report the problem.

FOTS3738 **Received disconnect from** *remote_ip* **:** *error_message*

Explanation: An SSH DISCONNECT packet was received on the connection.

System action: The program end.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Retry the connection. If unable to resolve, contact your system programmer to report the problem.

FOTS3739 **setsockopt IPV6_TCLASS** *tos* **:** *error_message***:**

Explanation: The socket() system call used to configure IPQoS for an IPV6 socket failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

User response: Refer to *z/OS XL C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3740 **channel** *channel***: must not sent eow on closed output**

Explanation: Internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3744 *function***: template string too short**

Explanation: Internal error. The temporary file template name provided is too short.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3746 **Tunnel interfaces are not supported on this platform**

Explanation: Tunnel interfaces are not supported on z/OS.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3747 *function***: key_to_certified failed**

Explanation: An internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your systems programmer.

FOTS3748 *file* **line** *line***:** *value* **value not specified, defaults to 'shell,exec'.**

Explanation: An internal error.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your systems programmer.

FOTS3749 *function*: **BN_bn2bin() failed: gbuf_len** *gbuf_length* **!= bnum_len** *bnum_length*

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3750 *function*: **DSA_SIG_new failed**

Explanation: Internal error.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3751 *function*: **d2i_DSA_SIG failed**

Explanation: A call to OpenSSL function d2i_DSA_SIG failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3752 *function*: **i2d_DSA_SIG failed**

Explanation: A call to OpenSSL function i2d_DSA_SIG failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3801 **No authentication or GSSAPI context**

Explanation: Internal error

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3802 **Couldn't convert client name**

Explanation: Internal error. The sshd server ssh_gssapi_getclient() function failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3803 **Couldn't identify host exchange**

Explanation: Internal error. The ssh client failed attempting GSSAPIKeyExchange.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3804 Couldn't import hostname

Explanation: Internal error. The ssh client failed attempting GSSAPIKeyExchange.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3805 Couldn't acquire client credentials

Explanation: Internal error. The ssh client failed attempting GSSAPIKeyExchange.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer to report the problem.

FOTS3806 kexgss_client: BN_new() failed

Explanation: During ssh client GSSAPIKeyExchange, a call to the OpenSSL function BN_new() failed. BN_new() allocates and initializes a BIGNUM structure. An internal error has occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3807 GSSGRP_GEX group out of range: *min nbits max*

Explanation: During ssh client GSSAPIKeyExchange, the parameters for group exchange were incorrect.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3808 kexgss_client: Unexpected KEX type %d

Explanation: During ssh client GSSAPIKeyExchange, an unexpected KEX type was received from the server.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3809 dh_server_pub == NULL

Explanation: During ssh client GSSAPIKeyExchange, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3810 gss_init_context failed, RC=0x*major***/***minor*

Explanation: During ssh client GSSAPIKeyExchange, the gss_init_context() function failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to "z/OS Integrated Security Services Network Authentication Services Administation" for the major/minor status code description. If unable to resolve, contact your system programmer.

FOTS3811 Mutual authentication failed

Explanation: During GSSAPIKeyExchange, gss_init_context() completed, but a mutual authentication indication was not received.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3812 Integrity check failed

Explanation: During GSSAPIKeyExchange, gss_init_context() completed, but a completed integrity check indication indication was not received.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3813 Server host key received more than once

Explanation: During GSSAPIKeyExchange, the server's host key was received more than once.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3814 GSSAPI Continue received from server when complete

Explanation: During GSSAPIKeyExchange, a SSH2_MSG_KEXGSS_CONTINUE message was received after key exchange was already complete.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3815 GSSAPI Error: *message*

Explanation: During GSSAPIKeyExchange, a SSH2_MSG_KEXGSS_ERROR message was received from the server containing the given message.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3816 Not complete, and no token output

Explanation: Internal error. During GSSAPIKeyExchange, gss_init_sec_context() completed, but an expected token was not received.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3817 Didn't receive a SSH2_MSG_KEXGSS_COMPLETE when I expected it

Explanation: Internal error. During GSSAPIKeyExchange, the expected message was not received.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3818 Unknown gssapi mechanism

Explanation: During GSSAPIKeyExchange, an unknown GSSAPI key exchange mechanism was received.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3819 Unable to acquire credentials for the server

Explanation: During GSSAPI key exchange, the sshd server was unable acquire credentials for the server principal.

