z/OS
3.1

z/OS OpenSSH User's Guide

SC27-6806-60

Note

Before using this information and the product it supports, read the information in “Notices” on page 523.

This edition applies to IBM® z/OS® 3.1 (5655-ZOS) and to all subsequent releases and modifications until otherwise indicated in new editions.

Last updated: 2024-07-19

Contents

Figures

Tables

About this document

This document presents the information you need to set up and use 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 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 Information Roadmap*.

To find the complete z/OS library, go to IBM Documentation (www.ibm.com/docs/en/zos).

Learning resources: Getting started with IBM zSystems (developer.ibm.com/learningpaths/get-started-ibmz/) provides online learning about IBM Z® basics and Red Hat® Open Shift on IBM Z.

Discussion list

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

To search through past discussions, go to the list archives available at OpenSSH (www.openssh.com).

How to provide feedback to IBM

We welcome any feedback that you have, including comments on the clarity, accuracy, or completeness of the information. For more information, see How to send feedback to IBM.

Summary of changes

This information includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations for the current edition are indicated by a vertical line to the left of the change.

Note: IBM z/OS policy for the integration of service information into the z/OS product documentation library is documented on the z/OS Internet Library under IBM z/OS Product Documentation Update Policy (www.ibm.com/docs/en/zos/latest?topic=zos-product-documentation-update-policy).

Summary of changes for z/OS 3.1

The following content is new, changed, or no longer included in z/OS 3.1.

New

The following content is new.

February 2024 refresh
The description for **sshd_config** keyword `HostKeyAlgorithms` is updated to indicate FIPSMODE information: "File format" on page 172.

November 2023 refresh
Updated the description for the **sshd_config** keyword `KexAlgorithms` to indicate that all KEX algorithms are supported, except for `curve25519-sha256,curve25519-sha256@libssh.org`.

September 2023 release

- z/OS OpenSSH is updated to OpenSSH 8.4p1. Previously, the product was based on OpenSSH 7.6p1.
- Support is added for FIDO/U2F key authentication, which is standardized support for user-present hardware tokens. z/OS OpenSSH supports these for verification only where the actual hardware token is not required such as:
  - z/OS SSHD authentication of a remote user with a FIDO/U2F token.
  - z/OS ssh client verification of a host key, where the server has a FIDO/U2F token.

  For more information, see "Using FIDO/U2F hardware authenticators with z/OS OpenSSH" on page 80.
- Less-secure algorithms are either deprecated or removed as defaults:
  - `Diffie-hellman-group14-sha1` is removed from the default KexAlgorithms list.
  - If **ssh-keygen** is used to create new OpenSSH certificates with an RSA key, the `rsa-sha2-512` algorithm is used by default.
  - The `ssh-rsa` (sha1) key algorithm is still supported as a default key algorithm, but is deprecated. It will be removed as a default in a future release.

Changed

The following content is changed.

July 2024 refresh

- The HostKeyAlgorithms keyword is updated. See "File format" on page 147.

May 2024 refresh

- Resource information is added to Chapter 1, "Introduction to z/OS OpenSSH ," on page 1.

- Additional information is added to “Steps for setting up the system to collect OpenSSH SMF records” on page 50.
- “Usage notes for BPX.SMF.type.subtype ” on page 52 is updated.

September 2023 release

- None.

Deleted

The following content was deleted.

September 2023 release

- None.

Terminology changes

To ensure alignment with current industry guidelines for inclusive language, the terms *master pseudoterminal* and *slave pseudoterminal* are replaced with *manager pseudoterminal* and *subsidiary pseudoterminal*. As other industry leaders join IBM in embracing the use of inclusive language, IBM will continue to update the documentation to reflect those changes.

Message changes

The following lists indicate the messages that are new, changed, or no longer issued in z/OS 3.1 and its updates.

New messages

The following messages are new.

FOTS4291 (APAR OA66005), which also applies to V2R4 and later
FOTS4292 (APAR OA66005), which also applies to V2R4 and later
FOTS0723 (APAR OA64483, which also applies to V2R4 and later
FOTS4322 (APAR OA64483, which also applies to V2R4 and later

Changed messages

The following messages are changed.

FOTS1555
FOTS2241
FOTS2914
FOTS4126

Deleted messages

The following messages were deleted.

None.

Chapter 1. Introduction to z/OS OpenSSH

The z/OS OpenSSH program product is a port of OpenSSH provided by IBM as part of z/OS starting in Version 2 Release 2. Users of the previous releases of IBM Ported Tools for z/OS: OpenSSH must migrate to the new release as described in *z/OS Upgrade Workflow* before using the information in this book.

OpenSSH refers to the z/OS implementation of OpenSSH. For the open source documentation, see OpenSSH (www.openssh.com).

Reference information:

The IBM Education home page (www.ibm.com/training) contains a course catalog, training paths, a list of classes, and several links, including a link to the IBM Education Assistant. The IBM Education Assistant is a collection of multimedia educational modules that are designed to help you gain a better understanding of IBM products and use them more effectively to meet your business requirements. z/OS 3.1 IBM Education Assistant (OpenSSH upgrade to 8.4) (ibm.biz/ibmeducation_openssh_upgrade) provides additional information about the upgrade to 8.4.

Chapter 2. What's new or changed in z/OS 3.1 OpenSSH

This topic documents changes that were introduced in z/OS 3.1 OpenSSH. It includes these sections:

- "Summary of changes to commands" on page 3
- "New and changed configuration files" 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

The following table lists commands that were changed in z/OS 3.1.

Table 1. Summary of changes to commands in z/OS 3.1

Command	Changes
scp	The following options are added: `-3`, `-A`, `-J` Support URI format of destination. Reference: • "scp - Secure copy (remote file copy program)" on page 91
sftp	The following options are added: `-A`, `-J` Support URI format of destination. Subcommand: **cd**, **lcd**, **chgrp**, **chmod**, **chown**, **get**, **put**, **reget**, **reput** Reference: • "sftp - Secure file transfer program" on page 93
sftp-server	The following options are added: `-t` Reference: • "sftp-server - SFTP server subsystem" on page 100
ssh	The following options are added: Support URI format of destination. The following options are changed: `-J`, `-Q` Reference: • "ssh - OpenSSH client (remote login program)" on page 102
ssh-add	The following options are added: `-T`, `-v` The following options are changed: `-d` Reference: • "ssh-add - Add private key identities to the authentication agent" on page 115

Table 1. Summary of changes to commands in z/OS 3.1 (continued)

Command	Changes
ssh-keygen	The following options are changed: -a, -b, -e, -F, -m, -M, -O, -R, -t, -V, -z Reference: - "ssh-keygen - Authentication key generation, management, and conversion" on page 122
sshd	the following options are changed: -C Reference: - "sshd - OpenSSH daemon" on page 136

New and changed configuration files

Table 2 on page 4 lists configuration files that were added or changed in Version 3 Release 1 of z/OS OpenSSH.

Table 2. Summary of changes to configuration files in 3.1 for z/OS OpenSSH

Configuration file	Changes
ssh_config	The following options were added: CASignatureAlgorithms, GSSAPIKexAlgorithms, SetEnv The following options were changed: AddKeysToAgent, CertificateFile, Ciphers, ControlPath, ControlPersist, ForwardAgent, ForwardX11Timeout, HostbasedKeyTypes, HostKeyAlgorithms, IdentityAgent, KexAlgorithms, LocalForward, MACs, Match, ProxyJump, PubkeyAcceptedKeyTypes, RemoteForward, SendEnv, UserKnownHostsFile Many options were changed and added in OpenSSH 8.4. See "ssh_config - OpenSSH client configuration files" on page 147.
sshd_config	The following options were added: CASignatureAlgorithms, GSSAPIKexAlgorithms, PermitListen, PubkeyAuthOptions, SetEnv The following options were changed: Ciphers, HostbasedAcceptedKeyTypes, HostCertificate, HostKeyAlgorithms, IgnoreRhosts, Include, KexAlgorithms, MACs, Match, PermitOpen, PermitUserEnvironment, PubkeyAcceptedKeyTypes Many options were changed and added in OpenSSH 8.4. See "sshd_config - OpenSSH daemon configuration file" on page 172.
moduli	The file that configures moduli for SSH group-exchange kex algorithms has changed.

Changed environment variables

Table 3 on page 5 lists environment variables that are changed for Version 3 Release 1 of z/OS OpenSSH.

Table 3. List of changed environment variables in 3.1 of z/OS OpenSSH

Environment variable	**Changes**
_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. The default value is YES. Reference: None

Summary of changes to SYS1.MACLIB

Table 4 on page 5 lists members of SYS1.MACLIB that were added in 3.1 for z/OS OpenSSH.

Table 4. Summary of changes to SYS1.MACLIB in 3.1 for z/OS OpenSSH

Sample	**Changes**
FOTSMF77	New constants to support new OpenSSH 8.4 algorithms. Reference: • Chapter 15, “SMF Type 119 records for OpenSSH,” on page 203

Summary of changes to non-configuration files in /samples

Table 5 on page 5 lists files in the `/samples` directory that were added in 3.1 of z/OS OpenSSH.

Table 5. Summary of changes to /samples in 3.1 of z/OS OpenSSH

Sample	**Changes**
ssh_smf.h **94 and 95 records**	New constants to support new OpenSSH 8.4 algorithms
ssh_config, sshd_config	Updated with new options and default values for OpenSSH 8.4
moduli	Updated with new prime number groups for "Group exchange" based key exchanged methods.

Chapter 3. What's new or changed in z/OS Version 2 Release 4 OpenSSH

This topic documents changes that were introduced in z/OS Version 2 Release 4 OpenSSH. It includes these sections:

- "New and changed configuration files" on page 7
- "Summary of changes to SYS1.MACLIB" on page 7
- "Summary of changes to non-configuration files in /samples" on page 8

New and changed configuration files

Table 6 on page 7 lists configuration files that were added or changed in Version 2 Release 4 of z/OS OpenSSH.

Table 6. Summary of changes to configuration files in V2R4 of z/OS OpenSSH

Configuration file	Changes
ssh_config	The following protocol 1 options were removed: Cipher, CompressionLevel, RhostsAuthentication, RhostsRSAAuthentication, RSAAuthentication. The obsolete KeepAlive option is no longer documented, but it is still recognized as an alias for the TCPKeepAlive option. The AFSTokenPassing option was removed, but was not available on z/OS UNIX. Many options were changed and added in OpenSSH 7.6. See the following reference. Reference: • "ssh_config - OpenSSH client configuration files" on page 147
sshd_config	The following protocol 1 options were removed: KeyRegenerationInteval, RhostsAuthentication, RhostsRSAAuthentication, RSAAuthentication, ServerKeyBits, UseLogin The PAMAuthenticationViaKbdInt option was removed, but was not available on z/OS UNIX. Many options were changed and added in OpenSSH 7.6. See the following reference: Reference: • "sshd_config - OpenSSH daemon configuration file" on page 172
moduli	The file which configures moduli for SSH group-exchange kex algorithms has changed.

Summary of changes to SYS1.MACLIB

Table 7 on page 8 lists members of SYS1.MACLIB that were added in Version 2 Release 4 of z/OS OpenSSH.

Table 7. Summary of changes to SYS1.MACLIB in V2R4 of z/OS OpenSSH

Sample	Changes
FOTSMF77	New constants to support new OpenSSH 7.6 algorithms; new triplet-section added to subtype 94 and 95 records. Reference: • Chapter 15, “SMF Type 119 records for OpenSSH,” on page 203

Summary of changes to non-configuration files in /samples

Table 8 on page 8 lists files in the `/samples` directory that were added in Version 2 Release 4 of z/OS OpenSSH.

Table 8. Summary of changes to /samples in V2R4 of z/OS OpenSSH

Sample	Changes
ssh_smf.h **94 and 95 records**	New constants to support new OpenSSH 7.6 algorithms; new triplet-section added to subtype
ssh_config, sshd_config	Updated with new options and default values for OpenSSH 7.6

Chapter 4. What's new or changed in z/OS Version 2 Release 3 OpenSSH

This topic documents changes that were introduced in z/OS Version 2 Release 3 OpenSSH. It includes these sections:

- "New and changed configuration files" on page 9
- "Summary of changes to SYS1.MACLIB" on page 9
- "Summary of changes to non-configuration files in /samples" on page 10

New and changed configuration files

Table 9 on page 9 lists configuration files that were added or changed in Version 2 Release 3 of z/OS OpenSSH.

Table 9. Summary of changes to configuration files in V2R3 of z/OS OpenSSH

Configuration file	Changes
zos_ssh_config	New CPACF option has been added for the CiphersSource and MACsSource keywords Reference: • zos_sshd_config
zos_sshd_config	New CPACF option has been added for the CiphersSource and MACsSource keywords Reference: • zos_sshd_config
zos_user_ssh_config	New CPACF option has been added for the CiphersSource and MACsSource keywords Reference: • zos_user_ssh_config

Summary of changes to SYS1.MACLIB

Table 10 on page 9 lists members of SYS1.MACLIB that were added in Version 2 Release 3 of z/OS OpenSSH.

Table 10. Summary of changes to SYS1.MACLIB in V2R3 of z/OS OpenSSH

Sample	Changes
FOTSMF77	New constants were added for CPACF Ciphers and MAC algorithms. Reference: • Chapter 15, "SMF Type 119 records for OpenSSH," on page 203

Summary of changes to non-configuration files in /samples

Table 11 on page 10 lists files in the `/samples` directory that were added in Version 2 Release 3 of z/OS OpenSSH.

Table 11. Summary of changes to /samples in V2R3 of z/OS OpenSSH

Sample	Changes
ssh_smf.h	New constants for CPACF Ciphers and MAC algorithms were added. • Chapter 15, "SMF Type 119 records for OpenSSH," on page 203

Chapter 5. What's new or changed in z/OS Version 2 Release 2 OpenSSH

This topic documents changes that were introduced in z/OS Version 2 Release 2 OpenSSH. It includes these sections:

- "Summary of changes to commands" on page 11
- "New and changed configuration files" on page 11
- "Summary of changes to SYS1.MACLIB" on page 13
- "Summary of changes to non-configuration files in /samples" on page 13

Summary of changes to commands

Table 12 on page 11 lists commands that were changed in Version 2 Release 2 of z/OS OpenSSH.

Table 12. Summary of changes to commands in V2R2 of z/OS OpenSSH

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

New and changed configuration files

Table 13 on page 11 lists configuration files that were added or changed in Version 2 Release 2 of z/OS OpenSSH.

Table 13. Summary of changes to configuration files in V2R2 of 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 13. Summary of changes to configuration files in V2R2 of 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 14 on page 13 lists environment variables that are changed for Version 2 Release 2 of z/OS OpenSSH.

Table 14. List of changed environment variables in V2R2 of z/OS OpenSSH	
Environment variable	**Changes**
_ZOS_OPENSSH_DEBUG_TIMESTAMP	This environment variable has been added. Reference: None

Summary of changes to SYS1.MACLIB

Table 15 on page 13 lists members of SYS1.MACLIB that were added in Version 2 Release 2 of z/OS OpenSSH.

Table 15. Summary of changes to SYS1.MACLIB in V2R2 of z/OS OpenSSH	
Sample	**Changes**
FOTSMF77	New authentication method types were added to the Common Security section. Reference: • Chapter 15, "SMF Type 119 records for OpenSSH," on page 203

Summary of changes to non-configuration files in /samples

Table 16 on page 13 lists files in the `/samples` directory that were added in Version 2 Release 2 of z/OS OpenSSH.

Table 16. Summary of changes to /samples in V2R2 of 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 15, "SMF Type 119 records for OpenSSH," on page 203

Chapter 6. How does z/OS OpenSSH differ from the open source version?

This topic describes how z/OS OpenSSH differs from the open source version.

What 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 10, “Globalization on z/OS systems,” on page 67.

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.

z/OS OpenSSH has different default settings. 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 CPACF hardware accelerated algorithms.
- 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. 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.
- Certain Cipher and MAC algorithms may be implemented using z/Architecture CPACF instructions or through the Integrated Cryptographic Service Facility (ICSF). These extensions enable OpenSSH to use hardware support when applicable. See CiphersSource and MACsSource in zos_sshd_config, zos_user_ssh_config, zos_sshd_config, and “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 z/OS OpenSSH does not support

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 165 and “zos_sshd_config - z/OS-specific OpenSSH daemon configuration file” on page 192.

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.

z/OS OpenSSH does not support multibyte locales. z/OS OpenSSH does not support running in multibyte locales. It only supports single-byte locales that are compatible with ASCII coded character set ISO/IEC 8859-1. For more information, see Chapter 10, “Globalization on z/OS systems,” on page 67.

Chapter 7. Migrating to z/OS OpenSSH Version 2 Release 4

Use the information provided in the following sections to assist with migrating from a previous version of z/OS OpenSSH.

Key ring SAF/RACF access

Authentication using key rings is done using ICSF. This requires that you permit SAF read access to several algorithm resources (if they have been defined). See step 6 in Construct the key ring for more information.

Supported protocol and algorithm changes

The following sections describe protocols (SSH Protocol 1) and algorithms that are no longer supported or enabled by default in z/OS OpenSSH V2R4.

Available SSH protocol

SSH Version 1 protocol, also referred to as SSH-1, is no longer available. Only SSH Version 2 is supported.

Ciphers option

Support for Blowfish and RC4 ciphers and the RIPE-MD160 HMAC (Hash Message Authentication Code) are no longer available, specifically: blowfish-cbc, cast128-cbc, arcfour, arcfour128, arcfour256, hmac-ripemd160, and hmac-ripemd160@openssh.com. You can remove them from the cipher list.

Support for the Triple DES cipher is no longer enabled by default, specifically 3des-cbc. You can enable it by adding the following to `/etc/ssh/ssh_config` and `/etc/ssh/sshd_config`, or `$HOME/.ssh/config` file:

```
Ciphers +3des-cbc
```

MACs option

Support for MD5-based and truncated MD5 and SHA1 HMAC algorithms are no longer enabled by default, specifically: hmac-md5, hmac-md5-96@openssh.com, hmac-sha1-96@openssh.com, hmac-md5-etm@openssh.com, hmac-md5-96-etm@openssh.com and hmac-sha1-96-etm@openssh.com. You can enable the above MACs by adding a plus sign '+' to the algorithm in the list in /etc/ssh/ssh_config and /etc/ssh/sshd_config, or $HOME/.ssh/config file, as in the following example:

```
MACs +hmac-md5, +hmac-md5-96@openssh.com
```

KexAlgorithms option

Support for the 1024-bit Diffie Hellman key exchange is no longer enabled by default, specifically diffie-hellman-group1-sha1. You can enable it by adding the following to /etc/ssh/ssh_config and /etc/ssh/sshd_config, or $HOME/.ssh/config file:

```
KexAlgorithms +diffie-hellman-group1-sha1
```

See “Other configuration options and sample configuration files” on page 19 for configuration suggestions.

Cipher and MAC ICSF usage

With z/OS V2R4 (and support added in previous z/OS V2R3 PTFs), most users should consider not using ICSF for Ciphers and MACs. The defaults and sample configuration files will prefer and automatically use direct CPACF implementations for these algorithms, which will generally result in the best performance and lowest CPU utilization.