System action: The program ends.

System programmer response: Review the z/OS GSS/Kerberos configuration for the sshd server. If unable to resolve, follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3820 GSS_GEX, bad parameters: $ *min nbits max*

Explanation: During ssh server GSSAPI key exchange, the parameters for group exchange were incorrect.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3821 Received KEXGSS_INIT after initialising

Explanation: During ssh server GSSAPI key exchange, a message was received out of expected sequence.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3822 dh_client_pub == NULL

Explanation: During sshd server GSSAPI key exchange, a protocol error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3823 Zero length token output when incomplete

Explanation: During sshd server GSSAPI key exchange, a protocol error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3824 No client public key

Explanation: During sshd server GSSAPI key exchange, a protocol error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3825 gss_accept_sec_context() failed, RC=0x*major***/***minor*

Explanation: During GSSAPI key exchange, the gss_accept_sec_context() function failed.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Refer to "z/OS Integrated Security Services Network Authentication Services Administation" for the major/minor status code description. If unable to resolve, contact your system programmer.

FOTS3826 Mutual Authentication flag wasn't set

Explanation: During sshd server GSSAPI key exchange, the gss_accept_sec_context() function completed without setting the mutual authentication flag.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3827 Integrity flag wasn't set

Explanation: During sshd server GSSAPI key exchange, the gss_accept_sec_context() function completed without setting the integrity flag.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3828 Couldn't get MIC

Explanation: During sshd server GSSAPI key exchange, a protocol error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3829 In GSSAPI monitor when GSSAPI is disabled

Explanation: During sshd server GSSAPI key exchange, an internal error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3830 *function***: data length incorrect:** *length*

Explanation: During sshd server GSSAPI authentication, a protocol error occurred.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3831 **No supported key exchange algorithms**

Explanation: During sshd server host key exchange, no supported algorithms could be found.

System action: The program ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: If GSSAPIKeyExchange has been requested, there is an issue with GSS. Check your GSSAPI configuration. Otherwise, check your host keys.

FOTS3832 *function*: **there is no SAF userid associated with krb5 principal:** *principal*

Explanation: During GSSAPI principal validation, R_usermap failed to find a SAF userid associated with the krb5 principal.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Confirm that the necessary KERBNAME is defined and that the userid has a KERB segment.

FOTS3833 *function*: **R_usermap(): SAF_RC=***saf_rc* **RACF_RC=***racf_rc* **RACF_REAS=***racf_reas* **krb5 principal:** *principal*

Explanation: During GSSAPI principal validation, R_usermap failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Confirm that the necessary KERBNAME is defined and that the userid has a KERB segment.

Check *z/OS Security Server RACF Callable Services*

FOTS3834 *function*: **krb5 principal:** *principal* **is not associated with userid:** *userid*

Explanation: During GSSAPI principal validation, the R_usermap returned a userid doesn't match the expected userid for the krb5 principal.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Confirm that the necessary KERBNAME is defined and that the userid has a KERB segment.

FOTS3901 **FIPS mode does not support protocol 1**

Explanation: FIPS mode only applies to SSH protocol 2.

System action: Command ends.

System programmer response: Check the configuration.

User response: Check the configuration, choose FIPS mode with protocol 2 or non-FIPS mode. Contact your system administrator if the configuration is global.

FOTS3902 **FIPS mode does not support protocol 1, choose protocol 2**

Explanation: FIPS mode only applies to SSH protocol 2. If SSH protocol 1 and 2 are both specified, only protocol 2 take effect.

System action: The program continues.

System programmer response: Check the configuration.

User response: Check the configuration. Do not set FIPSMode to yes with protocol 1. Contact your system administrator if the configuration is global.

FOTS3903 **Ignore** ***key_file*****:** ***filename*** **in FIPS mode**

Explanation: FIPS mode restricts the key store to Key Ring, not UNIX file.

System action: The program continues.

User response: Please use the Key Ring instead of UNIX file.

FOTS3904 *option* **is not supported in FIPS mode, disable it**

Explanation: The option is not supported in FIPS mode. OpenSSH disable the option automatically.

System action: The program continues.