Users that have made zos_ssh_config and zos_sshd_config configuration file changes to specify CiphersSource and MACsSource should consider removing these. The SAF/RACF security setup required for using ICSF algorithms is also not required when using the default CPACF implementations.

Note: ICSF must be configured and use for all cyptographic operations if FIPS mode is enabled.

/etc/ssh/moduli configuration file

The /etc/ssh/moduli configuration file has changed to support new group-exchange KEX algorithms with larger group sizes. You should copy /samples/moduli to /etc/ssh/moduli. See “Setting up the sshd daemon” on page 23 for details.

DSA (ssh-dss) key support

DSA user or host keys are also no longer supported by default. If you are using DSA keys, you should enable them by adding the following to /etc/ssh/ssh_config and /etc/ssh/sshd_config, or $HOME/.ssh/config file:

```
PubkeyAcceptedKeyTypes +ssh-dss
HostKeyAlgorithms +ssh-dss
```

SSH server root login

Root login using a password is not enabled by default. The default setting of PermitRootLogin is "prohibit-password", which disables password and keyboard-interactive authentication. To enable the use of password login for superuser(root), change the following in the /etc/ssh/sshd_config file:

```
PermitRootLogin yes
```

A sample sshd_config file is also provided in /samples/sshd_config as a template for server settings. However, you are suggested to disable this for security reasons.

AuthorizedKeysFile option

While the internal default setting for the AuthorizedKeysFile option has not changed, the entry for it in the sample /etc/ssh/sshd_config is now uncommented by default. This overrides the internal setting in .

When this option is commented out or not present, **sshd** will search the user's `$HOME/.ssh/authorized_keys` and `$HOME/.ssh/authorized_keys2` files. With the new `/samples/sshd_config` file where AuthorizedKeysFile is uncommented, **sshd** will only search the `$HOME/.ssh/authorized_keys` file.

To restore the original behavior, comment out the AuthorizedKeysFile entry in `/etc/ssh/sshd_config`.

UseDNS option

The default value for the UseDNS option changed from "yes" to "no". With this change, **sshd** no longer converts a client's IP address back into a host name. This prevents the use of hostnames in Host match blocks in the configuration file, also causes host-based authentication to fail (which is not enabled by default). To restore the OpenSSH 6.x behavior, add the following option to `/etc/ssh/sshd_config`.

Note: This option is re-enabled in `/samples/sshd_config` for compatability, but you may want to disable this so as to avoid DNS lookups during login.

ClientSMF option

When the ClientSMF option is specified to collect client SMF records, the user needs to have READ access to the BPX.SMF.119.94 SAF/RACF profile. Otherwise, the client program will be terminated.

For more information on how to set up OpenSSH to collect SMF records, refer to "Setting up OpenSSH to collect SMF records" on page 50.

Other configuration options and sample configuration files

Review your configuration files (`/etc/ssh/ssh_config`, `/etc/ssh/sshd_config`, `/etc/ssh/zos_ssh_config`, `/etc/ssh/zos_sshd_config`) to determine the applicability of new features or the use of obsolete options. Many new configuration options were added through OpenSSH 7.6, and defaults for others were changed.

Perform the following steps. Consider implementing the new versions of these configuration files in `/samples`:

1. Copy the updated `/samples/moduli` to `/etc/ssh/moduli` (see "Setting up the sshd daemon" on page 23 for details).
2. Compare these to their current installed versions and review the differences. Pay particular attention to uncommented options in the current installed configuration files that were changed or are obsolete.
3. Add or change options as required for the installation.
4. Test the new installation and configuration.
5. See Chapter 13, "OpenSSH files," on page 147 for more information on configuration options.

Chapter 8. For system administrators

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

Rule: All files used by 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: 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 LibreSSL 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 519.

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 515.

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 on page 22 as a reference, check that certain directories were set up correctly when 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 and Kerberos libraries are defined to program control, the standard Language Environment library is HLQ.CEE.SCEERUN and the XPLINK is HLQ.CEE.SCEERUN2. The Kerberos library resides in SYS1.SIEALNKE. To perform this task, you can define program control (or update using RALTER) using the following TSO command:

   ```
   RDEFINE PROGRAM ** ADDMEM(
       'HLQ.CEE.SCEERUN'/volser/NOPADCHK
       'HLQ.CEE.SCEERUN2'/volser/NOPADCHK
       'SYS1.SIEANLKE'/volser/NOPADCHK
       ) UACC(READ)
   ```

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

   ```
   ls -El progname
   ```

   where *progname* is `/bin/ssh`, `/bin/ssh-proxyc`, `/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 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 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:

   ```
   -rwsr-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" on page 24.

- Server authentication must be set up as described in "Steps for setting up server authentication when keys are stored in UNIX files" on page 26 and "Steps for setting up server authentication when keys are stored in key rings" on page 28.
- 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 z/OS OpenSSH is an optional task. The task is described in "Setting up the message catalog 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.

n

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 644 /etc/ssh/sshd_config
   chmod 644 /etc/ssh/zos_sshd_config
   ```

   Table 21 on page 199 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 517 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. For more information about the sshd_config configuration file, see "sshd_config - OpenSSH daemon configuration file" on page 172.

An example of an sshd_config entry is:

```
Port 1022
```

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. 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 48. 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 10, “Globalization on z/OS systems,” on page 67 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.

Restriction: Starting with z/OS OpenSSH V2R4, SSH Protocol 1 is no longer supported. This is consistent with the open source version and prior statements of direction.

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” on page 26
- “Steps for setting up server authentication when keys are stored in key rings” on page 28
- “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. 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 (rsa, dsa, ecdsa, ed25519):

   ```
   ssh-keygen -A
   ```

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

```
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 ""
```

```
ssh-keygen -t ed25519 -f /etc/ssh/ssh_host_ed25519_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 one or more of the local host's public keys to the `/etc/ssh/ssh_known_hosts` file at the remote host.

   ```
   /etc/ssh/ssh_host_dsa_key.pub
   /etc/ssh/ssh_host_rsa_key.pub
   /etc/ssh/ssh_host_ecdsa_key.pub
   /etc/ssh/ssh-host_ed25519_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 141. 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.

      i) Use `ssh-keyscan` as described earlier in this step, or

      ii) 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 28 shows how the known_hosts file is created when keys are stored in UNIX files.

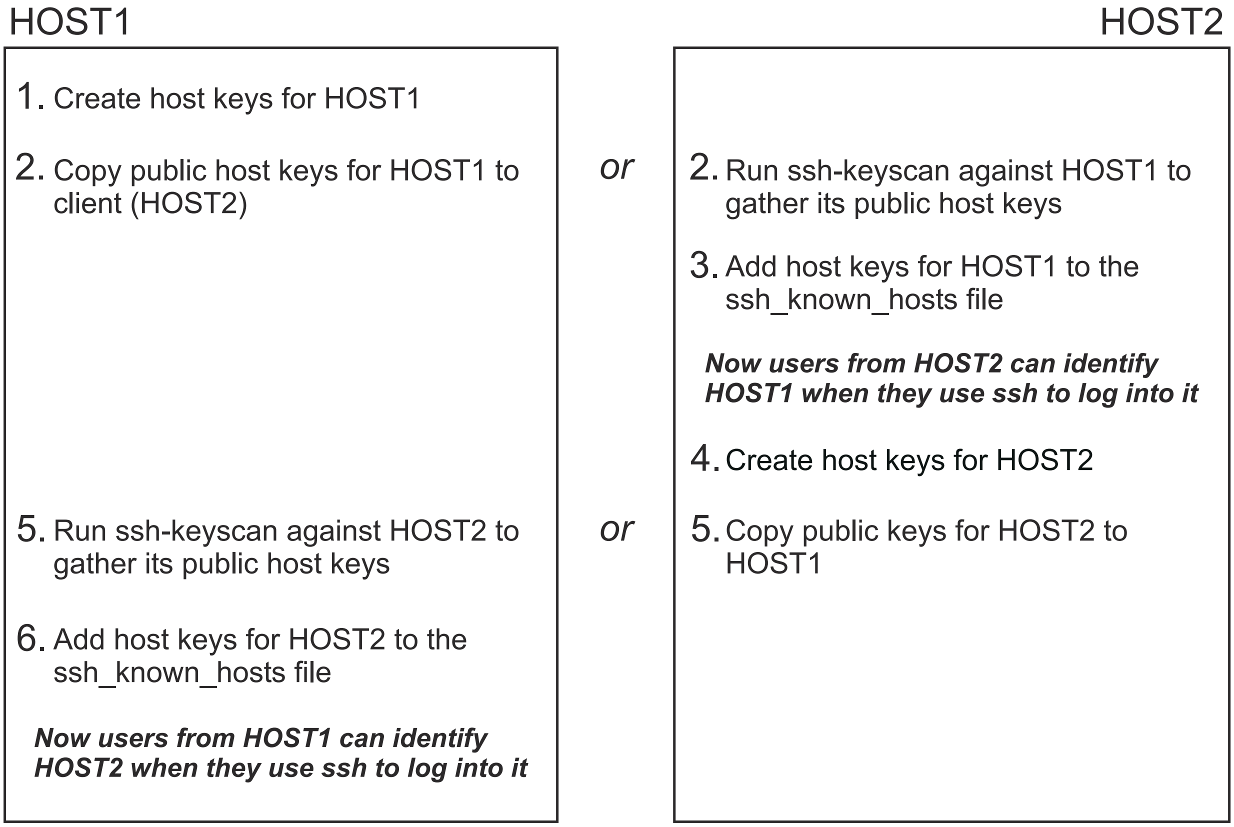

HOST1
HOST2
1. Create host keys for HOST1
2. Copy public host keys for HOST1 to client (HOST2)
or
2. Run ssh-keyscan against HOST1 to gather its public host keys
3. Add host keys for HOST1 to the ssh_known_hosts file
Now users from HOST2 can identify HOST1 when they use ssh to log into it
4. Create host 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 29. 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 31. 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. 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 61 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 39.
- 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, ECDSA, any of the three, or all three). For RSA keys, the minimum size is 768 bits and the maximum size is 32768 bits. Typically, 2048 bits are considered sufficient. DSA keys can be 1024 bits in both FIPS and non-FIPS mode. Since DSA 2048 isn't supported by open group OpenSSH, z/OS OpenSSH may not communicate with open group OpenSSH if DSA 2048 key is used. It requires that both client and server be z/OS OpenSSH and running in FIPS mode, if DSA 2048 is used. DSA keys larger than 2048 bits associated with certificates in a key ring are not supported by OpenSSH. ECDSA keys are supported that use the NIST curves of size 256, 384, or 521 bits in both FIPS and non-FIPS mode.

   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.

- 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 1024 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')
  ```

- To generate a certificate and a 2048 DSA public/private key pair, storing the private key in the RACF database as a non-ICSF key:

  ```
  RDEFINE FACILITY IRR.DSA.SHA256 UACC(NONE)
  SETROPTS RACLIST(FACILITY) REFRESH
  RACDCERT GENCERT ID(SSHDAEM) SUBJECTSDN(CN(’host-ssh-dsa-cn’))
  SIZE(2048) DSA WITHLABEL(’host-ssh-dsa’)
  ```

- To generate a certificate and a Elliptic-Curve DSA public/private key pair using the NIST p256 curve:

  ```
  RACDCERT GENCERT ID(SSHDAEM) SUBJECTSDN(CN('host-ssh-ecdsa-cn'))
  SIZE(256) NISTECC WITHLABEL('host-ssh-ecdsa')
  ```

  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 for this user ID 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
  ```

____

6. Permit access to ICSF digital signature algorithms. If you have defined the following resources in the CSFSERV class, then you must permit read access to the userid (for example, SSHDAEM):

   ```
   CSFIQA, CSF1TRC, CSF1TRD,
   CSF1PKS, CSF1PKV, CSF1DVK,
   CSF1GAV
   ```

   For example,

   ```
   PERMIT CSFIQA CLASS(CSFSERV) ID(SSHDAEM) ACC(READ)
   ```

   If you have a cryptographic coprocessor card installed, then you must also permit read access to the following CSFSERV resources (if they are defined):

   ```
   CSFDSG, CSFDSV, CSFPKI
   ```

   . For example,

   ```
   PERMIT CSFDSG CLASS(CSFSERV) ID(SSHDAEM) ACC(READ)
   ```

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" on page 31.

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 26.

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 141.

____

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. Permit access to ICSF digital signature algorithms If you have defined the following resources in the CSFSERV class, then you must permit read access to the userid (for example, SSHDAEM):

   ```
   CSFIQA, CSF1TRC, CSF1TRD,
   CSF1PKS, CSF1PKV, CSF1DVK,
   CSF1GAV
   ```

   If you have a cryptographic coprocessor card installed, then you must also permit read access to the following CSFSERV resources (if they are defined):

   ```
   CSFDSG, CSFDSV, CSFPKI
   ```

9. 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 " on page 34.

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 27 in "Steps for setting up server authentication when keys are stored in UNIX files" on page 26.

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 141.

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 31.

8. Permit access to ICSF digital signature algorithms. If you have defined the following resources in the CSFSERV class, then you must permit read access to the userid:

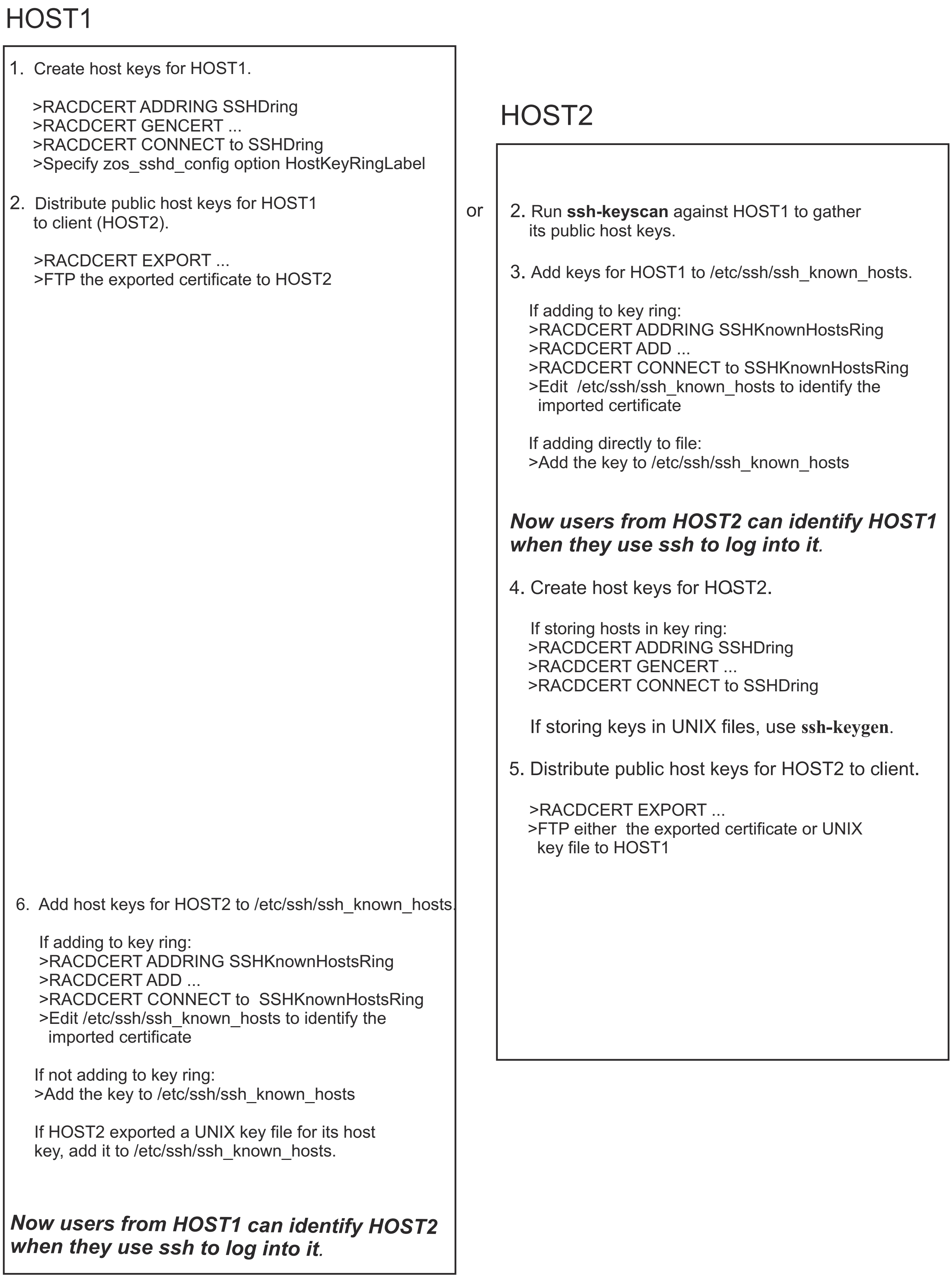
   ```
   CSFIQA, CSF1TRC, CSF1TRD,
   CSF1PKS, CSF1PKV, CSF1DVK,
   CSF1GAV
   ```

   If you have a cryptographic coprocessor card installed, then you must also permit read access to the following CSFSERV resources (if they are defined):

   ```
   CSFDSG, DSFDSV, CSFPKI
   ```

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.



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
```

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

z/OS OpenSSH operates on the principal of least privilege by using a mechanism that is called *privilege separation*. Privilege separation consists of two phases: pre-authentication and post-authentication. When a user establishes an incoming session, the server handles network communication by using an unprivileged process during pre-authentication phase. It then handles user network data by using user privileged process during post-authentication. This design prevents anonymous or unauthenticated users from compromising or exchanging information with the highly privileged (UID 0) daemon. As a result of this design, activities can be observed on the system for the unauthorized user prior to authentication, or due to authentication failure in the pre-authentication phase. Examples include, but are not limited to, the file system access (accessing the incoming user's `$HOME/.ssh/` directory content) or RACF accesses (for example, accessing RACF key rings).

In the pre-authentication phase, the unprivileged process is forked as a child of a privileged parent process from the daemon by using a specially defined, unprivileged ID (SSHD) and communicates directly with the untrusted client.

Note: The unprivileged process has restricted access to the file system, so it might need to send a request to the privileged process (UID 0) to validate the incoming user's authorized_keys file and content. The privileged process uses `seteuid()`/BPX1SEU to temporarily switch its privileged ID to the unauthenticated user's ID. When the ID is switched, the security product might indicate that the incoming user was active on the system before the authentication is completed (either successful or failure) due to the creation of an accessor environment element (ACEE).

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

The issuer of these commands 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 GID, and *yyy* is an unused nonzero UID.

```
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 z/OS OpenSSH

Setting up the message catalog 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" on page 39. 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 that is 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 user ID used to start 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 that the FACILITY class is Active and RACLISTed. 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*.

```
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.

   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.

   The following example of a started procedure 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 39.

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

   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" on page 40 (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

The /etc/rc shell script can be used 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.

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 39.

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.

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 running, send it a SIGHUP signal to allow the new configuration files with sshd settings to be read.

Stopping the sshd daemon

There are several ways to stop sshd.

From the MVS console

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” on page 42, determine the process ID (PID) of the sshd process. Issue:

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

   where *aaaa* is the ASID obtained in Step “1” on page 42. The PID of the daemon will be returned.
3. Using the PID obtained in Step “2” on page 42, stop the sshd daemon. Issue:

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

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

From z/OS UNIX

About this task

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

Procedure

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" on page 42. For example:

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

   or

   ```
   kill pppppppp
   ```

   where *ppppppp* is the PID obtained in Step "1" on page 42.

Using BPXBATCH

About this task

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

Procedure

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 39.

   ```
   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 user ID used to start 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. The following is an example error in syslog:

```
fatal: FOTS1446 __poe() failed for accepted socket: EDC5139I Operation not permitted.
(errno2=0x1331056F)
```

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. The following is an example error in syslog:

```
fatal: FOTS2039 seteuid 12: EDC5164I SAF/RACF error.
(errno2=0x0B7F3000)
```

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 88.