System programmer response: Check the configuration.

User response: Check the configuration. Do not set FIPSMode to yes with the option enable. Contact your system administrator if the configuration is global.

FOTS3905 **ForwardAgent is not supported in FIPS mode**

Explanation: The option is not supported in FIPS mode.

System action: Command ends.

System programmer response: Check the configuration.

User response: Check the configuration. Do not set FIPSMode to yes with the ForwardAgent enable. Contact your system administrator if the configuration is global.

FOTS3906 *function*: **FIPS mode is enable, CiphersSource/KexAlgorithmsSource/MacsSource must be ICSF or Any**

Explanation: FIPS mode requires all of CiphersSource/KexAlgorithmsSource/MacsSource set to ICSF or Any.

System action: Command ends.

System programmer response: Check the configuration.

User response: Check the configuration. Contact your system administrator if the configuration is global.

FOTS3907 *function*: **FIPS mode is enable, switching algorithmsSource to ICSF source**

Explanation: If CiphersSource/KexAlgorithmsSource/MacsSource is set to yes in FIPS mode, OpenSSH will change it to ICSF automatically.

System action: The program continues.

System programmer response: NONE

User response: NONE

FOTS3908 **System SSL change into FIPS mode failed**

Explanation: The System SSL change into FIPS mode failed.

System action: Command ends.

System programmer response: Check if ICSF is avaliable. If unable to resolve, Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3909 *function* **(***line_number***): systemssl_function failed: (***return_code***).** *error_message***.**

Explanation: A call to System SSL function failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3910 **ssh_rsa_sign: RSA signature with MD5 digest is not supported in FIPSMODE**

Explanation: MD5 algorithms does not comply with FIPSMODE.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3911 **ssh_rsa_sign: sysssl_rsa_sign() failed**

Explanation: Generate RSA signature failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3912 **ssh_rsa_verify: RSA signature with MD5 digest is not supported in FIPSMODE**

Explanation: MD5 algorithms does not comply with FIPSMODE.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3913 **Invalid or not supported hash method** *hash_method_number*

Explanation: Invalid or not supported hash method.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3914 *function***: bad big number len** *length*

Explanation: A call to OpenSSL function BN_num_bytes failed.

System action: The program continues.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

FOTS3915 *function***: md5 is not supported in fips mode**

Explanation: MD5 algorithms does not comply with FIPSMODE.

System action: Command ends.

System programmer response: Follow local procedures for reporting problems to IBM.

User response: Contact your system programmer.

| **FOTS3916** *function*: **Unsupported hash method**

| **Explanation:** Unsupported hash method.

| **System action:** Command ends.

| **System programmer response:** Follow local procedures for reporting problems to IBM.

| **User response:** Contact your system programmer.

Appendix A. Accessing MVS data sets within sftp

OpenSSH's **sftp** does not have built-in support for MVS data sets. However, there are alternate (indirect) ways to access MVS data sets within **sftp**.

Solution 1

From within **sftp**, use a shell escape to copy between MVS and the z/OS UNIX file system. Do this by preceding any shell command by a '!'.

For example:

```
!cp "//'CTWARE.C(HELLO)'" hello.c
```

The 'HELLO' member is copied to a local file `hello.c`, which could then be transferred from **sftp**. This would be executed while you are within an sftp shell.

Note: The `hello.c` file will remain in the z/OS UNIX file system until it is manually removed.

You can use this solution from within an **sftp** batch file as well, to automate certain tasks or help in removal of the file:

```
> cat batchfile
lcd sftptest
cd Test
!cp "//'CTWARE.C(HELLO)'" hello.c
put hello.c
!rm hello.c
> sftp -b batchfile user@remotehost
```

This example would change directories (both local and remote), copy an MVS dataset to the z/OS UNIX file system (on the local machine), transfer the file (to the remote system), and then remove the (local) z/OS UNIX file system copy. This would save you some work, and you would not have to manually remove 'temporary' files.

Tip: Because the **sftp** exit value is not affected by shell command escapes, Solution 2 is preferred if verification of a successful copy is required.

Solution 2

Copy the data from an MVS dataset to the z/OS UNIX file system prior to using **sftp**.