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. If the SAF FACILITY resource CSF.CSFSERV.AUTH.CSFRNG.DISABLE is 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 message is issued on the MVS console.

Example: A message 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 user ID 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 group name 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 to the CSFRNG profile, issue:

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

     Giving all users 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 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 profile 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) to use. For example:

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

3. In order to collect record subtype 94 ("Client connection started"), the user ID associated with 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 95 and 98, the user ID assigned to the **sshd** daemon command (for example, SSHDAEM) and the Separation Userid SSHD must both have READ access to the BPX.SMF.119.95 and BPX.SMF.119.98 SAF/RACF profiles. For example:

   ```
   RDEFINE FACILITY BPX.SMF.119.95 UACC(NONE)
   PERMIT BPX.SMF.119.95 CLASS(FACILITY) ID(SSHDAEM) ACCESS(READ)
   PERMIT BPX.SMF.119.95 CLASS(FACILITY) ID(SSHD) ACCESS(READ)
   SETROPTS RACLIST(FACILITY) REFRESH
   RDEFINE FACILITY BPX.SMF.119.98 UACC(NONE)
   PERMIT BPX.SMF.119.98 CLASS(FACILITY) ID(SSHDAEM) ACCESS(READ)
   PERMIT BPX.SMF.119.98 CLASS(FACILITY) ID(SSHD) ACCESS(READ)
   SETROPTS RACLIST(FACILITY) REFRESH
   ```

5. In order to collect record subtype 96, ("Server transfer completion record"), the user ID associated with the daemon's execution of the **scp** or **sftp-server** on the server commands must have READ access to the SMF service to do authorization checks based on the RACF BPX.SMF.119.96 FACILITY class profile.

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

6.

In order to collect record subtype 97, ("Client transfer completion record"), the user ID associated with the **scp** or **sftp** 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.

Authorization checking:

z/OS UNIX uses the SMF service to do authorization checks based on the BPX.SMF.*type*.*subtype* FACILITY class. Only permitted users can write SMF records for specific SMF types and subtypes. For more information about BPX.SMF, see Setting up the UNIX-related FACILITY and SURROGAT class profiles in *z/OS UNIX System Services Planning*.

Reference information:

- For more information about SMF records, see *z/OS MVS System Management Facilities (SMF)*.
- For more information about IDFPRMxx, see SMFPRMxx (system management facilities (SMF) parameters) in *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. Make your choice based on which exit is running on your system - IEFU83 or IEFU84.

Procedure

1. If SMF recording is desired when z/OS is acting as a client, 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. If SMF recording is desired when z/OS is acting as a server, 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.

Usage notes for BPX.SMF.*type.subtype*

z/OS UNIX uses the SMF service to do authorization checks based on the BPX.SMF.*type.subtype* FACILITY class. Only permitted users can write SMF records for specific SMF types and subtypes. For more information about BPX.SMF, see Setting up the UNIX-related FACILITY and SURROGAT class profiles in *z/OS UNIX System Services Planning*.

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*.

By default, OpenSSH will directly use CPACF instructions for Cipher and MAC operations without using ICSF. For most customers, this is the recommended configuration and will result in the best performance.

Note: ICSF must be configured and used for all cryptographic operations if FIPS mode is enabled (see: "Setting up OpenSSH to run in FIPS mode" on page 58).

Steps to use ICSF to implement OpenSSH ciphers

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

Note: z/OS OpenSSH V2R3 APAR OA54299 added support for direct use of z/Architecture CP Assist for Cryptographic Function (CPACF) instructions for common MAC and Cipher algorithms. This support reduces the CPU consumption compared to either ICSF or LibreSSL and is the default configuration. Setting up OpenSSH to use ICSF for these algorithms is not necessary unless operating in FIPS mode.

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. 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 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.

   c. (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,aes128-cbc,aes192-cbc,
aes256-cbc,3des-cbc,aes128-gcm@openssh.com,aes256-gcm@openssh.com
```

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

   Example server side ciphers list when setting the CiphersSource keyword to "ICSF". 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,aes192-cbc,aes256-cbc,3des-cbc
```

Example ciphers list when ICSF FIPS 140-2 compliant ciphers are required. While the ciphers list is typically one long unbroken line, it is not shown as one unbroken line due to space limitations:

```
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.

Steps to use ICSF to implement OpenSSH MAC algorithms

About this task

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

hmac-sha1
hmac-sha1-etm@openssh.com
hmac-sha2-256
hmac-sha2-256-etm@openssh.com
hmac-sha2-512
hmac-sha2-512-etm@openssh.com

ICSF will use CP Assist for Cryptographic Function (CPACF) hardware support when applicable for the hmac-sha1, all hmac-sha2 MAC algorithms and their "-etm@openssh.com" variants. Any MAC algorithm 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, 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. (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-sha1-etm@openssh.com,hmac-sha2-256-etm@openssh.com,
   hmac-sha2-512-etm@openssh.com,hmac-sha1,hmac-sha2-256,hmac-sha2-512,
   umac-64-etm@openssh.com,umac-128-etm@openssh.com,umac-64@openssh.com,
   umac-128@openssh.com
   ```

   Example MAC algorithms list when setting the MACsSource keyword to "ICSF". 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-sha1-etm@openssh.com,hmac-sha2-256-etm@openssh.com,
   hmac-sha2-512-etm@openssh.com,hmac-sha1,hmac-sha2-256,hmac-sha2-512
   ```

   Example MAC algorithms list when ICSF FIPS 140-2 compliant MAC algorithms are required. 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-sha1-etm@openssh.com,hmac-sha2-256-etm@openssh.com,
   hmac-sha2-512-etm@openssh.com,hmac-sha1,hmac-sha2-256,hmac-sha2-512
   ```

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

____

Results

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

Steps to use ICSF to implement OpenSSH KexAlgorithms

About this task

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.

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, 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. 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
```

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

Results

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

Determining the cipher, MAC, and key exchange algorithm source and FIPS status

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

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.

Configuring ICSF PKCS #11 services to operate in compliance with FIPS 140-2

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.

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. 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 Parameters in the installation options data set in *z/OS Cryptographic Services ICSF System Programmer's Guide* , which describes the ICSF FIPSMODE parameter. Also see Operating in compliance with FIPS 140-2 in *z/OS Cryptographic Services ICSF Writing PKCS #11 Applications* , 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 mode on the server 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 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 28.
10. Setup key rings for user authentication. See the "Steps for setting up user authentication when using key rings to store keys" on page 81.
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 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

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

Usage notes for setting up OpenSSH to run in FIPS mode

- 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 are introduced. If the CLEARKEY.SYSTOK-SESSION-ONLY resource is defined, 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. FIPS mode only supports the storing of keys in key rings.
- 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.

Managing OpenSSH user heap

While using OpenSSH, you might 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(,,ANY,FREE)" environment variable when invoking OpenSSH commands. Language Environment will free all unused storage after a call to the 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 Tuning heap storage in *z/OS Language Environment Programming Guide*.
- Set the _CEE_REALLOC_CONTROL="256K,25" environment variable when invoking OpenSSH commands. Language Environment will optimize heap storage reallocation for OpenSSH. For more information about the _CEE_REALLOC_CONTROL environment variable, see _CEE_REALLOC_CONTROL in *z/OS XL C/C++ Programming Guide*.
- 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 9. 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*.

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.

Using key rings for OpenSSH certificate CA keys

OpenSSH certificates provide a mechanism that can simplify the management of user and host SSH public keys. Additionally, these certificates can provide for controls such as expiration and can be used to simplify key rotation.

- OpenSSH certificates are different from X.509 certificates. For more information, refer to the command **ssh-keygen** in "Certificates" on page 128.

  Note: OpenSSH certificates are not part of SSH2 standards, and not all implementations of SSH2 support them.

- When using z/OS OpenSSH keys with key rings, the key ring X.509 certificate is only a container for the SSH public key. The private key associated with the key ring certificate may be used as the complimentary SSH private key.

  Note: The key ring certificate must still be valid in order for z/OS OpenSSH to use the SSH keys.

- A key ring certificate can be used to hold the OpenSSH "CA" key. Storing the OpenSSH CA private key in a key ring (optionally in a secure ICSF hardware token) can be valuable in order to protect it. The only usage of the CA private key is then by the z/OS OpenSSH **ssh-keygen -s** command, which is used to create an OpenSSH certificate. The matching OpenSSH CA public key fingerprint can be extracted from the key ring and used in z/OS OpenSSH like any CA public key.

  The OpenSSH CA key can be created in a key ring by the RACDCERT command like any other key supported by z/OS OpenSSH. The same key ring key types that are supported by z/OS OpenSSH are supported for OpenSSH CA keys. They are not different from other OpenSSH keys except for how they will be used by z/OS OpenSSH.

- You cannot store OpenSSH certificates in key rings. These must be stored in the zFS file system, but they do not contain any private key material.

Example: Using OpenSSH certificates for user authentication

Procedure

1. Create the OpenSSH CA key

   a. Construct a key ring and X.509 certificate to hold the OpenSSH CA key. For this action, refer to "Step 1. Construct the key ring" on page 81 (skip item 4. Update the user's z/OS-specific per-user client configuration file).

      Note: This key ring certificate will be owned by the z/OS "CA" administrator user ID, and it will only be used by the OpenSSH CA administrator with the **ssh-keygen -s** command when creating user certificates.

      Assume for this example the user ID is SSHCA and the qualified name of the key ring certificate is `SSHCA/CARING USERCA_001`.

   b. Extract the CA public key into a zFS file:

      ```
      ZOS_SSH_KEY_RING_LABEL="SSHCA/CARNG USERCA_001" \ ssh-keygen -y >
      id_sshca_userca_001.pub
      ```

      Note: The first **ssh-keygen -e** exports the key ring public key in RFC format, and the second **ssh-keygen -i** command converts that to the OpenSSH single line public key format.

2. For each z/OS ssh client user ID, create an SSH user identity key.

Note: This example will use a key ring, but file system keys may also be used. Existing user SSH keys may also be used. Assume that the user ID is "joe".

a. Construct the key ring certificate for the user's key (refer to "Step 1. Construct the key ring" on page 81). Assume for this example that the key ring label = "JOE/SSHRNG ID_JOE".

b. Extract the public key:

```
_ZOS_SSH_KEY_RING_LABEL="JOE/SSHRNG ID_JOE" \
ssh-keygen -y > id_joe.pub
```

3. Create an OpenSSH certificate by signing the public key `id_joe.pub`.

   a. This will be done by the OpenSSH CA administrator using the OpenSSH CA private key. Only the principal(user) `joe` will be allowed to login with this certificate which will expire in 54 weeks. A unique serial number (-z) can be given to the certificate in case it might need to be revoked.

   ```
   ssh-keygen -s "keyringlabel://SSHCA/CARNG USERCA_001" \
   -I user_joe -n joe \
   -V +54w -z 123456 \
   id_joe.pub     # creates file id_joe-cert.pub
   ```

4. Update required OpenSSH servers to accept certificates created by this OpenSSH CA key.

   a. Create a file on the server, for example: `/etc/ssh/trusted_ca_user_keys`

   Note: This file could be copied to many servers in the same organization or domain.

   ```
   cd /etc/ssh
   touch trusted_user_ca_keys
   chmod 600 trusted_user_ca_keys   # or 644 but only writable by root
   ```

   b. Add a line to this file containing the OpenSSH format public key of the OpenSSH CA. The **ssh-keygen** command can be used to convert the CA public key file to this format.

   `cat id_sshca_user_001.pub >> /etc/ssh/trusted_user_ca_keys`

   c. Update `/etc/ssh/sshd_config` and add the following:

   ```
   TrustedUserCAKeys /etc/ssh/trusted_user_ca_keys
   ```

   d. Restart the OpenSSH servers.

5. Update the z/OS users OpenSSH client configuration:

   a. Update the z/OS-specific OpenSSH client configuration file for the user (joe) so that any ssh connections will try to use the keyring private key created in Step 2:

   ```
   cd ~joe/.ssh
   echo "IdentityKeyRingLabel \"JOE/SSHRNG ID_JOE\"" >> zos_user_ssh_config
   ```

   b. Update the OpenSSH client configuration file for the user so that the matching OpenSSH certificate is available for any connection that supports OpenSSH certificates. The certificate file can be in the user's `.ssh` directory (for example, `~/.ssh/id_joe-cert.pub`), or somewhere else readable by the user.

   ```
   cd ~joe/.ssh
   echo "CertificateFile /path/to/id_joe-cert.pub"  >> config
   ```

6. Test an ssh connection from z/OS user `joe`

   ```
   ssh someserver
   ```

   Note: By default, the local z/OS user ID (for example, `JOE`) will be used to log into the remote server. The key ring label "`JOE/SSHRNG ID_JOE`" private key will be used to authenticate the user (Step 5a).

   Distribution of the user's public key to the server is not required since an OpenSSH certificate vouching for this key is used (Step 5b) and the server was configured in Step 4 to trust the OpenSSH CA key.

Example: Using OpenSSH certificates for server host keys

Procedure

1. Create the OpenSSH CA key

   a. Construct a key ring and X.509 certificate to hold the OpenSSH CA key. For this action, refer to "Step 1. Construct the key ring" on page 81 (skip item 4. Update the user's z/OS-specific per-user client configuration file).

      Note: You could use the same CA key used for user certificates, but this example will create a new CA key just for host certificates.

      Assume for this example the user ID is "SSHCA" and the qualified name of the key ring certificate is "`SSHCA/CARING HOSTCA_001`". `SSHCA/CARING USERCA_001`.

   b. Extract the CA public key into a zFS file:

```
_ZOS_SSH_KEY_RING_LABEL="SSHCA/CARNG HOSTCA_001" \
   ssh-keygen -y > id_sshca_hostca_001.pub
```

2. For each OpenSSH server in your enterprise (or domain), create an OpenSSH certificate for one or more of its existing HostKeys.

   a. Review the server's `/etc/ssh/sshd_config` file to see which HostKey files are being used. Select one (or more) for which to create OpenSSH certificates. Transfer the public host keys to the z/OS server where the CA Key Ring key will be used to create the certificate.

      In this example, we will create a certificate for the host public key "/etc/ssh/ssh_host_ecdsa_key.pub" for the server named server12, which we transfer to z/OS and name it `server12_ecdsa_yyyymmdd.pub`

      Note: OpenSSH public key files are text and should be converted to EBCDIC(IBM-1047) when transferring to z/OS.

   b. Using the z/OS CA user ID, create an OpenSSH certificate by signing the host public key. Only the principal (host) server12 will be allowed to use this certificate which will expire in 107 weeks. A unique serial number can be given to the certificate in case it might need to be revoked.

```
ssh-keygen -s "keyringlabel://SSHCA/CARNG HOSTCA_001" \
     -I host_server12 -h -n server12.myco.com \
     -V +107w -z 123478 \
     server12_ecdsa_yyyymmdd.pub

   # This creates file server12_ecdsa_yyyymmdd-cert.pub
```

   c. Transfer the OpenSSH host certificate (`server12_ecdsa_yyyymmdd-cert.pub`) back to the server's `/etc/ssh` directory and update the server's `sshd_config` file:

```
server12> cd /etc/ssh
server12> echo \
     "HostCertificate /etc/ssh/server12_ecdsa_yyyymmdd-cert.pub" \
      >>  sshd_config
```

      Note: OpenSSH certificate files are text and should be converted from EBCDIC(IBM-1047) to ASCII when transferring from z/OS to non z/OS platforms.

3. Update ssh clients in your organization or domain to trust host certificates signed by your OpenSSH CA

   a. Get the one-line OpenSSH format public key of the OpenSSH CA public key:

```
> cat id_sshca_hostca_001.pub
ecdsa-sha2-nistp256 AAAAE2V.....
```

   b. Add this line to the client's global `/etc/ssh/ssh_known_hosts` file as follows:

```
@cert-authority *.myco.com ecdsa-sha2-nistp256 AAAAE2V.....
```

    This will allow users on this ssh client machine to trust host certificates presented by any server matching "`*.myco.com`" if the certificate is signed by the private CA key matching this public key.

   c. Remove any keys from `/etc/ssh/ssh_known_hosts` or user `$HOME/.ssh/known_hosts` for servers that have certificates.

      If your organization only supports ssh servers with certificates, consider eliminating the use of user `known_hosts` files.

4. Test an ssh connection

```
ssh -v server12.myco.com
...
debug1: Server host certificate: ecdsa-sha2-nistp256-cert-v01@openssh.com SHA256:EuG...,
serial ... ID "host_server12" CA ecdsa-sha2-nistp256 SHA256:LQic... valid from ... to ...
debug1: Host 'server12.myco.com' is known and matches the ECDSA-CERT host certificate.
debug1: Found CA key in /etc/ssh/ssh_known_hosts:5
...
```

   If the client (with default domain of `myco.com`) uses an unqualified hostname, then the host certificate will not work. For example:

```

        ssh -v server12
...
debug1: Server host certificate: ecdsa-sha2-nistp256-cert-v01@openssh.com SHA256:EuG...,
serial ... ID "host_server12" CA ecdsa-sha2-nistp256 SHA256:LQic... valid from ... to ...
debug1: No matching CA found. Retry with plain key
The authenticity of host 'server12' ([xx.xx.xx.xx:22])' can't be established.
ECDSA key fingerprint is SHA256:EuG...
Are you sure you want to continue connecting (yes/no)?
```

   You can add the following to your `$HOME/.ssh/config` or `/etc/ssh/ssh_config` to resolve this:

```
CanonicalizeHostname yes
    CanonicalDomains myco.com
```

Chapter 10. 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 69 and "Configuring the OpenSSH client" on page 69 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 z/OS OpenSSH is summarized in Table 20 on page 68. 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" on page 69 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.

Table 20. Summary of support provided by OpenSSH V1R2 (continued)

Scenario	**Session is:**	**Client is running:**	**Server is running:**	**Coded character set of network data is:**
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: 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 runtime 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 72 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.

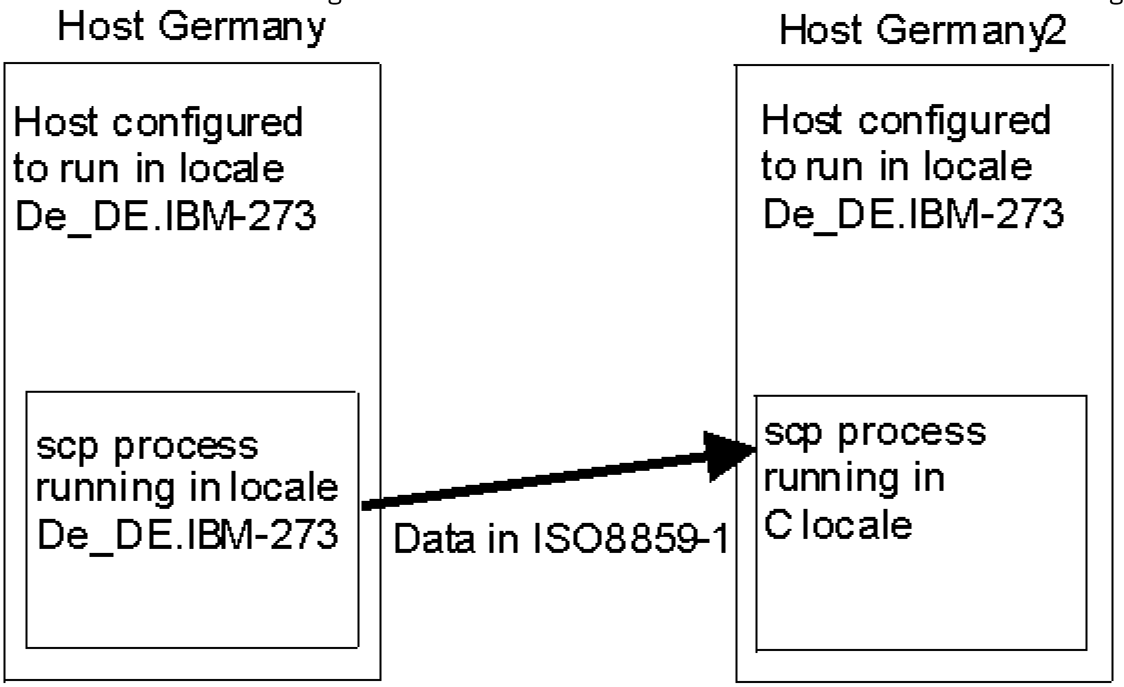

Host Germany
Host configured to run in locale De_DE.IBM-273
scp process running in locale De_DE.IBM-273
Data in ISO8859-1
Host Germany2
Host configured to run in locale De_DE.IBM-273
scp process running in C locale

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 on page 73 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.

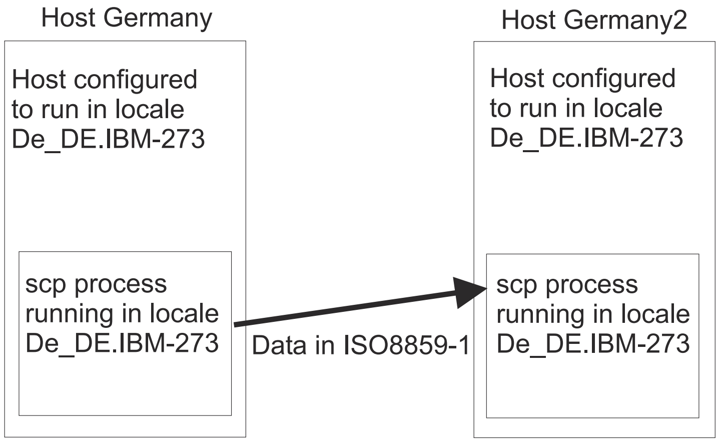

Host Germany
Host configured to run in locale De_DE.IBM-273
scp process running in locale De_DE.IBM-273
Data in ISO8859-1
Host Germany2
Host configured to run in locale De_DE.IBM-273
scp process running in locale De_DE.IBM-273

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" on page 73.
- 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" on page 73.
- 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" on page 74.

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 11. 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.

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" on page 77
Setting up user authentication	"Steps for setting up user authentication when using UNIX files to store keys" on page 78 "Steps for setting up user authentication when using key rings to store keys" on page 81
Configuring your setup for X11 forwarding	"Steps for configuring your setup for X11 forwarding" on page 88

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.

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 78
- "Steps for setting up user authentication when using key rings to store keys" on page 81
- "Steps for setting up user authentication with GSS-API (Kerberos)" on page 87

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 key type you wish to use. Example:

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

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 80 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 on page 80 shows how the process would work.

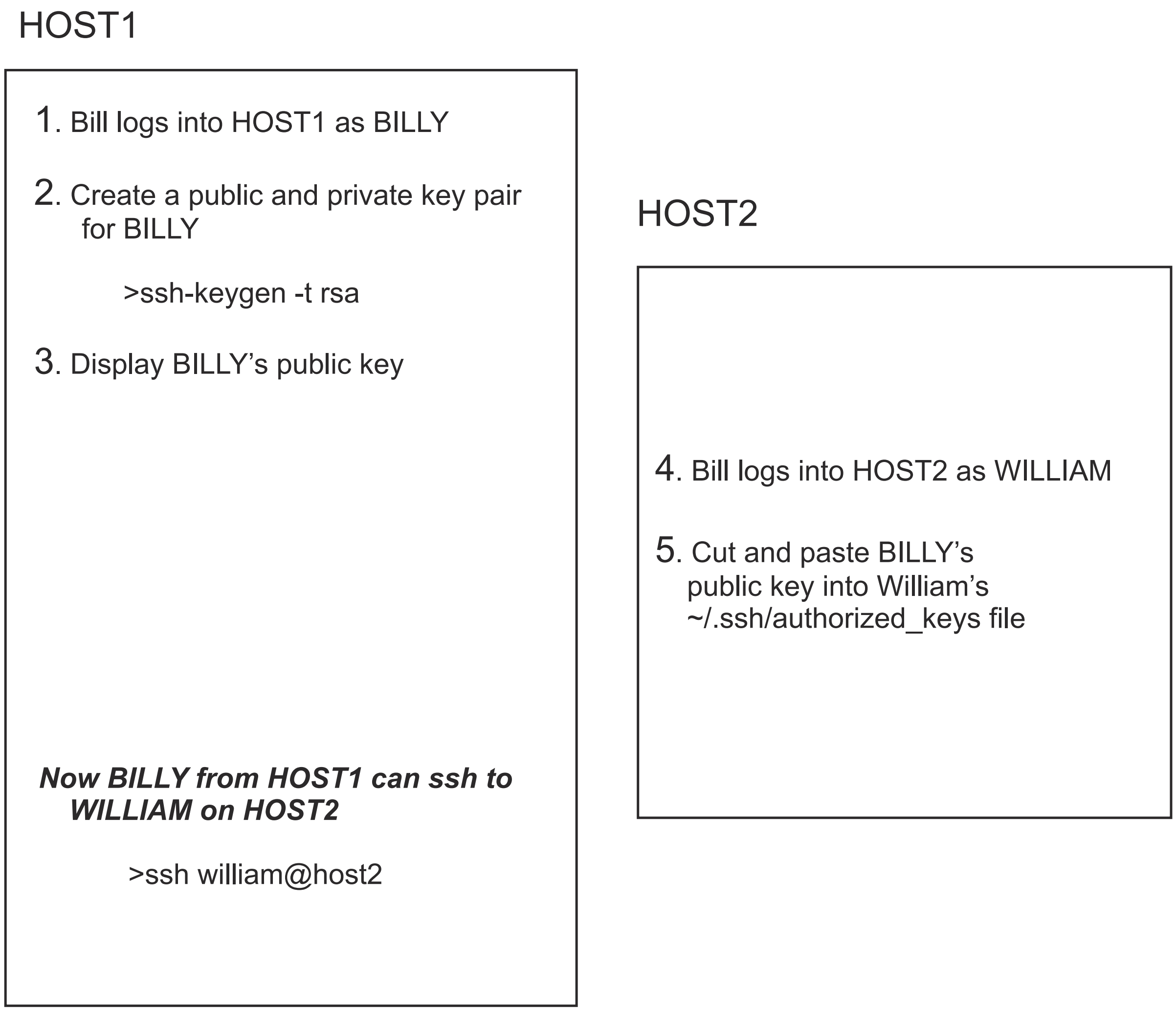

HOST1
1. Bill logs into HOST1 as BILLY
2. Create a public and private key pair for BILLY
>ssh-keygen -t rsa
3. Display BILLY's public key
Now BILLY from HOST1 can ssh to WILLIAM on HOST2
>ssh william@host2
HOST2
4. Bill logs into HOST2 as WILLIAM
5. Cut and paste BILLY's public key into William's ~/.ssh/authorized_keys file

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

Using FIDO/U2F hardware authenticators with z/OS OpenSSH

OpenSSH 8.2 introduced support for FIDO/U2F hardware authenticators. Details can be found in the release notes: OpenSSH 8.2 (www.openssh.com/txt/release-8.2).

z/OS OpenSSH "opensshr84" is based on OpenSSH 8.4p1 and supports the server (SSHD) verification of FIDO/FIDO2 based keys for authentication of remote ssh clients. It does not support:

- Use of z/OS-attached FIDO/U2F hardware tokens.
- Generation (by using **ssh-keygen**) of keys on FIDO/U2F tokens.
- z/OS ssh client authentication (by using either **ssh** or **ssh-agent**) using a FIDO token.

The following example illustrates how z/OS **sshd** can verify a FIDO-based key that was generated on a remote platform:

1. On a remote system such as Linux, which has an attached FIDO hardware token, generate a FIDO key:

```
linux> ssh-keygen -t ecdsa-sk
```

2. Add the ECDSA-SK public key to `$HOME/.ssh/authorized_keys` on z/OS in the same manner as with other SSH public key types.

3. Connect to z/OS OpenSSH with the FIDO-based key:

```
linux> ssh -i ~/.ssh/id_ecdsa_sk user@zos.myco.com
```

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 81
- "Step 2. Distribute the public keys to all remote hosts" on page 84

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 61 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:

- 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" on page 82.
   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, ECDSA, any, or all.) For RSA keys, the minimum size is 768 bits, the maximum size is 32768 bits. Typically, 2048 bits is considered sufficient. DSA keys can be 1024 bits in both FIPS and non-FIPS mode. Since DSA 2048 is not supported by open group OpenSSH, z/OS OpenSSH may not communicate with open group OpenSSH if DSA 2048 key is used. It requires both client and server to be z/OS OpenSSH and run in FIPS mode if DSA 2048 is used. DSA keys larger than 2048 bits associated with certificates in a key ring are not supported by OpenSSH. ECDSA keys are supported that use the NIST curves of size 256, 384, or 521 bits in both FIPS and non-FIPS mode.

   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 . 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 1024 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)
     ```

   - To generate a certificate and a 2048 DSA public/private key pair, storing the private key in the RACF database as a non-ICSF key:

     ```
     RDEFINE FACILITY IRR.DSA.SHA256 UACC(NONE)
     SETROPTS RACLIST(FACILITY) REFRESH
     RACDCERT    GENCERT SUBJECTSDN(CN('uniq-ssh-dsa-cn')) SIZE(2048) DSA
      WITHLABEL('uniq-ssh-dsa') ID(userID)
     ```

   - To generate a certificate and a Elliptic-Curve DSA public/private key pair using the NIST p256 curve:

     ```
     RACDCERT GENCERT ID(userID)
     SUBJECTSDN(CN('uniq-ssh-ecdsa-cn'))
     SIZE(256) NISTECC WITHLABEL('uniq-ssh-ecdsa')
     ```

   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
     ```

6. Permit access to ICSF digital signature algorithms. If you have defined the following resources in the CSFSERV class, then you must permit read access to the userid (for example, SSHDAEM):

   ```
   CSFIQA, CSF1TRC, CSF1TRD,
   CSF1PKS, CSF1PKV, CSF1DVK,
   CSF1GAV
   ```

   If you have a cryptographic coprocessor card installed, then you must also permit read access to the following CSFSERV resources (if they are defined):

```
CSFDSG, CSFDSV, CSFPKI
```

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 87 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" on page 85. 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 139 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
  ```

- Permit access to ICSF digital signature algorithms. If you have defined the following resources in the CSFSERV class, then you must permit read access to the userid (for example, SSHDAEM):

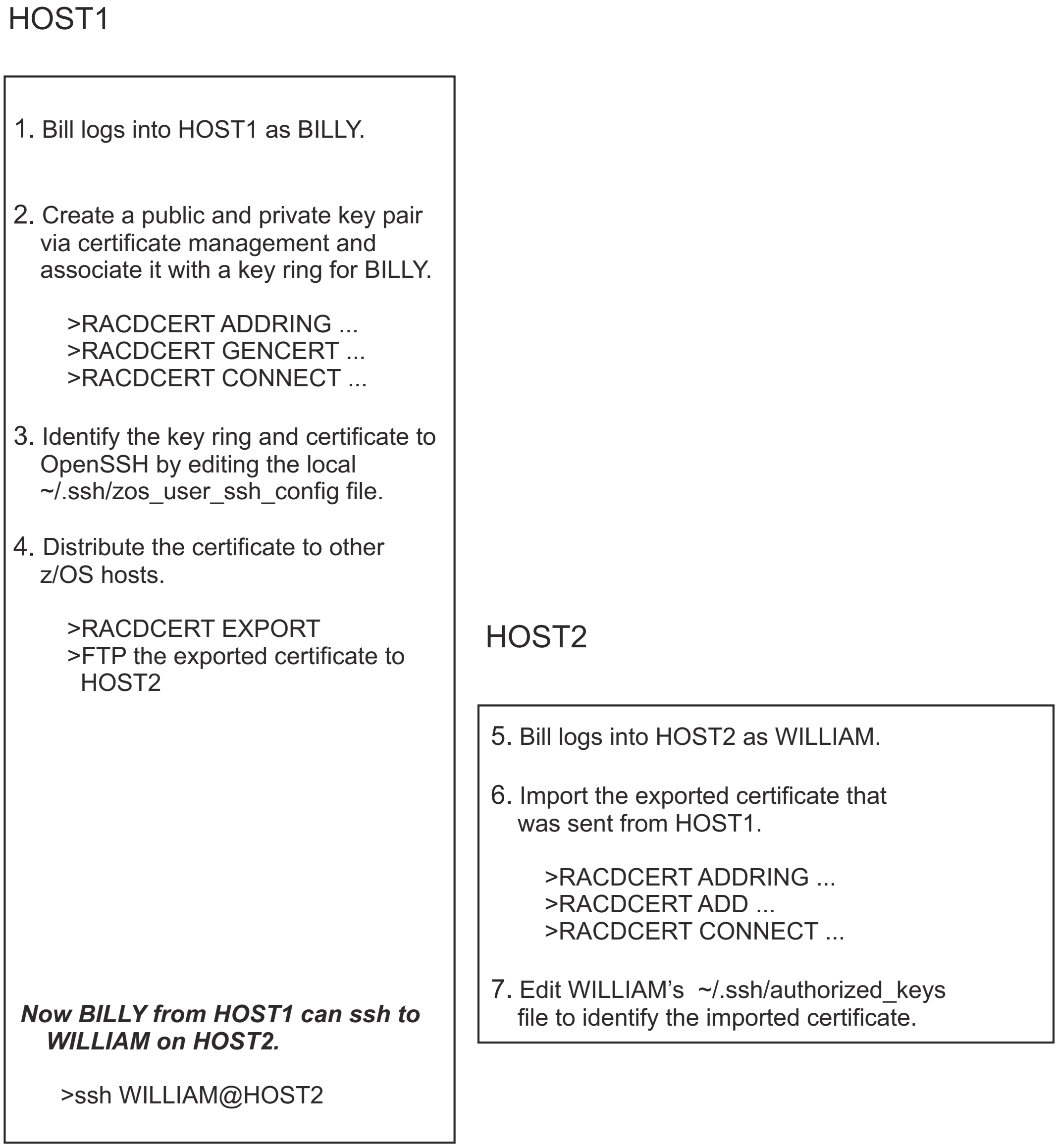
  ```
  CSFIQA, CSF1TRC, CSF1TRD,
  CSF1PKS, CSF1PKV, CSF1DVK,
  CSF1GAV
  ```

  If you have a cryptographic coprocessor card installed, then you must also permit read access to the following CSFSERV resources (if they are defined):

  ```
  CSFDSG, CSFDSV, CSFPKI
  ```

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



HOST1

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
```

Now BILLY from HOST1 can ssh to WILLIAM on HOST2.

```
>ssh WILLIAM@HOST2
```

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.

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.

Setting a TCP/IP stack affinity

Users in a multiple IP stack environment can set a TCP/IP stack affinity. This is done by setting the _BPXK_SETIBMOPT_TRANSPORT environment variable to the value of the job name of the TCP/IP stack which should be used.

Note: You must set this variable prior to invocation, for any environment and OpenSSH utility you that you want to set an affinity.

For example, if you want to set an affinity to a TCP/IP stack running under job name "TCPIP", use the following shell command:

```
export _BPXK_SETIBMOPT_TRANSPORT=TCPIP
```

Chapter 12. OpenSSH command descriptions

scp - Secure copy (remote file copy program)

Format

`scp` [`-346ABCpqrTv`] [`-c` *cipher*] [`-F` *ssh_config*] [`-i` *identity_file*] [`-J` *destination*] [`-l` *limit*] [`-o` *ssh_option*] [`-P` *port*] [`-S` *program*] *source ... target*

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.

The source and target may be specified as a local pathname, a remote host with optional path in the form [user@]host:[path], or a URI in the form scp://[user@]host[:port][/path]. 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. When copying between two remote hosts, if the URI format is used, a port may only be specified on the target if the -3 option is used.

`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 15, "SMF Type 119 records for OpenSSH," on page 203 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 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, Cipher, and MAC algorithms required for FIPS mode. 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

-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 and selects batch mode for the second host, since scp cannot ask for passwords or passphrases for both hosts.

-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.

-A
Allows forward of ssh-agent to the remote system. The default is not to forward an authentication agent.

-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.

-J *destination*
Connect to the target host by first making an scp connection to the jump host described by the destination and then establishing a TCP forwarding to the ultimate destination from there. Multiple jump hops may be specified separated by comma characters. This is shortcut to specify a ProxyJump configuration directive. This option is directly passed to ssh.

-l
Limits the used bandwidth, which is 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 set StrictHostKeyChecking option:

```
scp -oStrictHostKeyChecking=no
```

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 that are 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.

-T
Disable strict filename checking. By default, when copying files from a remote host to a local directory, scp checks that the received filenames match those requested on the command-line to prevent the remote end from sending unexpected or unwanted files. Because of differences in how various operating systems and shells interpret filename wildcards, these checks may cause wanted files to be rejected. This option disables these checks at the expense of fully trusting that the server will not send unexpected filenames.

-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 [-46aCpqrv] [-B *buffer_size*] [-b *batchfile*] [-c *cipher*] [-D *sftp_server_path*] [-F *ssh_config*] [-i *identity_file*] [-J *destination*] [-l *limit*] [-o *ssh_option*] [-P *port*] [-R *num_requests*] [-S *program*] [-s *subsystem* | *sftp_server*] *destination*

Description

`sftp` is a 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 destination may be specified either as [user@]host[:path] or as a URI in the form sftp://[user@]host[:port][/path].

If the destination includes a path and it is not a directory, sftp will retrieve files automatically if a non-interactive authentication method is used; otherwise it will do so after successful interactive authentication.

If no path is specified, or if the path is a directory, sftp will log in to the specified host and enter interactive command mode, changing to the remote directory if one was specified. An optional trailing slash can be used to force the path to be interpreted as a directory.

Since the destination formats use colon characters to delimit host names from path names or port numbers, IPv6 addresses must be enclosed in square brackets to avoid ambiguity.

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 15, "SMF Type 119 records for OpenSSH," on page 203 for more information about the SMF client transfer completion records (subtype 97).

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, Cipher, and MAC algorithms required for FIPS mode. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

The maximum full path name length is 1023 bytes for files processed by `sftp`. Exceeding this maximum might result in unexpected behavior.

Options

-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.

-a
: Attempt to continue interrupted transfers rather than overwriting existing partial or complete copies of files. If the partial contents differ from those being transferred, then the resultant file is likely to be corrupted.

-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 96. 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*
```

Echo of the command may be suppressed by prefixing the command with a '@' character. These two prefixes may be combined in any order.

For example:

```
-@ls /tmp/file2
```

Note: If "Batchmode=no" behavior is required for use with a user's SSH_ASKPASS program, the invocation flag "-oBatchMode=no" must be placed before to the -b *batchfile* option.

-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 96.

-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.

-J *destination*
Connect to the target host by first making an sftp connection to the jump host described by the destination and then establishing a TCP forwarding to the ultimate destination from there. Multiple jump hops may be specified separated by comma characters. This is shortcut to specify a ProxyJump configuration directive. This option is directly passed to ssh.

-l *limit*
Limits the used bandwidth, which is specified in Kbits.

-N
Disables quiet mode, that is, overrides the implicit quiet mode set by the -b flag.

-o *ssh_option*
Can be used to pass options to ssh in the format that is 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

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:

- Command names are not case-sensitive.
- The sftp subcommands do not support a continuation character; all options and parameters must exist on one line.
- 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*. If path is not specified, then change directory to the one the session started in.

lcd [*path*]
Changes the local directory to *path*. If path is not specified, then change directory to the local user's home directory.

chgrp [*-h*] *grp path*
Changes group of file *path* to *grp*. If the -h flag is specified, then symlinks will not be followed. *grp* must be a numeric GID. *path* can contain glob characters and match multiple files.

chmod [*-h*] *mode path*
Changes permissions of file *path* to *mode*. If the -h flag is specified, then symlinks will not be followed. *path* can contain glob characters and match multiple files.

chown [*-h*] *own path*
Changes owner of file *path* to *own*. If the -h flag is specified, then symlinks will not be followed. *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 [-afpR] *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 `-f` flag is specified, then fsync() will be called after the file transfer has completed to flush the local file to disk.

If the -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 [-afpR] *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 `-a` flag is specified, then attempt to resume partial transfers of existing files.

Note: Resumption assumes that any partial copy of the remote file matches the local copy. If the local file contents differ from the remote local copy, then the resultant file is likely to be corrupt.

If the `-f` flag is specified, then a request will be sent to the server to call fsync(2) after the file has been transferred.

Note: This is only supported by servers that implement the "`fsync@openssh.com`" extension.

If the `-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 [-fpR] ***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*.

reput [-fpR] ***[local-path] remote-path*** **.**
Resume upload of [local-path] . Equivalent to `put` with the `-a` flag set.

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 96.

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*] [`-P` *denied_requests*] [`-p` *allowed_requests*] [`-t` *session_timeout*] [`-u` *umask*]

`sftp-server` `-Q` *protocol_feature*

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 15, "SMF Type 119 records for OpenSSH," on page 203 for more information about the SMF server transfer completion records (subtype 96).

`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, Cipher, and MAC algorithms which are required when running in FIPS mode. 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 path name 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*.

-P *denied_requests*
Specify a comma-separated list of SFTP protocol requests that are banned by the server. **`sftp-server`** will reply to any denied request with a failure. The `-Q` flag can be used to determine the supported request types. If both a denied and an allowed list are specified, then the denied list is applied before the allowed list.

-p *allowlisted_requests*
Specify a comma-separated list of SFTP protocol requests that are permitted by the server. All request types that are not on the allowed list will be logged and replied to with a failure message.

Care must be taken when using this feature to ensure that requests made implicitly by SFTP clients are permitted.

-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.

-t *session_timeout*
Sets a timeout for idle connections in seconds. Specify 0 to disable the timeout.

-u*umask*
Sets an explicit umask to be 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.

-Q *protocol_feature*
Query protocol features supported by **`sftp-server`**. At present, the only feature that may be queried is "requests", which may be used to deny or allow specific request (flags `-P` and `-p`, respectively).

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` [`-46AaCfGgKkMNnqsTtVvXxYy`] [`-b` *bind_address*] [`-c` *cipher_spec*] [`-D` [*bind-address:*] *port*] [`-E` log_file] [`-e` *escape_char*] [`-F` *configfile*] [`-I` *pkcs11*] [`-i` *identity_file*] [`-J` [*destination*]] [`-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*]] *destination* [*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, arbitrary TCP ports and UNIX-domain sockets can also be forwarded over the secure channel.

`ssh` connects and logs into the specified destination, which may be specified as either [user@]hostname or a URI of the form ssh://[user@]hostname[:port]. 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 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, Cipher, and MAC algorithms, which are required in FIPS mode. See "Setting up OpenSSH to use ICSF cryptographic operations" on page 52 for more information.

Options

-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.

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.

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.

Ciphers can be specified in order of preference in a comma-separated list. For a list of valid ciphers, see "Ciphers" on page 149.

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 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. 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 517 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`. If set to 'none', no configuration files will be read. This option has no effect on the z/OS-specific configuration files.

-g
Allows remote hosts to connect to local forwarded ports.

-G
Causes **ssh** to print its configuration after evaluating Host and Match blocks and exit.

-i *identity_file*
Selects a file from which the identity (private key) for RSA, DSA or ECDSA authentication is read. The default is `~/.ssh/id_rsa`, `~/.ssh/id_dsa`, `~/.ssh/id_ecdsa`, and `~/.ssh/id_ed25519` . 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).

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.

-J*destination*]

Connect to the target host by first making a ssh connection to the jump host described by destination and then establishing a TCP forwarding to the ultimate destination from there. Multiple jump hops may be specified separated by comma characters. This is a shortcut to specify a ProxyJump configuration directive. Note that configuration directives supplied on the command-line generally apply to the destination host and not any specified jump hosts. Use ~/.ssh/config to specify configuration for jump hosts.

-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 that is supported on z/OS UNIX is Kerberos V5. For more details, check IETF standard RFC 2743 (tools.ietf.org/html/rfc2743).

-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*
-L [*bind-address:*]*port*:*remote_socket*
-L *local_socket*:*host*:*hostport*
-L *local_socket*:*remote_socket*

Specifies that connections to the given TCP port or UNIX socket on the local (client) host are to be forwarded to the given host and port, or UNIX socket, on the remote side. This works by allocating a socket to listen to either a TCP port on the local side, optionally bound to the specified *bind_address*, or to a UNIX socket. Whenever a connection is made to the local port or socket, the connection is forwarded over the secure channel, and a connection is made to either host port *hostport*, or the UNIX socket *remote_socket*, from the remote machine.

Port forwardings can also be specified in the configuration file. Only the superuser can forward privileged ports. IPv6 addresses can be specified 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* may be used to bind the connection to a specific address. The *bind_address* of "local host" 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 517 has examples of port forwarding.

-m *mac_spec*

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 secondary 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), "exit" (request the master to exit), "forward" (request forwardings without command execution), "cancel" (cancel forwardings), "proxy" (invoke multiplexing proxy mode), "stop" (request the master to stop accepting further multiplexing requests).

-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), cipher-auth (supported symmetric ciphers that support authenticated encryption), "help" (supported query terms for use with the -Q flag), "mac" (supported message integrity codes), "kex" (key exchange algorithms), "key" (key types), key-cert (certificate key types), key-plain (non-certificate key types), "key-sig" (all key types and signature algorithms), protocol-version (supported SSH protocol versions), and "sig" (supported signature algorithms). Alternatively, any keyword from ssh_config or sshd_config that takes an algorithm list may be used as an alias for the corresponding query_option.. Protocol features are treated case insensitively.

-R [*bind_address*:]*port*:*host*:*hostport*
-R [*bind_address*:]*port*:*local_socket*
-R *remote_socket*:*host*:*hostport*
-R *remote_socket*:*local_socket*
-R [*bind_address*:]*port*

Specifies that connections to the given TCP port or UNIX socket on the remote (server) host are to be forwarded to the local side. This works by allocating a socket to listen to either a TCP port or to a UNIX socket on the remote side. Whenever a connection is made to this port or UNIX socket, the connection is forwarded over the secure channel, and a connection is made from the local machine to either an explicit destination specified by host port *hostport*, or *local_socket*, or, if no explicit destination was specified, **ssh** will act as a SOCKS 4/5 proxy and forward connections to the destinations requested by the remote SOCKS client.

Port forwardings can also be specified in the configuration file. Privileged ports can be forwarded only when logging in as a root on the remote machine. IPv6 addresses can be specified by enclosing the address in square brackets.

By default, TCP listening sockets on the server will be bound to the loopback interface only. This may 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 (see 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 112 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 LibreSSL 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 supported by z/OS UNIX.

Guideline: Before connecting to a server for the first time, it is recommended to gather host keys of the target server and add them to the local user's known hosts file `~/.ssh/known_hosts`. If the preparation is not done, when connecting to the server, the ssh client might ask whether to continue connecting and will display the fingerprint of the host key. Before making the decision, verify the displayed host key fingerprint carefully to prevent server spoofing or man-in-the-middle attacks. The command **`ssh-keyscan`** could gather the public host keys for the target server and the command **`ssh-keygen -l`** could show the fingerprint of the specified public key file. See "ssh-keyscan - Gather ssh public keys" on page 132 and "ssh-keygen - Authentication key generation, management, and conversion" on page 122 for more information. After the user has confirmed the connection, `ssh` will add the new host key to the user known host files automatically. Additional host keys can also be added by enabling the option UpdateHostKeys defined in the configuration file `ssh_config`. For security reasons, it is recommended to set the option HostKeyAlgorithms explicitly (without '+' or '-'). This is defined in the configuration file ssh_config and should be set according to the type of host keys stored in ~/.ssh/known_hosts and /etc/ssh/ssh_known_hosts. Using the default list of HostKeyAlgorithms could help attackers identify users connecting to a server for the first time without false positives. For more information about options UpdateHostKeys and HostKeyAlgorithms, see UpdateHostKeys and HostKeyAlgorithms in "File format" on page 147.

Authentication

The z/OS OpenSSH client supports SSH protocol version 2.

The methods available for authentication are:

- Host-based authentication (disabled by default). See "Host-based authentication" on page 109.
- Public key authentication. See "Public key authentication" on page 109.
- Challenge-response authentication (not supported on z/OS UNIX). See "Challenge-response authentication" on page 110.
- Password authentication. See "Password authentication" on page 110.
- GSSAPI-based authentication.

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, the user is non-root 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.

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/id_dsa (DSA), ~/.ssh/id_ecdsa (ECDSA), ~/.ssh/id_ed25519 (Ed25519), or ~/.ssh/id_rsa (RSA) and stores the public key in ~/.ssh/id_dsa.pub (DSA), ~/.ssh/id_ecdsa.pub (ECDSA), ~/.ssh/id_ed25519.pub (Ed25519), or ~/.ssh/id_rsa.pub (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 81 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 128 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” on page 110.

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.

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 port forwardings using the `-KL`[*bind_address*:]*port* for local, `-KR`[*bind_address*:]*port* for remote or `-KD`[*bind_address*:]*port* for dynamic port-forwardings.
- 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 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 102) 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 517.

Running OpenSSH in other locales

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 519. 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.

Restriction: 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 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 139. 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 114.

~/.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). `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/id_dsa.pub, ~/.ssh/id_rsa.pub, ~/.ssh/id_ecdsa.pub, ~/.ssh/id_ed25519
Contains the public key for authentication. These files are not sensitive and can (but need not) be readable by anyone. The contents of these files must be added to `~/.ssh/authorized_keys` on all machines where the user wants to log in . The contents of the `~/.ssh/id_dsa.pub`, `~/.ssh/id_ecdsa`, `~/.ssh/id_ed25519.pub`, and `~/.ssh/id_rsa.pub` file must be added to `~/.ssh/authorized_keys` on all machines where the user wants to log in. 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 141. 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 143.

~/.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 143.

/etc/ssh/shosts.equiv
This file is used in 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_dsa_key, /etc/ssh/ssh_host_rsa_key, /etc/ssh/ssh_host_ecdsa_key, /etc/ssh/ssh_host_ed25519_key
These five files contain the private parts of the host keys and are used for host-based authentication. `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.

~/.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 file format and configuration information, see ssh_config.

/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 141.

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 143.

/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_ASKPASS_REQUIRE
Allows further control over the use of an askpass program. If this variable is set to 'never' then ssh will never attempt to use one. If it is set to 'prefer', then ssh will prefer to use the askpass program instead of the TTY when requesting passwords. Finally, if the variable is set to 'force', then the askpass program will be used for all passphrase input regardless of whether DISPLAY is set.

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.

SSH_USER_AUTH
Optionally set by sshd, this variable may contain a pathname to a file that lists the authentication methods successfully used when the session was established, including any public keys that were used.

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 private key identities to the authentication agent

Format

```
ssh-add [-cDdkLlqvXx] [-t life] [file ...]
ssh-add -s pkcs11
ssh-add -e pkcs11
ssh-add [-E fingerprint_hash]
ssh-add [-T pubkey ...]
```

Description

`ssh-add` adds private key identities to the authentication agent, `ssh-agent`. When run without arguments, it adds the files `~/.ssh/id_rsa`, `~/.ssh/id_dsa`, `~/.ssh/id_ecdsa`, and `~/.ssh/id_ed25519` . 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 117.

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 128 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.

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 117.

-d
Removes the identity from the agent. When run without specifying an identity to remove, the keys for the default identities and their corresponding certificates will be removed.

When the identity is specified, `ssh-add` looks for the public key in the path name of the identity. If the key is not found, **ssh-add** will append `.`pub and retry. If the argument list consists of '-' then ssh-add will read public keys to be removed from standard input.

-D
Deletes all identities from the agent.

-e *pkcs11*
Not supported in z/OS UNIX. Removes keys provided by PKCS#11 shared library *pkcs11*.

-E *fingerprint_hash*
Specifies the hash algorithm used when displaying key fingerprints. Valid options are: "md5" and "sha256". The default is "sha256".

-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 that are represented by the agent.

-L
Lists public key parameters of all identities that are represented by the agent.

-q
Be quiet after a successful operation.

-s *pkcs11*
Not supported in z/OS UNIX. Adds keys provided by the PKCS#11 shared library *pkcs11*.

-T *pubkey ...*
Tests whether the private keys that correspond to the specified pubkey files are usable by performing sign and verify operations on each.

-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**.

-v
Verbose mode. Causes ssh-add to print debugging messages about its progress. Multiple -v options increase the verbosity. The maximum is 3.

-X
Unlocks the agent.

-x
Locks the agent with a password.

-X
Unlocks the agent.

Files

~/.ssh/id_dsa
Contains the DSA authentication identity of the user.

~/.ssh/id_ecdsa
Contains the ECDSA authentication identity of the user.

~/.ssh/id_ed25519
Contains the Ed25519 authentication identity of the user.

~/.ssh/id_rsa
Contains the 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 quotation marks 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, SSH_ASKPASS_REQUIRE

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 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_ASKPASS_REQUIRE allows further control over the use of an askpass program. If this variable is set to 'never' then ssh-add will never attempt to use one. If it is set to 'prefer', then ssh-add will prefer to use the askpass program instead of the TTY when requesting passwords. Finally, if the variable is set to 'force', then the askpass program will be used for all passphrase input regardless of whether DISPLAY is set.

SSH_AUTH_SOCK

Identifies the path of a UNIX-domain socket that is 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] [-dD] [-a *bind_address*] [-E *fingerprint_hash*] [-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, Ed25519). 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 (or ssh-add. When executed without arguments, ssh-add adds the files ~/.ssh/id_rsa, ~/.ssh/id_dsa, ~/.ssh/id_ecdsa, and ~/.ssh/id_ed25519. . 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 that are 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.

Note: Loaded keys are not preserved when ssh-agent terminates (or an IPL occurs), the keys will need to be reloaded into the agent.

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 may be forwarded over SSH remote logins using the -A option to ssh 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. Sub-shell method: `ssh-agent $SHELL`
2. Current shell method: `eval 'ssh-agent -s'`

For tcsh syntax:

1. Sub-shell method: `ssh-agent $SHELL`
2. Current shell method: `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.

-D
Foreground mode. When this option is specified **`ssh-agent`** will not fork.

-E*fingerprint_hash*
Specifies the hash algorithm used when displaying key fingerprints. Valid options are: "md5" and "sha256". The default is "sha256".

-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/id_dsa
Contains the DSA authentication identity of the user.

~/.ssh/id_ecdsa
Contains the ECDSA authentication identity of the user.

~/.ssh/id_ed25519
Contains the Ed25519 authentication identity of the user.

~/.ssh/id_rsa
Contains the 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.

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

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ssh-keygen - Authentication key generation, management, and conversion

Format

ssh-keygen [-q] [-b *bits*] [-t *type*] [-a *rounds*] [-N *new_passphrase*] [-O *option*] [-C *comment*] [-f *output_keyfile*]

ssh-keygen -p [-a *rounds*] [-m *format*] [-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 [-f *input_keyfile*]
ssh-keygen -c [-a *rounds*] [-P *passphrase*] [-C *comment*] [-f *keyfile*]
ssh-keygen -l [-v] [-E *fingerprint_hash*] [-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 -M generate [-O *option*] *output_file*
ssh-keygen -M screen [-f *input_file*] [-O *option*] *output_file*
ssh-keygen -s *ca_key* -I *certificate_identity* [-h] [-U] [-n *principals*] [-O *option*] [-V *validity_interval*] [-z *serial_number*] file ...
ssh-keygen -L [-f *input_keyfile*]
ssh-keygen -A [-a *rounds*] [-f *prefix_path*]

ssh-keygen -k -f *krl_file* [-u] [-s *ca_public*] [-z *version_number*] file ...
ssh-keygen -Q [-l] -f *krl_file* file ...

Description

ssh-keygen generates, manages, and converts authentication keys for ssh. It can create 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 .

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 RFC 4253 (tools.ietf.org/html/rfc4253). For additional information, see "Moduli generation" on page 127.

If not using SAF key rings, each user who wants to use SSH with public key authentication runs ssh-keygen once to create the authentication key in ~/.ssh/id_dsa, ~/.ssh/id_ecdsa, ~/.ssh/id_ed25519, 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 130 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.

ssh-keygen will by default write keys in an OpenSSH-specific format. This format is preferred as it offers better protection for keys at rest as well as allowing storage of key comments within the private key file itself. The key comment may be useful to help identify the key. The comment is initialized to "user@host" when the key is created, but can be changed using the -C option.

It is still possible for ssh-keygen to write the previously-used PEM format private keys using the -m flag. This may be used when generating new keys, and existing new-format keys may be converted using this option in conjunction with the -p (change passphrase) flag.

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 *rounds*

When saving a private key, this option specifies the number of KDF (key derivation function) rounds used. Higher numbers result in slower passphrase verification and increased resistance to brute-force password cracking (should the keys be stolen). The default is 16 rounds.

-A

For each of the key types (`rsa`, `dsa`, `ecdsa`, and `ed25519`) 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. If `-f` has also been specified, its argument is used as a prefix to the default path for the resulting host key files.