For example:

```
cp "//'CTWARE.C(HELLO)'" hello.c
```

The 'HELLO' member is copied to a local file `hello.c`, which could then be transferred from **sftp**. This would be executed from a standard z/OS UNIX shell

Note: The `hello.c` file remains in the z/OS UNIX file system until it is manually removed.

Appendix B. OpenSSH - port forwarding examples

OpenSSH - without TCP forwarding

Direct client/server connection (no forwarding)

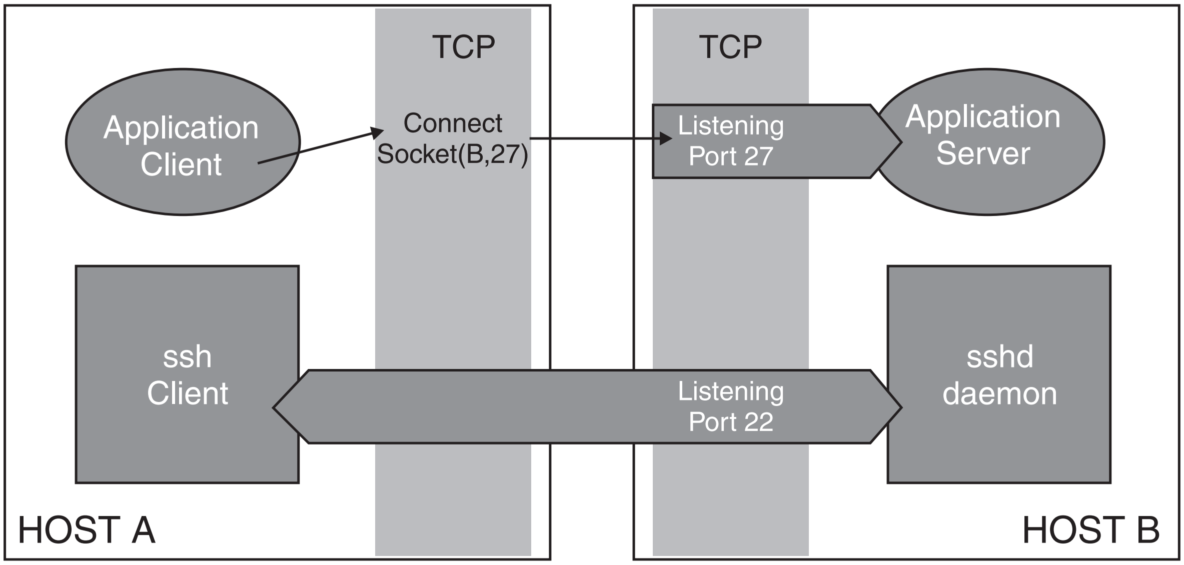


Figure 8. OpenSSH - without TCP port forwarding

OpenSSH - with TCP port forwarding

OpenSSH provides TCP port forwarding, also known as tunnelling, which allows other TCP applications to forward their network data over a secure SSH connection. In other words, existing TCP applications that do not encrypt their data before sending it across the network can send their network traffic through an SSH channel, thereby securing it.

Without TCP forwarding, an application's client connections directly to its server across the network, as shown in Figure 8. To use port forwarding, an existing SSH session must exist.

Example: An example of invoking the **ssh** client to support local port forwarding is:

```
ssh -L 2001:remotehost:27 billy@remotehost
```

Result: The **ssh** client on Host A listens on port 2001 for connections (see Figure 9 on page 520). The TCP application will now connect to port 2001 on the local host (Host A), rather than connect to its well-known port on Host B, where the remote server is listening. This is demonstrated in Figure 10 on page 520. The **ssh** client accepts the connection on port 2001 and forwards the application's data to the OpenSSH server (**sshd**) on Host B. **sshd** then forwards the data to the application's well-known port on Host B, as specified on invocation of the **ssh** client to be port 27. This is demonstrated in Figure 11 on page 521.

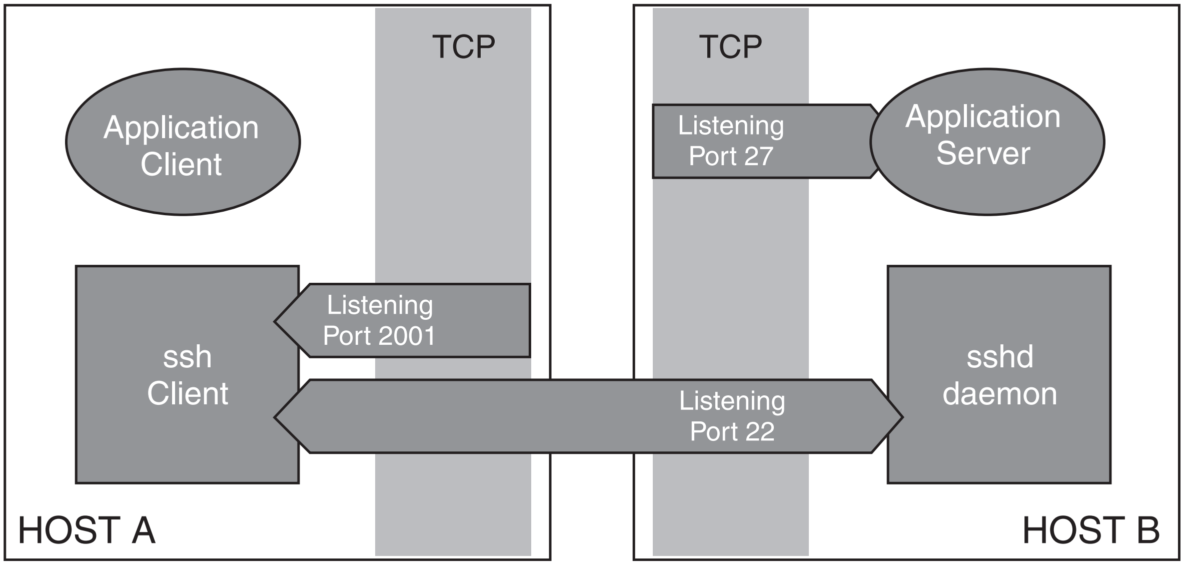


Figure 9. The ssh client is listening on port 2001 for a connection

The TCP application wants to contact the server through a SSH connection.

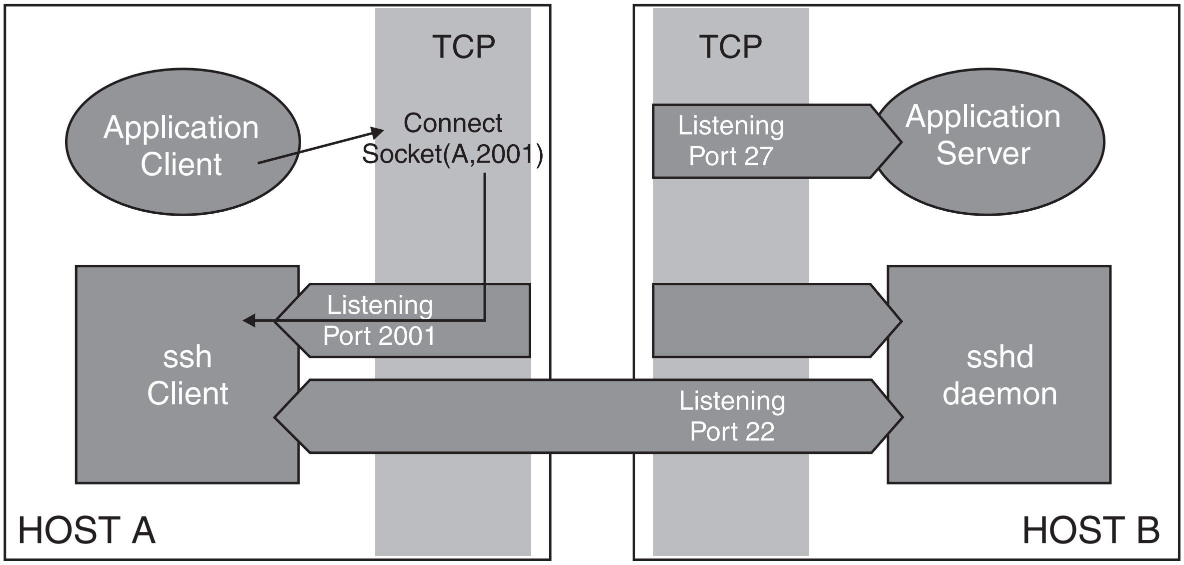


Figure 10. The application is connecting to port 2001 on the local host (Host A)

ssh forwards the data through an SSH tunnel; **sshd** delivers to server.