-b *bits*

Specifies the number of bits in the key to create. For RSA keys, the minimum size is 1024 bits, the maximum size is 16384 bits, and the default is 3072 bits. Generally, 3072 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. Ed25519 keys have a fixed length and the `-b` flag will be ignored.

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 keys stored in the newer OpenSSH format (now the default)). 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 128 for details).

-e

Reads a private or public OpenSSH key file and prints a public key in one of the formats specified by the -m option to stdout. The default export format is RFC 2716. 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`.

-E *fingerprint_hash*

Specifies the hash algorithm used when displaying key fingerprints. Valid options are: "md5" and "sha256". The default is "sha256".

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 | hostname:port*

Searches for the specified *hostname* (with optional port number) 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.

-h
When signing a key, create a host certificate instead of a user certificate. See "Certificates" on page 128 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 the format specified by the `-m` option and prints an OpenSSH compatible private (or public) key to stdout. This option allows importing keys from other software, including several commercial SSH implementations. The default import format is "RFC4716".

-I ***certificate_identity***
Specify the key identity when signing a public key. See "Certificates" on page 128 for details.

-l
Shows the fingerprint of specified public key file. `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 key generation, the `-i` (import), `-e` (export) conversion options , and the `-p` (change password) operation. 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 key format is RFC4716.

-M generate
Generate candidate Diffie-Hellman Group Exchange (DH-GEX) parameters for eventual use by the diffie-hellman-group-exchange-* key exchange methods. The numbers generated by this operation must be further screened before use. See the MODULI GENERATION section for more information.

-M screen
Screen candidate parameters for Diffie-Hellman Group Exchange. This will accept a list of candidate numbers and test that they are safe (Sophie Germain) primes with acceptable group generators. The results of this operation may be added to the /etc/moduli file. See the MODULI GENERATION section for more information.

-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 128 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.

Restriction: 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 key/value option. These are specific to the operation that ssh-keygen has been requested to perform. When signing certificates, one of the options listed in the CERTIFICATES section may be specified here. When performing moduli generation or screening, one of the options listed in the MODULI GENERATION section may be specified.

Note: The -O option may be specified multiple times.

-O

-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. If the -l option is also specified then the contents of the KRL will be printed.

-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*** **|** ***hostname:port***

Removes all keys belonging to *hostname* (with optional port number) 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 128 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 130 for details

The argument *ca_key* may also specify a z/OS key ring label for the private CA key using the following syntax: -s *"keyringlabel://myring mylabel"* . As an alternative, the following syntax can be used instead: -s *"keyringlabel://myuser/myring mylabel"* . The quotes are included in the previous examples so that the z/OS UNIX shell will treat the argument to the "-s" option as a single word. Refer to "Using key rings for OpenSSH certificate CA keys" on page 62 for more information.

-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 "dsa", "ecdsa", "ed25519", or "rsa". The program will prompt for the file name to contain the private keys and passphrase, if `-P` or `-N`, and `-f` is not specified. This flag may also be used to specify the desired signature type when signing certificates using an RSA CA key. The available RSA signature variants are "ssh-rsa" (SHA1 signatures, not recommended), "rsa-sha2-256", and "rsa-sha2-512" (the default).

-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

When used in combination with `-s`, this option indicates that a CA key resides in a ssh-agent. See the "Certificates" on page 128 for more information.

-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 the string “always” to indicate the certificate has no specified start time, a date in YYYYMMDD format, a time in YYYYMMDDHHMM[SS] format, a relative time (to the current time) consisting of a minus sign followed by an interval in the format described in the TIME FORMATS section of sshd_config.

The end time may be specified as a YYYYMMDD date, a YYYYMMDDHHMM[SS] time, a relative time starting with a plus character or the string “forever” to indicate that the certificate has no expiry date.

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. If the serial_number is prefixed with a ‘+’ character, then the serial number will be incremented for each certificate signed on a single command-line. 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 `-M generate` option to generate the primes. You can specify the length of the primes using the `-O bits` option.

For example:

```
ssh-keygen -M generate -O bits=2048 moduli-2048.candidates
```

By default, the search for primes begins at a random point in the requested length range. You can override this using the `-O start` option, which specifies a different start point (in hex).

After a set of candidates is generated, the candidates must be tested for suitability. Use the `-M screen` option. In this mode, `ssh-keygen` reads the candidates from standard input (or a file that is specified by using the `-f` option).

For example:

```
ssh-keygen -M screen moduli-2048 -f moduli-2048.candidates
```

By default, each candidate is subject to 100 primality tests. You can override the default by using the `-O prime-tests` 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 `-O generator` option. Valid generator values are 2, 3 and 5.

You can install screened DH groups in `/etc/ssh/moduli`.

The `/etc/ssh/moduli` file must contain moduli of a range of bit lengths, and both ends of a connection must share common moduli.

Some options are available for moduli generation and screening via the `-O` flag.

lines=*number*
: Exits after the specified number of lines is screened while DH candidate screening is being performed.

start-line=*line-number*
: Starts screening at the specified line number while DH candidate screening is being performed.

checkpoint=*filename*
: Write the last line that is processed to the specified file while DH candidate screening is being performed. This option skips lines in the input file that were already processed if the job is restarted.

memory=*mbytes*
: Specifies the amount of memory to use (in megabytes) when candidate moduli for DH-GEX are generated.

start=*hex-value*
: Specifies the start point (in hex) when the candidate moduli for DH-GEX are generated.

generator=*value*
: Specifies the generator (in decimal) when the candidate moduli for DH-GEX are tested.

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.

The following options are valid for user certificates:

clear
: Clear all enabled permissions. This is useful for clearing the default set of permissions so permissions may be added individually.

critical:name[=contents] extension:name[=contents]
: Includes an arbitrary certificate critical option or extension. The specified name should include a domain suffix, for example `name@example.com`. If *contents* is specified, then it is included as the contents of the extension/option encoded as a string, otherwise the extension/option is created with no contents (usually indicating a flag). Extensions may be ignored by a client or server that does not recognise them, whereas unknown critical options will cause the certificate to be refused.

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` (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`.

permit-X11-forwarding
: Allows X11 forwarding.

no-touch-required
: Do not require signatures made using this key include demonstration of user presence (for example, by having the user touch the authenticator). This option only makes sense for the FIDO authenticator algorithms ecdsa-sk and ed25519-sk.

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.

verify-required
: Require signatures made using this key indicate that the user was first verified. This option only makes sense for the FIDO authenticator algorithms ecdsa-sk and ed25519-sk. PIN authentication is the only supported verification method, but other methods may be supported in the future. At present, no standard options are valid for host keys.

Finally, certificates can 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**.

The *ca_key* argument may specify a z/OS key ring label for the private CA key. Refer to the `-s` option in "Options" on page 123 and "Using key rings for OpenSSH certificate CA keys" on page 62.

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 including its SHA1 hash in the KRL.

sha256: *public_key*
Revokes the specified key by including its SHA256 hash in the KRL.

hash: *fingerprint*
Revokes a key using a fingerprint hash, as obtained from a sshd authentication log message or the ssh-keygen -l flag. Only SHA256 finterprints are supported here.

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/id_dsa
Contains the 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 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 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 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_ed25519
Contains the protocol Ed25519 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_ed25519.pub
Contains the Ed25519 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 Ed25519 authentication. You do not need to keep the contents of this file a secret.

~/.ssh/id_rsa
Contains the 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 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 quotation marks 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` [`-46cHv`] [`-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 rsa 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.

-c
Request certificates from target hosts instead of plain keys.

-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.

-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 "dsa", "ecdsa", "ed25519", or "rsa". Multiple values may be specified by separating them with commas. The default is to fetch "rsa", "ecdsa", and "ed25519" keys.

-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.

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 rsa, dsa, ecdsa, and ed25519 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 141 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. 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, /etc/ssh/ssh_host_ed25519_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

ssh-proxyc - HTTP SOCKS-5 proxy command for ssh client

Format

`ssh-proxyc` [−46EHv] −p *proxy_address*[:*port*] *destination* [*port*]

Description

`ssh-proxyc` enables an ssh client to connect through a SOCKS-5 proxy to remote host.

Some installations do not allow for direct ssh outbound communication, but require connection through a SOCK5 proxy server. The **ssh** option "ProxyCommand" can specify an external program that will perform the SOCKS negotiation.

The **ssh-proxyc** command requires the **ssh** "ProxyUseFdPass" option, which supports passing the fd for the connected socket back to the ssh client so that once the SOCKS negotiation is complete, the proxy command can exit and not be required for the I/O.

Options

-4
Forces `ssh-proxyc` to use IPv4 addresses only. If both `-4` and `-6` are specified, `ssh-proxyc` uses the option that appears last on the command line.

-6
Forces `ssh-proxyc` to use IPv6 addresses only. If both `-4` and `-6` are specified, `ssh-proxyc` uses the option that appears last on the command line.

-c
Request certificates from target hosts instead of plain keys.

-E
Disables EBCDIC-ASCII conversions for SOCKS negotiation.

Note: This is useful when the "ssh -D ..." command is used as a SOCKS server on z/OS.

-h
Provides help information.

-v
Enables verbose mode.

-p *addr*[:*port*]
Specifies the proxy address and port.

Here is an examples:

```
ssh -oProxyUseFdpass=yes
-oProxyCommand='ssh-proxyc -p socks_server:1080 %h %p'
user@remote_host
```

Another example in ssh_config:

```
Host *.mydomain.com
ProxyCommand ssh-proxyc -p socks_server:1080 %h %p
```

Related information

ssh, ssh_config: ProxyCommand, ProxyUseFdPass

sshd - OpenSSH daemon

Format

sshd [-46dDeiqTt] [-C *connection_spec*] [-c *host_certificate_file*] [-E *log_file*] [-f *config_file*] [-g *login_grace_time*] [-h *host_key_file*] [-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 8, “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.

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 15, “SMF Type 119 records for OpenSSH,” on page 203 for more information about the SMF login failure records (subtype 98) and server transfer completion records (subtype 96).

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 , Cipher, and MAC algorithms which are required in FIPS mode. 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.

-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 are applied before the configuration is written to standard output. The connection parameters are supplied as keyword=value pairs. The keywords are “addr,” “user”, “host”, “laddr”, “lport”, and “rdomain” and correspond to source address, user, resolved source host name, local address, local port number and routing domain respectively. 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 files are /etc/ssh/ssh_host_rsa_key , /etc/ssh/ssh_host_dsa_key, /etc/ssh/ssh_host_ecdsa_key, and /etc/ssh/ssh_host_ed25519_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.

-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. Checks the validity of both the `sshd_config` configuration file and 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 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

This version of z/OS OpenSSH supports protocol version 2 only. Each host has a host-specific key used to identify the host. Whenever a client connects, the daemon responds with its public host key. The client compares the host key against its own database to verify that it has not changed.

Forward security is provided through a Diffie-Hellman key agreement. 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 143 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).

- 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).

  Public keys that are in a key ring only consist of options, one of which must be the *zos-key-ring-label* option.

  The keytype is "ssh-dss", "ssh-rsa", "ecdsa-sha2-nistp256", "ecdsa-sha2- nistp384", or "ecdsa-sha2-nistp521", "ssh-ed25519".

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. This length permits DSA keys up to 8 kilobits and RSA keys up to 16 kilobits. To avoid typing them, copy the `id_dsa.pub`, `id_ecdsa.pub`, `id_ed25519.pub` or `id_rsa.pub` file and edit it.

`sshd` enforces a minimum RSA key modulus size for keys of 1024 bits.

The options field (if present) consists of comma-separated option specifications. No spaces are permitted, except within double quotation marks. The following option specifications are supported (option keywords are not case-sensitive):

agent-forwarding

Enable authentication agent forwarding previously disabled by the *restrict* option.

cert-authority

Specifies that the listed key is a certificate 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 quotation mark 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, for example, using the restrict key option. 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 114 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.

expiry-time="timespec"
Specifies a time after which the key will not be accepted. The time may be specified as a YYYYMMDD date or a YYYYMMDDHHMM[SS] time in the system time-zone.

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.

See "Patterns" on page 164 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.

permitlisten="[host:]port"
Limits remove port forwarding with the `ssh -R` option such that it may only listen on the specified host (optional) and port. IPv6 addresses can be specified by enclosing the address in square brackets. Multiple permitlisten options may be applied separated by commas. Hostnames may include wildcards as described in the PATTERNS section in ssh_config(5). A port specification of * matches any port. Note that the setting of GatewayPorts may further restrict listen addresses. Note that ssh(1) will send a hostname of "localhost" if a listen host was not specified when the forwarding was requested, and that this name is treated differently to the explicit localhost addresses "127.0.0.1" and "::1".

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 hostnames, they must be literal domains or addresses. A port specification of "*" matches any port.

Appendix B, "OpenSSH - port forwarding examples," on page 517 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.

port-forwarding

Enable port forwarding previously disabled by the *restrict* option.

restrict

Enable all restrictions, that is, disable port, agent and X11 forwarding, as well as disabling PTY allocation and execution of `~/.ssh/rc`. If any future restriction capabilities are added to authorized_keys files they will be included in this set.

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.

user-rc

Enables execution of `~/.ssh/rc` previously disabled by the *restrict* option.

X11-forwarding

Permits X11 forwarding previously disabled by the *restrict* option.

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 quotation marks. Key fields following the options (on the same line) are ignored.

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 81.

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 RSA, DSA, ECDSA, or Ed25519 from the `id_rsa.pub`, `id_dsa.pub`, `id_ecdsa.pub`, or `id_ed25519.pub files`

marker (optional), hostnames, 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 `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 quotation marks. Any fields following *zos-key-ring-label* on the same line are ignored. The *zos-key-ring-label* specification keyword is not case-sensitive.

Remember: 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 28.

The marker is optional. 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 128 for more information on SSH-style certificates.

Hostnames is a comma-separated list of patterns (* and ? act as wildcards). Each pattern is matched against the canonical hostname 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 hostname 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.

Alternatively, hostnames can be stored in a hashed form, which hides hostnames 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 previous negation or wildcard operators can be applied.

The keytype and base64-encoded key are taken directly from the host key; they can be obtained, for example, from `/etc/ssh/ssh_host_rsa_key.pub`. The optional comment field continues to the end of the line, and is not used.

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 was stolen. Revoked keys are specified by including the "@revoked" marker at the beginning of the key line. They 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 hostnames 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 hostnames at the front. **`ssh-keygen(1)`** also offers some basic automated editing for `~/.ssh/known_hosts`, including removing hosts matching a hostname and converting all hostnames to their hashed representations.

An example of a `ssh_known_hosts` file is as follows.

```
# 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.

Restriction:

- 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 10, "Globalization on z/OS systems," on page 67.

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/Ed25519) 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 139. 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 141 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 entries that deny access..

/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_dsa_key, /etc/ssh/ssh_host_ecdsa_key, /etc/ssh/ssh_host_ed25519_key.pub, /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_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 141 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.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 13. 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. (see the CanonicalizeHostname option in "File format" on page 147 for exceptions)

Tip: 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 that start with # as comments.

Configuration options can be specified using two different formats.

- The first format is the keyword argument pair that is separated by white space.
- The second format is the keyword argument pair that is separated with exactly one "=" and optional white space. This format is useful to avoid the need to quote white space when specifying configuration options by using the scp, sftp , and ssh -o options. Arguments can optionally be enclosed in double quotation marks (") in order to represent arguments that contain 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).

AddKeysToAgent
Specifies whether to automatically add keys to a running **ssh-agent**. If this option is set to 'yes' and a key is loaded from a file, the key and its passphrase are added to the agent with the default lifetime, as if by **ssh-add**. If this option is set to 'ask', **ssh** will require confirmation using the SSH_ASKPASS program before adding a key (see "ssh-add - Add private key identities to the authentication agent" on page 115 for details). If this option is set to 'confirm', each use of the key must be confirmed, as if the -c option was specified to **ssh-add**. If this option is set to 'no', no keys are added to the agent. Alternatively, this option can be specified as a time interval. Use the format described in the Time Formats section of **sshd_config** to specify the key's lifetime in **ssh-agent**, after which it is automatically be removed. The argument must be yes, confirm, ask, or no (the default).

BatchMode

If BatchMode is set to "yes", user interaction such as passphrase/password querying and confirmation requests for host keys 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".

Restriction: An SSH agent, Kerberos authentication (if available), SSH_ASKPASS program, 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.

BindInterface

Use the address of the specified interface on the local machine as the source address of the connection. This option is not supported on z/OS UNIX.

CanonicalDomains

When CanonicalizeHostname is enabled, this option specifies the list of domain suffixes in which to search for the specified destination host.

CanonicalizeFallbackLocal

Specifies whether to fail with an error when hostname canonicalization fails. The default, 'yes', will attempt to look up the unqualified hostname by using the system resolver's search rules. A value of 'no' will cause **ssh** to fail instantly if CanonicalizeHostname is enabled and the target hostname cannot be found in any of the domains that are specified by CanonicalDomains.

CanonicalizeHostname

Controls whether explicit hostname canonicalization is performed. The default, 'no', is not to perform any name rewriting and let the system resolver handle all hostname lookups. If CanonicalizeHostname is set to 'yes' then, for connections that do not use ProxyCommand or ProxyJump, **ssh** attempts to canonicalize the hostname specified on the command line by using the CanonicalDomains suffixes and CanonicalizePermittedCNAMEs rules. If CanonicalizeHostname is set to 'always', then canonicalization is applied to proxied connections too.

If this option is enabled, then the configuration files are processed again using the new target name to pick up any new configuration in matching Host and Match stanzas.

CanonicalizeMaxDots

Specifies the maximum number of dot characters in a hostname before canonicalization is disabled. The default, '1', allows a single dot (that is, `hostname.subdomain`).

CanonicalizePermittedCNAMEs

Specifies rules to determine whether CNAMEs should be followed when canonicalizing hostnames. The rules consist of one or more arguments of "source_domain_list:target_domain_list", where source_domain_list is a pattern-list of domains that can follow CNAMEs in canonicalization, and target_domain_list is a pattern-list of domains that they may resolve to.

For example, "`*.a.example.com:*.b.example.com,*.c.example.com`" will allow hostnames matching "`*.a.example.com`" to be canonicalized to names in the "`*.b.example.com`" or "`*.c.example.com`" domains.

CASignatureAlgorithms

Specifies which algorithms are allowed for signing of certificates by certificate authorities (CAs). The default is:

ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521, ssh-ed25519,rsa-sha2-512,rsa-sha2-256

ssh does not accept host certificates that are signed using algorithms other than those specified.

CertificateFile

Specifies a file from which the user's OpenSSH certificate is read. A corresponding private key must be provided separately in order to use this certificate either from an IdentityFile directive or `-i` flag to or by way of **`ssh-agent`**.

Arguments to CertificateFile can use the tilde syntax to refer to a user's home directory or the tokens described in "Tokens" on page 164. The arguments can also use environment variables as described in the environment variables section.

You can have multiple certificate files specified in configuration files; these certificates are tried in sequence. Multiple CertificateFile directives will add to the list of certificates used for authentication.

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 hostname. Enabling this option means that both the user-specified hostname 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 regardless of the setting of StrictHostKeyChecking. 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".

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. If the specified value begins with a '+' character, then the specified ciphers are appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified ciphers (including wildcards) will be removed from the default set instead of replacing them. If the specified value begins with a '^' character, then the specified ciphers will be placed at the head of the default set. 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

chacha20-poly1305@openssh.com

ChaCha20 cipher with Poly1305 authenticator.

The ciphers list is typically one long unbroken line;. However, to space limitations, the default ciphers list is not shown as one unbroken line. The default is:

```
aes128-ctr,aes192-ctr,aes256-ctr,
aes128-gcm@openssh.com,aes256-gcm@openssh.com,
chacha20-poly1305@openssh.com
```

For example:

```
ssh  -o"Ciphers aes192-ctr,aes256-ctr"   Billy@us.pok.ibm.com
```

Note: See /samples/ssh_config for recommended Ciphers configuration on z/OS.

Restriction: The following options are not supported in FIPS mode.