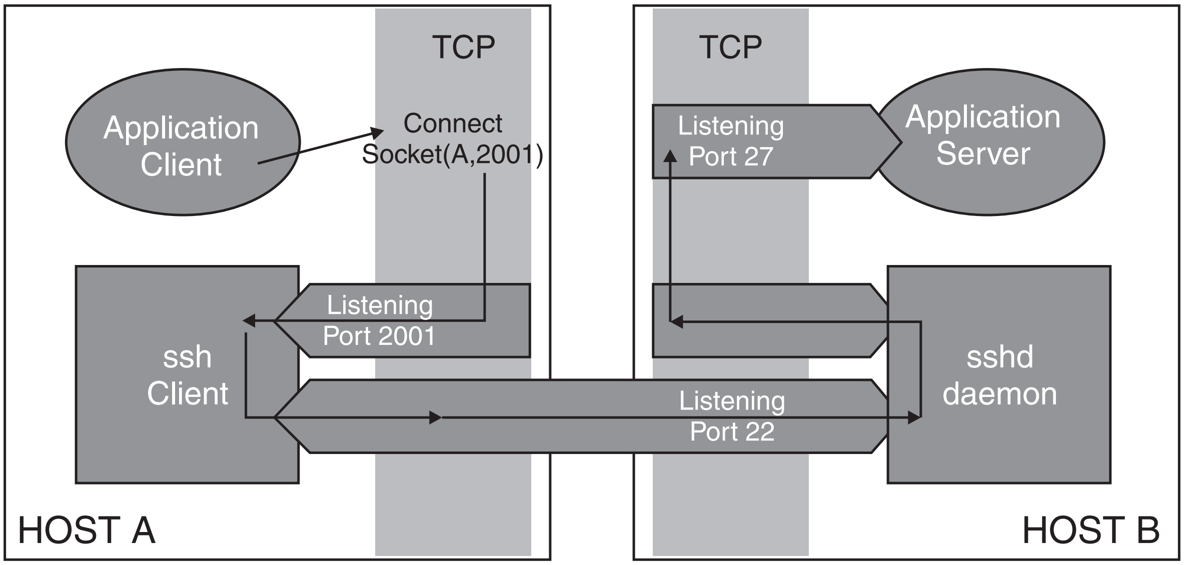


Figure 11. The ssh client accepts the connection on port 2001, forwards the application's data to sshd on Host B, sshd then forwards the data to the application's server, listening on Port 27

Appendix C. RFCs and Internet drafts

The Internet Engineering Task Force (http://www.ietf.org/) has a Secure Shell (SECSH) working group whose goal is to update and standardize the popular SSH protocol. The following SECSH RFCs describe some of the different layers of the protocol:

- The Secure Shell (SSH) Protocol Assigned Numbers, RFC 4250, 2006.
- The Secure Shell (SSH) Protocol Architecture, RFC 4251, 2006.
- The Secure Shell (SSH) Authentication Protocol, RFC 4252, 2006.
- The Secure Shell (SSH) Transport Layer Protocol, RFC 4253, 2006.
- The Secure Shell (SSH) Connection Protocol, RFC 4254, 2006.
- Using DNS to Securely Publish Secure Shell (SSH) Key Fingerprints, RFC 4255, 2006.
- Generic Message Exchange Authentication for the Secure Shell Protocol (SSH), RFC 4256, 2006.
- The Secure Shell (SSH) Session Channel Break Extension, RFC 4335, 2006.
- The Secure Shell (SSH) Transport Layer Encryption Modes, RFC 4344, 2006.
- Improved Arcfour Modes for the Secure Shell (SSH) Transport Layer Protocol, RFC 4345, 2006.
- Diffie-Hellman Group Exchange for the Secure Shell (SSH) Transport Layer Protocol, RFC 4419, 2006.
- GSS-API Authentication and Key Exchange (only authentication implemented). RFC 4462, 2006.
- The Secure Shell (SSH) Public Key File Format, RFC 4716, 2006.
- The Secure Shell (SSH) Public Key Subsystem, RFC 4819, 2007.
- Elliptic Curve Algorithm Integration in SSH, RFC 5656, 2009.
- SHA-256 SSHFP Resource Records in DNS. RFC 6594 2012.
- SHA-2 Data Integrity Algorithms. RFC 6668, 2012.

Because internet drafts can be updated, replaced, or obsoleted by newer versions, OpenSSH may only conform to a particular version of the draft. Refer to the IETF Web site at http://www.ietf.org/for a list of drafts.

Appendix D. Accessibility

Accessible publications for this product are offered through IBM Knowledge Center (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 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 V2R2 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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This glossary defines technical terms and abbreviations used in the OpenSSH portion of the IBM Ported Tools for z/OS documentation. If you do not find the term you are looking for, view IBM Glossary of Computing Terms, located at: http://www.ibm.com/ibm/terminology

A

address space identifier (ASID)
A unique, system-assigned identifier for an address space.

ASID See address space identifier.

B

Basic Encoding Rules (BER)
A set of rules used to encode Abstract Syntax Notation One (ASN.1) values as strings of octets.

BCD See binary-coded decimal.

BER See Basic Encoding Rules.

binary-coded decimal (BCD)
A system for encoding decimal numbers in binary form to avoid rounding and conversion errors. In BCD, the digits of a decimal number are individually represented in 4-bit binary notation. For example, the decimal number 1024 is recorded in BCD as 0001000000100100.

C

CERT Coordination Center (CERT/CC)
The CERT/CC is a major reporting center for Internet security problems. Staff members provide technical advice and coordinate responses to security compromises, identify trends in intruder activity, work with other security experts to identify solutions to security problems, and disseminate information to the broad community. The CERT/CC also analyzes product vulnerabilities, publishes technical documents, and presents training courses. For more detailed information about the CERT/CC, see "Meet the CERT/CC" at http://www.cert.org/meet_cert/meetcertcc.html.

CERT/CC
See CERT Coordination Center (CERT/CC).

certificate
In computer security, a digital document that binds a public key to the identity of the certificate owner, thereby enabling the certificate owner to be authenticated. A certificate is issued by a certificate authority and is digitally signed by that authority.

certificate authority
An organization that issues digital certificates. The certificate authority authenticates the certificate owner's identity and the services that the owner is authorized to use, and revokes certificates belonging to users who are no longer authorized to use them.

D

Data Encryption Standard (DES)
A cryptographic algorithm designed to encrypt and decrypt data using a private key.

DER See Distinguished Encoding Rules.

DES See Data Encryption Standard.

DH-GEX
See Diffie-Hellman Group Exchange.

Diffie-Hellman Group Exchange (DH-GEX)
A key agreement method that allows two parties to derive a shared secret key securely over an open (unprotected) network.

digital certificate
A digital document that binds a public key to the identity of the certificate owner, thereby enabling the certificate owner to be authenticated. A certificate is issued by a certificate authority.

digital signature algorithm (DSA)
A security protocol that uses a pair of keys (one public and one private) and a one-way encryption algorithm to provide a robust way of authenticating users and systems. If a public key can successfully decrypt a digital signature, a user can be

sure that the signature was encrypted using the private key.

Distinguished Encoding Rules (DER)
A standard, based on the Basic Encoding Rules, that is designed to ensure a unique encoding of each ASN.1 value, defined in ITU-T X.690.

DSA See digital signature algorithm.

F

Federal Information Processing Standard (FIPS)
A standard produced by the National Institute of Standards and Technology when national and international standards are nonexistent or inadequate to satisfy the U.S. government requirements.

FIPS See Federal Information Processing Standard.

G

Generic Security Services Application Programming Interface (GSS-API)
An Internet Standard protocol (R2078) that specifies calling conventions by which an application (typically another communication protocol) can obtain authentication, integrity, and confidentiality security services independently of the underlying security mechanisms and technologies, thus allowing the application source code to be ported to different environments.

globalization
In computing, the provision of a single software solution that has (1) multicultural support and (2) a user interface and documentation that is available in one or more languages.

GSS-API
See Generic Security Services Application Programming Interface.

I

Integrated Cryptographic Service Facility (ICSF)
A z/OS licensed program that provides access to the hardware cryptographic feature for programming applications. The combination of the hardware cryptographic feature and ICSF provides secure high-speed cryptographic services.