```
aes128-gcm@openssh.com,
aes256-gcm@openssh.com,
chacha20-poly1305@openssh.com
```

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".

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 timeout is applied both to establishing the connection and to performing the initial SSH protocol handshake and key exchange.

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 secondary 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. Arguments to ControlPath may use the tilde syntax to refer to a user's home directory, the tokens described in "Tokens" on page 164 and environment variables as described in the ENVIRONMENT VARIABLES section. To ensure that shared connections are uniquely identified, any ControlPath used for opportunistic connection sharing should include at least *%h*, *%p*, and *%r* (or alternatively *%C*) and be placed in a directory that is not writable by other users. .

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 it is set to "no" (the default), then the master connection will not be placed into the background, and will close as soon as the initial client connection is closed. If it is set to "yes or 0, 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 that are documented in **`sshd_config`**, then the background 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 is to be bound for local use only, while an empty address or * indicates that the port should be available from all interfaces.

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.

Note: ExitOnForwardFailure does not apply to connections made over port forwardings and will not, for example, cause **ssh** to exit if TCP connections to the ultimate forwarding destination fail.

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".

Important: 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".

FingerprintHash

Specifies the hash algorithm that is used when logging key fingerprints. Valid options are: md5 and sha256. The default is sha256.

ForwardAgent

Specifies whether the connection to the authentication agent (if any) is to be forwarded to the remote machine. The argument may be yes, no (the default), an explicit path to an agent socket or the name of an environment variable (beginning with "$") in which to find the path.

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 are refused. Setting ForwardX11Timeout to zero will disable the timeout and permit X11 forwarding for the life of the connection. 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 white space. 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 (tools.ietf.org/html/rfc2743).

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 (tools.ietf.org/html/rfc2743).

GSSAPIDelegateCredentials

Forwards (delegates) credentials to 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 (tools.ietf.org/html/rfc2743).

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 (tools.ietf.org/html/rfc2743).

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 (tools.ietf.org/html/rfc2743).

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 (tools.ietf.org/html/rfc2743).

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 (tools.ietf.org/html/rfc2743).

GSSAPIKexAlgorithms

The list of key exchange algorithms that are accepted by GSSAPI key exchange. Possible values are:

```
gss-group14-sha256-,
gss-group16-sha512-,
gss-nistp256-sha256-,
gss-curve25519-sha256-
gss-group14-sha1-,
gss-gex-sha1-,
gss-group1-sha1-
```

The default is:

```
gss-group14-sha256-,
gss-group16-sha512-,
gss-nistp256-sha256-,
gss-curve25519-sha256-
gss-group14-sha1-,
gss-gex-sha1-
```

This option only applies to connections using GSSAPI.

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 white space. 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 hostname before matching). (see the CanonicalizeHostname option, "CanonicalizeHostname" on page 148 for exceptions)

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 164 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".

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".

HostbasedKeyTypes

Specifies the key types that will be used for host-based authentication as a comma-separated pattern list. Alternately, if the specified value begins with a '+' character, then the specified key types are appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified key types (including wildcards) will be removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified key types are placed at the head of the default set. The default for this option is:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com,
sk-ecdsa-sha2-nistp256-cert-v01@openssh.com,
ssh-ed25519-cert-v01@openssh.com,
sk-ssh-ed25519-cert-v01@openssh.com,
rsa-sha2-512-cert-v01@openssh.com,
rsa-sha2-256-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
sk-ecdsa-sha2-nistp256@openssh.com,
ssh-ed25519,sk-ssh-ed25519@openssh.com,
rsa-sha2-512,rsa-sha2-256,ssh-rsa
```

The `-Q` option of **ssh** may be used to list supported key types.

HostKeyAlgorithms

Specifies the host key algorithms that the client wants to use in order of preference. If the specified value begins with a '+' character, then the specified ciphers are appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified algorithms (including wildcards) will be removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified key types will be placed at the head of the default set. 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,
sk-ecdsa-sha2-nistp256-cert-v01@openssh.com,
ssh-ed25519-cert-v01@openssh.com,
sk-ssh-ed25519-cert-v01@openssh.com,
rsa-sha2-512-cert-v01@openssh.com,
rsa-sha2-256-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
sk-ecdsa-sha2-nistp256@openssh.com,
ssh-ed25519,sk-ssh-ed25519@openssh.com,
rsa-sha2-512,rsa-sha2-256,ssh-rsa
```

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-ed25519-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
ssh-ed25519
```

If you are trying to add or remove multiple hostkeys from the list, then you only need to specify the + or - signs once at the beginning of the option:

```
HostkeyAlgorithms -rsa-sha2-512-cert-v01@openssh.com,ecdsa-sha2-nistp384-cert-
v01@openssh.com,ecdsa-sha2-nistp521-cert-v01@openssh.com
```

Hostkeys cannot be both added and removed at the same time from the default list. You must specify the exact hostkeys that are required.

HostKeyAlias

Specifies an alias that should be used instead of the real hostname when looking up or saving the 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 hostname to log into. You can use this option to specify nicknames or abbreviations for hosts. Arguments to HostName accept the tokens described in "Tokens" on page 164. Numeric IP addresses are also permitted both on the command line and in HostName specifications. The default is the name given on the command line.

IdentityAgent

Specifies the UNIX-domain socket used to communicate with the authentication agent. This option overrides the SSH_AUTH_SOCK environment variable and can be used to select a specific agent. Setting the socket name to 'none' disables the use of an authentication agent. If the string "SSH_AUTH_SOCK" is specified, the location of the socket will be read from the SSH_AUTH_SOCK environment variable. Arguments to IdentityAgent may use the tilde syntax to refer to a user's home directory, the tokens described in the tokens section and environment variables as described in the environment variables section.

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".

Use this option in situations where ssh-agent offers many different identities.

IdentityFile

Specifies a file from which the user's DSA, ECDSA, Ed25519 or RSA authentication identity is read. The default is ~/.ssh/id_dsa, ~/.ssh/id_ecdsa, ~/.ssh/id_ed25519 and ~/.ssh/id_rsa. Additionally, any identities that are represented by the authentication agent are used for authentication unless IdentitiesOnly is set.

If no certificates have been explicitly specified by CertificateFile, **ssh** will try to load certificate information from the filename that is obtained by appending -cert.pub to the path of a specified IdentityFile.

The file name can use the tilde syntax to refer to a user's home directory or the tokens described in "Tokens" on page 164.

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 behavior 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. IdentityFile may also be used in conjunction with CertificateFile in order to provide any certificate also needed for authentication with the identity.

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**.

Tip: List IgnoreUnknown early in the configuration file because it will not be applied to unknown options that appear before it.

Include

Include the specified configuration file. Multiple path names may be specified and each path name may contain glob wildcards and, for user configurations, shell-like '~' references to user home directories. Wildcards are expanded and processed in lexical order. Files without absolute paths are assumed to be in ~/.ssh if included in a user configuration file or /etc/ssh if included from the system configuration file. Include directive may appear inside a Match or Host block to perform conditional inclusion.

IPQoS

This keyword is 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 white space. 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".

KexAlgorithms

Specifies the available KEX (Key Exchange) algorithms. Multiple algorithms must be comma-separated. Alternately, if the specified value begins with a '+' character, then the specified methods are appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified methods (including wildcards) are removed from the default set instead of replacing them. If the specified list begins with '^' character, then the specified methods are placed at the head of the default set. The default is as follows:

```
curve25519-sha256,curve25519-sha256@libssh.org,
ecdh-sha2-nistp256,ecdh-sha2-nistp384,ecdh-sha2-nistp521,
diffie-hellman-group-exchange-sha256,
diffie-hellman-group16-sha512,
diffie-hellman-group18-sha512,

diffie-hellman-group14-sha256,
```

The list of available key exchange algorithms may also be obtained using **ssh** `-Q` *kex*.

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 except for `curve25519-sha256,curve25519-sha256@libssh.org` are supported in FIPS mode.

LocalCommand

Specifies a command to be executed on the local machine after successfully connecting to the server. Arguments to LocalCommand accept the tokens described in "Tokens" on page 164. The command string extends to the end of the line, and is executed with the user's shell.

The following escape character substitutions are performed: %d (local user's home directory), %h (remote hostname), %l (local hostname), %n (hostname as provided on the command line), %p (remote port), %r (remote username) or %u (local username).

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 specifies the listener and may be *[bind_address:]port* or a Unix domain socket path. The second argument is the destination and may be *host:hostport* or a Unix domain socket path if the remote host supports it. IPv6 addresses can be specified by enclosing addresses in square brackets or by using an alternative 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. UNIX domain socket paths may use the tokens described in the Tokens section and environment variables as described in the environment variables section.

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. Multiple algorithms must be comma-separated. If the specified value begins with a '+' character, then the specified algorithms are appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified algorithms (including wildcards) are removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified algorithms are placed at the head of the default set. The default is:

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

The list of available MAC algorithms may also be obtained using **ssh** `-Q` *mac*.

The algorithms that contain "-et" 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`.

Restriction:

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

Restricts the following declarations (up to the next Host or Match keyword) to be used only when the conditions following the Match keyword are satisfied. Match conditions are specified using one or more criteria or the single token `all` which always matches. The available criteria keywords are: canonical, final, exec, host, originalhost, user, and localuser. The `all` criteria must appear alone or immediately after `canonical` or `final`. Other criteria may be combined arbitrarily. All criteria but `all`, `canonical` , and `final` require an argument. Criteria may be negated by prepending an exclamation mark ('!').

The canonical keyword matches only when the configuration file is being reparsed after hostname canonicalization (see the “CanonicalizeHostname” on page 148 option.) This may be useful to specify conditions that work with canonical hostnames only.

The final keyword requests that the configuration be reparsed (regardless of whether CanonicalizeHostname is enabled), and matches only during this final pass. If CanonicalizeHostname is enabled, then canonical and final match during the same pass.

The `exec` keyword executes the specified command under the user's shell. If the command returns a zero exit status, then the condition is considered `true`. Commands containing white space characters must be quoted. Arguments to `exec` accept the tokens described in “Tokens” on page 164.

The other keywords' criteria must be single entries or comma-separated lists and may use the wildcard and negation operators described in the PATTERNS section. The criteria for the `host` keyword are matched against the target hostname, after any substitution by the Hostname or CanonicalizeHostname options. The `originalhost` keyword matches against the hostname as it was specified on the command-line. The `user` keyword matches against the target username on the remote host. The `localuser` keyword matches against the name of the local user running **ssh** (this keyword may be useful in system-wide **ssh_config** files).

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 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 *publickey,gssapi-keyex,gssapi-with-mic,hostbased,publickey,,password,hostbasedpassword*.

keyboard-interactive is not supported on z/OS UNIX.

Protocol

SSH Protocol Version 1 is no longer supported; only protocol Version 2 is supported. If specified, this option is ignored.

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 'exec' directive to avoid a lingering shell process. Arguments to ProxyCommand accept the tokens described in "Tokens" on page 164. 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 is done using the HostName of the host being connected (defaulting to the name typed by the user). Setting the command to 'none' disables this option entirely. The CheckHostIP keyword is not available for connects with a proxy command.

This directive is useful in conjunction with **ssh-proxyc** and its proxy support. For example, the following directive would connect by way of an HTTP proxy at 192.0.2.0:

```
ProxyCommand /usr/bin/ssh-proxyc -p 192.0.2.0:8080 %h %p
ProxyUseFDpass yes
```

ProxyJump

Specifies one or more jump proxies as either `[user@]host[:port]` or an ssh URI. Multiple proxies may be separated by comma characters and are visited sequentially. Setting this option will cause **ssh** to connect to the target host. To connect, it first makes a **ssh** connection to the specified ProxyJump host. Then it establishes a TCP forwarding to the ultimate target from there.

Note: This option competes with the ProxyCommand option - whichever is specified first will prevent later instances of the other from taking effect.

Note also that the configuration for the destination host (either supplied via the command-line or the configuration file) is not generally applied to jump hosts. ~/.ssh/config should be used if specific configuration is required for jump hosts.

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".

PubkeyAcceptedKeyTypes

Specifies the key types that is used for public key authentication as a comma-separated pattern list. Alternately, if the specified value begins with a '+' character, then the key types after it is appended to the default instead of replacing it. If the specified value begins with a '-' character, then the specified key types (including wildcards) are removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified key types ware placed at the head of the default set. The default for this option is:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com,
ssh-ed25519-cert-v01@openssh.com,
rsa-sha2-512-cert-v01@openssh.com,
rsa-sha2-256-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
ssh-ed25519,
rsa-sha2-512,rsa-sha2-256,ssh-rsa
```

The list of available key types may also be obtained using **ssh** -Q *key*.

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.

Restriction: The following restriction applies:

- The maximum value is UINT_MAX bytes and the minimum value is 16 bytes.

RemoteCommand

Specifies a command to execute on the remote 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. Arguments to RemoteCommand accept the tokens described in "Tokens" on page 164.

RemoteForward

Specifies that a TCP port on the remote machine is to be forwarded over the secure channel. The remote port may either be forwarded to a specified host and port from the local machine, or may act as a SOCKS 4/5 proxy that allows a remote client to connect to arbitrary destinations from the local machine. The first argument may be *[bind_address:]port* or, if the remote host supports it, a Unix domain socket. If forwarding to a specific destination, then the second argument must be *host :hostport* or a UNIX domain socket path, otherwise if no destination argument is specified, then the remote forwarding will be established as a SOCKS proxy. 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.

Unix domain socket paths can use the tokens described in the tokens section. Environment variables can also be used as described in the environment variable section.

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`**.

RevokedHostKeys

Specifies revoked host public keys. Keys listed in this file will be refused for host authentication.

Note: If this file does not exist or is not readable, then host authentication will be refused for all hosts.

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`**. For more information on KRLs, see the KEY REVOCATION LISTS section in “ssh-keygen - Authentication key generation, management, and conversion” on page 122.

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.

See “Patterns” on page 164 for more information about patterns.

It is possible to clear previously set SendEnv variable names by prefixing patterns with '-'. The default is not to send any environment variables.

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.

Note: The TERM environment variable is always sent whenever a pseudo-terminal is requested as it is required by the protocol.

The server must 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.

For 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.

SetEnv

Directly specify one or more environment variables and their contents to be sent to the server. Similarly to SendEnv, the server must be prepared to accept the environment variable.

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.

StreamLocalBindMask

Sets the octal file creation mode mask (umask) used when creating a UNIX-domain socket file for local or remote port forwarding. This option is only used for port forwarding to a UNIX-domain socket file.

The default value is 0177, which creates a UNIX-domain socket file that is readable and writable only by the owner.

StreamLocalBindUnlink

Specifies whether to remove an existing UNIX-domain socket file for local or remote port forwarding before creating a new one. If the socket file already exists and StreamLocalBindUnlink is not enabled, **ssh** will be unable to forward the port to the UNIX-domain socket file. This option is only used for port forwarding to a UNIX-domain socket file.

The argument must be 'yes' or 'no' (the default).

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 man-in-the-middle 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 this flag is set to 'accept-new', then **ssh** will automatically add new host keys to the user known hosts files, but will not permit connections to hosts with changed host keys. If the argument is set to "no" or "off", ssh will automatically add new host keys to the user known hosts files and allow connections to hosts with changed hostkeys to proceed, subject to some restrictions. If the flag is set to "ask" (the default), 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".

SyslogFacility

Gives the facility code that is used when logging messages from **ssh**. The possible values are the following: MON, USER, AUTH, LOCAL0, LOCAL1, LOCAL2, LOCAL3, LOCAL4, LOCAL5, LOCAL6, LOCAL7 . The default is USER.

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". See also "ServerAliveInterval" on page 161 for protocol-level keepalives.

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".

UpdateHostKeys

Specifies whether **ssh** should accept notifications of additional hostkeys from the server sent after authentication has completed and add them to UserKnownHostsFile. The argument must be `yes`, no (the default) or `ask`. Enabling this option allows learning alternative hostkeys for a server and supports graceful key rotation by allowing a server to send replacement public keys before old ones are removed. Additional hostkeys are only accepted if the key used to authenticate the host was already trusted or explicitly accepted by the user. If UpdateHostKeys is set to `ask`, then the user is asked to confirm the modifications to the known_hosts file. Confirmation is incompatible with ControlPersist, and will be disabled if it is enabled.

Presently, only **sshd** from OpenSSH 6.8 and greater support the `hostkeys@openssh.com` protocol extension used to inform the client of all the server's hostkeys.

User

Specifies the name that the user can use when logging on. This can be useful when a different username is used on different machines. You do not have to remember to give the username on the command line.

UserKnownHostsFile

Specifies one or more files to use for the user host key database separated by white space. Each file name can use tilde notation to refer to the user's home directory, the tokens described in the tokens section and environment variables as described in the environment variables section. 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".

Because z/OS UNIX does not support verified secure DNS SSHFP records, 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. The fingerprint string at login and for unknown host keys is also printed. If this flag is set to "no", no fingerprint strings are printed at login. Only the fingerprint string is 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"
```

Note that a negated match will never produce a positive result by itself. For example, attempting to match "host3" against the following pattern- list will fail:

```
from="!host1,!host2"
```

The solution here is to include a term that will yield a positive match, such as a wildcard:

```
from="!host1,!host2,*"
```

Tokens

Arguments to some keywords can make use of tokens, which are expanded at runtime:

%%
A literal '%'.

%C
Hash of %l%h%p%r.

%d
Local user's home directory.

%h
The remote hostname.

%i
The local user ID.

%k
The host key alias if specified, otherwise the original remote hostname given on the command line

%L
The local hostname.

%l
The local hostname, including the domain name.

%n
The original remote hostname, as given on the command line.

%p
The remote port.

%r
The remote username.

%u
The local username.

The following is a list of option types and their accepted tokens:

- CertificateFile, ControlPath, IdentityAgent, IdentityFile, LocalForward, Match exec, RemoteCommand, RemoteForward, and UserKnownHostsFile accept the tokens %%, %C, %d, %h, %i, %L, %l, %n, %p, %r, and %u.
- HostName accepts the tokens %% and %h.
- LocalCommand accepts the tokens %%, %C, %d, %h, %l, %n, %p, %r, and %u.
- ProxyCommand accepts the tokens %%, %h, %p, and %r.

Environment Variables

Arguments to some keywords can be expanded at runtime from environment variables on the client by enclosing them in ${}, for example ${HOME}/.ssh would refer to the user's .ssh directory. If a specified environment variable does not exist then an error will be returned and the setting for that keyword will be ignored.