Internet Engineering Task Force (IETF)
The task force of the Internet Architecture Board (IAB) that is responsible for solving the short-term engineering needs of the Internet. The IETF consists of numerous working groups, each focused on a particular problem. Specifications proposed as standards typically undergo a period of development and review before they are adopted as standards.

ICSF See Integrated Cryptographic Service Facility.

IETF See Internet Engineering Task Force.

K

Kerberos
The security system of Massachusetts Institute of Technology's (MIT) Project Athena. It uses symmetric key cryptography to provide security services to users in a network.

key In computer security, a sequence of symbols that is used with a cryptographic algorithm for encrypting or decrypting data. See also private key, public key.

key pair
In computer security, a public key and a private key. The sender uses the private key to encrypt the message. The recipient uses the public key to decrypt the message. Because the private key holds more of the encryption pattern than the public key does, the key pair is called asymmetric.

key ring
In computer security, a file that contains public keys, private keys, trusted roots, and certificates.

M

message authentication code (MAC)
In computer security, a value that is a part of a message or accompanies a message and is used to determine that the contents, origin, author, or other attributes of all or part of the message are as they appear to be.

MAC See message authentication code.

MTU See maximum transmission unit.

multilevel security
A security policy that allows the classification of data and users based on a system of hierarchical security levels (for example: unclassified, secret, top secret) combined with a system of

non-hierarchical security categories (for example: Project A, Project B, Project C). The system imposes mandatory access controls restricting which users can access data based on a comparison of the classification of the users and the data. In order to access data, a user must have a security level greater than or equal to that of the data, and be authorized to all of the categories assigned to the data. The mandatory access controls exist in addition to any discretionary access controls (such as access lists) that users can manipulate, and a user must pass both the mandatory controls and any discretionary controls in order to access the data protected by those controls.

maximum transmission unit (MTU)
The largest possible unit of data that can be sent on a given physical medium in a single frame. For example, the maximum transmission unit for Ethernet is 1500 bytes.

P

PAM See Pluggable Authentication Module.

Pluggable Authentication Module (PAM)
A programming interface that enables third-party security methods to be used. PAM enables multiple types of authentication, such as Kerberos and the Rivest-Shamir-Adleman (RSA) algorithm, to be used without changing login services.

passphrase
A type of password that is used to control access to OpenSSH authentication keys. It typically contains a sequence of words, punctuation, numbers, white space, or any string of characters, with a mix of uppercase and lowercase letters, numbers, and nonalphanumeric characters.

password phrase
A string consisting of mixed-case letters, numbers, and special characters, including blanks, that is used to control access to data and systems.

private key
In secure communication, an algorithmic pattern used to encrypt messages that only the corresponding public key can decrypt. The private key is also used to decrypt messages that were encrypted by the corresponding public key. The private key is kept on the user's system and is protected by a password. See also key, public key.

public key
In secure communication, an algorithmic pattern used to decrypt messages that were encrypted by the corresponding private key. A public key is also used to encrypt messages that can be decrypted only by the corresponding private key. Users broadcast their public keys to everyone with whom they must exchange encrypted messages. See also key, private key.

R

Rivest-Shamir-Adleman algorithm (RSA)
A public-key encryption technology developed by RSA Data Security, Inc, and used in the IBM implementation of SSL.

RSA See Rivest-Shamir-Adleman algorithm.

S

SAF See System Authorization Facility.

seed A value that adds randomness to the creation of pseudorandom numbers.

Secure Sockets Layer (SSL)
A security protocol that provides communication privacy. With SSL, client/server applications can communicate in a way that is designed to prevent eavesdropping, tampering, and message forgery.

SMF See System Management Facilities.

SOCKS server
A proxy server that provides a secure one-way connection through a firewall to server applications in a nonsecure network. The server applications in the secure network must be compatible with the socket interface.

SSL See Secure Sockets Layer.

System Authorization Facility (SAF)
A z/OS interface with which programs can communicate with an external security manager, such as RACF.

System Management Facilities (SMF)
A component of z/OS that collects and records a variety of system and job-related information.

T

TLS See Transport Layer Security.

Transport Layer Security
An Internet Engineering Task Force (IETF)-defined security protocol that is based on Secure Sockets Layer (SSL) and is specified in RFC 2246.

Index

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SA23-2246-03