The keywords CertificateFile, ControlPath, IdentityAgent, IdentityFile and UserKnownHostsFile support environment variables. The keywords LocalForward and RemoteForward support environment variables only for Unix domain socket paths.

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 519.)

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`, `ssh-proxyc`

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 that are separated by "Host" specifications, and that section is only applied for hosts that match one of the patterns given in the specification. The matched hostname 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 quotation marks (") 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, converting 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", "CPACF", "OpenSSL" or "ICSF". The default is "CPACF". Specifying "OpenSSL" requests all ciphers to be implemented using the statically linked LibreSSL cryptographic library. Specifying "CPACF" requests that supported ciphers be implemented using z/Architecture CPACF instructions, or otherwise by LibreSSL. 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 CPACF if available. Ciphers that are not supported by CPACF are implemented using ICSF if available, or otherwise using OpenSSH. 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. If FIPSMODE is not set to "yes" (the default), then `CiphersSource=CPACF` (the default) will generally result in the lowest CPU usage by OpenSSH. Ciphers supported by CPACF: "aes128-cbc", "aes192-cbc", "aes256-cbc", "aes128-ctr", "aes192-ctr", "aes256-ctr", "3des-cbc", .

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" , Type 119 client connection started records (subtype 94) are collected for the ssh client, and 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".

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 164 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 LibreSSL 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 LibreSSL. If ICSF is not available, all Key Exchange algorithms are implemented using LibreSSL. 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.

Note: Specifying ICSF for Kex algorithms does not force source=ICSF or MAC algorithms that are used as part of Key Exchange.

MACsSource
Specifies the source used to implement the MAC algorithms specified by the `ssh_config` keyword MACs. Valid arguments are "any", "CPACF", "OpenSSL" or "ICSF". The default is "CPACF". Specifying "OpenSSL" requests all MAC algorithms to be implemented using the statically linked LibreSSL cryptographic library. Specifying "CPACF" requests that supported MAC algorithms be implemented using z/Architecture CPACF instructions, or otherwise by LibreSSL. 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 CPACF if available. MAC algorithms that are not supported by CPACF are implemented using ICSF if available, or otherwise using LibreSSL. 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. If FIPSMODE is not set to "yes" (the default), then `MACsSource=CPACF` (the default) will generally result in the lowest CPU usage by OpenSSH. MAC algorithms supported by CPACF: "hmac-sha1", "hmac-sha2-256", "hmac-sha2-512" as well as the encrypt-then-mac variants of these: "hmac-sha1-etm@openssh.com", "hmac-sha2-256-etm@openssh.com", "hmac-sha2-512-etm@openssh.com"

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 quotation marks (") 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", "CPACF", "OpenSSL" or "ICSF". The default is "CPACF". Specifying "OpenSSL" requests all ciphers to be implemented using the statically linked LibreSSL cryptographic library. Specifying "CPACF" requests that supported cyphers algorithms be implemented using z/Architecture CPACF instructions, or otherwise by LibreSSL. 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 CPACF if available. Ciphers that are not supported by CPACF are implemented using ICSF if available, or otherwise using OpenSSH. 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. If FIPSMODE is not set to "yes" (the default), then CiphersSource=CPACF (the default) will generally result in the lowest CPU usage by OpenSSH. Ciphers supported by CPACF: "aes128-cbc", "aes192-cbc", "aes256-cbc", "aes128-ctr", "aes192-ctr", "aes256-ctr", "3des-cbc".

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".

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 164 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 78. 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 quotation marks 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 quotation marks 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. Typically, RSA 2048 bits are considered sufficient. As DSA 2048 is not supported by open group OpenSSH, z/OS OpenSSH may not communicate with open group OpenSSH if DSA 2048 key is used. It requires both client and server to be z/OS OpenSSH and running in FIPS mode, if DSA 2048 is used.

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 LibreSSL 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 LibreSSL. If ICSF is not available, all Key Exchange algorithms are implemented using LibreSSL. 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.

Note: Specifying ICSF for Kex algorithms does not force source=ICSF or MAC algorithms that are used as part of Key Exchange.

MACsSource

Specifies the source used to implement the MAC algorithms specified by the `ssh_config` keyword MACs. Valid arguments are "any", "CPACF", "OpenSSL" or "ICSF". The default is "CPACF". Specifying "OpenSSL" requests all MAC algorithms to be implemented using the statically linked LibreSSL cryptographic library. Specifying "CPACF" requests that supported MAC algorithms be implemented using z/Architecture CPACF instructions, or otherwise by LibreSSL. 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 CPACF if available. MAC algorithms that are not supported by CPACF are implemented using ICSF if available, or otherwise using LibreSSL. 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. If FIPSMODE is not set to "yes" (the default), then `MACsSource=CPACF` (the default) will generally result in the lowest CPU usage by OpenSSH. MAC algorithms supported by CPACF: "hmac-sha1", "hmac-sha2-256", "hmac-sha2-512" as well as the encrypt-then-mac variants of these: "hmac-sha1-etm@openssh.com", "hmac-sha2-256-etm@openssh.com", "hmac-sha2-512-etm@openssh.com"

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" on page 172 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 quotation marks (") in order to represent arguments containing spaces.

  For example:

  ```
  keyword argument
  keyword=argument
  ```

Keywords are not case-sensitive and arguments are case-sensitive. For each keyword, the first obtained value is used.

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 keywords SendEnv and SetEnv 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.

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.

The TERM environment variable is always accepted whenever the client requests a pseudo-terminal as it is required by the protocol.

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".

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 whether 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 164 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.

AllowStreamLocalForwarding

Specifies whether StreamLocal (UNIX-domain socket) forwarding is permitted. The available options are 'yes' (the default) or 'all' to allow StreamLocal forwarding, 'no' to prevent all StreamLocal forwarding, 'local' to allow local (from the perspective of **ssh**) forwarding only or 'remote' to allow remote forwarding only.

Note: Disabling StreamLocal forwarding does not improve security unless users are also denied shell access, as they can always install their own forwarders.

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. HOST criteria may additionally contain addresses to match in CIDR address/masklen format. The default is to allow login for all users. The allow and deny options are processed in the following order to determine whether 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 164 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, or by the single string any to indicate the default behavior of accepting any single authentication method.

For example, an argument of "publickey,password publickey,keyboard interactive" 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 "auth", "pax", or "ska", depending on the server configuration. For example, "keyboard-interactive:auth" would restrict keyboard interactive authentication to the bsdauth device. Keyboard interactive authentication is not supported on z/OS UNIX.

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.

The available authentication methods are as follows: "gssapi-with-mic", "hostbased", "keyboard-interactive", "none" (used for access to password-less accounts when PermitEmptyPassword is enabled), "password" and "publickey".

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 and specified by an absolute path. Arguments to AuthorizedKeysCommand accept the tokens described in "Tokens" on page 191. If no arguments are specified, then the username of the target user is used. The program should produce on standard output zero or more lines of authorized_keys output (see authorized_keys in "sshd - OpenSSH daemon" on page 136). 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. The format is described in the "Format of the authorized_keys file " on page 139 section of **sshd** . Arguments to AuthorizedKeysFile accept the tokens described in the "Tokens" on page 191 section. 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. Alternately, this option may be set to none to skip checking for user keys in files. 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.

AuthorizedPrincipalsCommand

Specifies a program to be used to generate the list of allowed certificate principals as per AuthorizedPrincipalsFile. The program must be owned by root, not writable by group or others and specified by an absolute path. Arguments to AuthorizedPrincipalsCommand accept the tokens described in "Tokens" on page 191. If no arguments are specified, then the username of the target user is used.

The program should produce on standard output zero or more lines of AuthorizedPrincipalsFile output. If either AuthorizedPrincipalsCommand or AuthorizedPrincipalsFile is specified, then certificates offered by the client for authentication must contain a principal that is listed. By default, no AuthorizedPrincipalsCommand is run.

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.

AuthorizedPrincipalsCommandUser

Specifies the user under whose account the AuthorizedPrincipalsCommand is run. It is recommended to use a dedicated user that has no other role on the host than running authorized principals commands. If AuthorizedPrincipalsCommand is specified but AuthorizedPrincipalsCommandUser is not, then **sshd** will refuse to start.

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.

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 139). Empty lines and comments starting with "#" are ignored.

Arguments to AuthorizedPrincipalsFile accept the tokens described in "Tokens" on page 191. 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 136 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.

CASignatureAlgorithms
Specifies which algorithms are allowed for signing of certificates by certificate authorities (CAs). The default is:

```
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
ssh-ed25519,rsa-sha2-512,rsa-sha2-256
```

Certificates signed using other algorithms will not be accepted for public key or host-based authentication.

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 138 in the `sshd` section.

Arguments to ChrootDirectory accept the tokens described in "Tokens" on page 191.

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.

The default is `none`, indicating not to chroot.

Ciphers
Specifies the ciphers to use for encrypting the session in protocol version 2. If the specified value begins with a '+' character, then the specified ciphers will be appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified ciphers (including wildcards) will be removed from the default set instead of replacing them. If the specified list begins

with a '^' character, then the specified ciphers are placed at the head of the default set. 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

chacha20-poly1305@openssh.com
ChaCha20 cipher with Poly1305 authenticator.

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:

```
chacha20-poly1305@openssh.com,
aes128-ctr,aes192-ctr,aes256-ctr,
aes128-gcm@openssh.com,aes256-gcm@openssh.com
```

See `/samples/sshd_config` for recommended Ciphers configuration on z/OS.

Restriction: If you are running in FIPS mode, the following options are not supported:

```
aes128-gcm@openssh.com, aes256-gcm@openssh.com,
chacha20-poly1305@openssh.com
```

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.

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.

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.

Note: The client alive mechanism is designed to periodically send SSH protocol messages over the connection to make it appear non-idle and keep the session alive. If the server does not receive data from the client within the given amount of time, the server sends a client-alive message to the client.

It continues sending these messages at the given interval until it receives a response or gives up after ClientAliveCountMax attempts and closes the inactive (disconnected) session. If the intention is to have idle sessions close, the recommended method is using the TMOUT environment variable, which can be set for the system in `/etc/profile`. The user's shell will detect when the session is idle and close the session despite the ClientAlive settings keeping the session alive. For more information about TMOUT, see SMFPRMxx in *z/OS UNIX System Services Planning*.

Compression

Specifies whether compression is enabled after the user has authenticated successfully. The argument must be "yes", "delayed: (a legacy synonym for yes) or "no". The default is "yes".

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 164 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. HOST criteria may additionally contain addresses to match in CIDR address/masklen format. 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 164 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.

DisableForwarding
Disables all forwarding features, including X11, **ssh-agent**, TCP and StreamLocal. This option overrides all other forwarding-related options and may simplify restricted configurations.

ExposeAuthInfo
If 'yes", **sshd** writes a temporary file containing a list of authentication methods and public credentials (for example, keys) used to authenticate the user. The location of the file is exposed to the user session through the SSH_USER_AUTH environment variable. The default is 'no'.

FingerprintHash
Specifies the hash algorithm used when logging key fingerprints. Valid options are as follows: md5 and sha256. The default is sha256.

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.

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 (tools.ietf.org/html/rfc2743).

GSSAPICleanupCredentials
Specifies whether to automatically destroy the user's credentials cache on logout. The default is "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 (tools.ietf.org/html/rfc2743).

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".

If running in FIPSMODE, this option will not be supported. Even though its 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 (tools.ietf.org/html/rfc2743).

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 (tools.ietf.org/html/rfc2743).

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".

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 (tools.ietf.org/html/rfc2743).

GSSAPIKexAlgorithms

The list of key exchange algorithms that are accepted by GSSAPI key exchange. Possible values are:

```
gss-group14-sha256-,
gss-group16-sha512-,
gss-nistp256-sha256-,
gss-curve25519-sha256-
gss-group14-sha1-,
gss-gex-sha1-,
gss-group1-sha1-
```

The default is:

```
gss-group14-sha256-,
gss-group16-sha512-,
gss-nistp256-sha256-,
gss-curve25519-sha256-
gss-group14-sha1-,
gss-gex-sha1-
```

This option only applies to connections using GSSAPI.

HostbasedAcceptedKeyTypes

Specifies the key types that will be accepted for hostbased authentication as a comma-separated pattern list. Alternately, if the specified value begins with a '+' character, then the specified key types will be appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified key types (including wildcards) will be removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified key types will be placed at the head of the default set. The default for this option is as follows:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com,
sk-ecdsa-sha2-nistp256-cert-v01@openssh.com,
ssh-ed25519-cert-v01@openssh.com,
sk-ssh-ed25519-cert-v01@openssh.com,
rsa-sha2-512-cert-v01@openssh.com,
rsa-sha2-256-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
sk-ecdsa-sha2-nistp256@openssh.com,
ssh-ed25519,sk-ssh-ed25519@openssh.com,
rsa-sha2-512,rsa-sha2-256,ssh-rsa
```

The list of available key types may also be obtained using **ssh** -Q *HostbasedAcceptedKeyTypes*.

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".

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 behavior 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_rsa_key, /etc/ssh/ssh_host_dsa_key, /etc/ssh/ssh_host_ecdsa_key, and /etc/ssh/ssh_host_ed25519_key. sshd will refuse to use a file if it is group/world-accessible.

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. The HostKeyAlgorithms option restricts which of the keys are actually used and only the first key found of each key type (for example, RSA, DSA, ECDSA, or Ed25519) 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.

HostKeyAlgorithms
Specifies the host key algorithms that the client wants to use in order of preference. Alternately, if the specified value begins with a '+' character, then the specified key types will be appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified key types (including wildcards) will be removed from the default set instead of replacing them. The default for this option is as follows:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com,
ssh-ed25519-cert-v01@openssh.com,
rsa-sha2-512-cert-v01@openssh.com,
rsa-sha2-256-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
ssh-ed25519,
rsa-sha2-512,rsa-sha2-256,ssh-rsa
```

If hostkeys are known for the destination host, then this default is modified to prefer their algorithms.

The list of available key types may also be obtained using **ssh** -Q *HostKeyAlgorithms*.

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-ed25519-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
ssh-ed25519
```

IgnoreRhosts
Specifies to ignore per-user `.rhosts` and `.shosts` files during HostbasedAuthentication.

The system-wide `/etc/hosts.equiv` and `/etc/shosts.equiv` files are still used regardless of this setting. Accepted values are "yes" (the default) to ignore all per-user files, "shosts-only" to allow the use of .shosts but to ignore .rhosts or "no" to allow both .shosts and rhosts.

IgnoreUserKnownHosts
Specifies whether `sshd` should ignore the user's `~/.ssh/known_hosts` during HostbasedAuthentication. The default is "no".

Include
Includes the specified configuration files. Multiple path names can be specified and each path name can contain glob wildcards that are expanded and processed in lexical order. Files without absolute paths are assumed to be in `/etc/ssh`. An Include directive may appear inside a Match block to perform conditional inclusion.

IPQoS
This option is 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".

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. Alternately, if the specified value begins with a '+' character, then the specified methods will be appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified methods (including wildcards) will be removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified methods are placed at the head of the default set. The supported algorithms are as follows:

```
diffie-hellman-group1-sha1
diffie-hellman-group14-sha1
diffie-hellman-group14-sha256
diffie-hellman-group16-sha512
diffie-hellman-group18-sha512
diffie-hellman-group-exchange-sha1
diffie-hellman-group-exchange-sha256
ecdh-sha2-nistp256
ecdh-sha2-nistp384
ecdh-sha2-nistp521
curve25519-sha256
curve25519-sha256@libssh.org
```

The default is as follows:

```
curve25519-sha256,curve25519-sha256@libssh.org,
ecdh-sha2-nistp256,ecdh-sha2-nistp384,ecdh-sha2-nistp521,
diffie-hellman-group-exchange-sha256,
diffie-hellman-group16-sha512,
diffie-hellman-group18-sha512,

diffie-hellman-group14-sha256
```

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 except for `curve25519-sha256,curve25519-sha256@libssh.org` are supported in FIPS mode.

Note: This keyword will not be supported in a match block.

The list of available key exchange algorithms may also be obtained using **ssh** `-Q` *KexAlgorithms*.

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 Configuring the syslogd daemon in *z/OS Communications Server: IP Configuration Guide*.

MACs

Specifies the available MAC (message authentication code) algorithms . The MAC algorithm is used for data integrity protection. Multiple algorithms must be comma-separated. If the specified value begins with a '+' character, then the specified algorithms will be appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified algorithms (including wildcards) are removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified algorithms are placed at the head of the default set. The supported MACs are as follows:

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

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 as follows:

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

.

The algorithms that contain "-et" 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: 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,
umac-64@openssh.com,
umac-64-etm@openssh.com,
umac-128-etm@openssh.com,
umac-128@openssh.com
```

The list of available MAC algorithms may also be obtained using **ssh** `-Q` *mac*.

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 164.

The patterns in an Address criteria may additionally contain addresses to match in CIDR `address/masklen` format, such as `192.0.2.0/24` or `2001:db8::/32`. The mask length provided must be consistent with the address - it is an error to specify a mask length that is too long for the address or one with bits set in this host portion of the address. For example, `192.0.2.0/33` and `192.0.2.0/8`, respectively. Some restrictions apply.

- Only a subset of keywords can be used on the lines following a Match keyword. Those keywords are AcceptEnv, AllowAgentForwarding, AllowGroups, AllowStreamLocalForwarding, AllowTcpForwarding, AllowUsers, AuthenticationMethods, AuthorizedKeysCommand, AuthorizedKeysCommandUser, AuthorizedKeysFile, AuthorizedPrincipalsCommand, AuthorizedPrincipalsCommandUser, AuthorizedPrincipalsFile, Banner, ChrootDirectory, ClientAliveCountMax, ClientAliveInterval, DenyGroups, DenyUsers, ForceCommand, GatewayPorts, GSSAPIAuthentication, HostbasedAcceptedKeyTypes, HostbasedAuthentication, HostbasedUsesNameFromPacketOnly, IgnoreRhosts, Include, IPQoS, KbdInteractiveAuthentication, KerberosAuthentication, LogLevel, MaxAuthTries, MaxSessions, PasswordAuthentication, PermitEmptyPasswords,PermitListen, PermitOpen, PermitRootLogin, PermitTTY, PermitTunnel, PermitUserRC, PubkeyAcceptedKeyTypes, PubkeyAuthentication, RekeyLimit, RevokedKeys, SetEnv, StreamLocalBindMask, StreamLocalBindUnlink, TrustedUserCAKeys, 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.

MaxSessions

Specifies the maximum number of open shell, login or subsystem (for example, sftp) sessions permitted per network connection. Multiple sessions may be established by clients that support connection multiplexing. Setting MaxSessions to 1 will effectively disable session multiplexing, whereas setting it to 0 will prevent all shell, login and subsystem sessions while still permitting forwarding. The default is 10.

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 "start" (10) unauthenticated connections. The probability increases linearly and all connection attempts are refused if the number of unauthenticated connections reaches "full" (100).

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.

PermitListen

Specifies the addresses/ports on which a remote TCP port forwarding may listen. The listen specification must be one of the following forms:

```
PermitListen port
PermitListen host:port
```

Multiple permissions may be specified by separating them with whitespace. An argument of any can be used to remove all restrictions and permit any listen requests. An argument of none can be used to prohibit all listen requests. The host name may contain wildcards as described in the PATTERNS section in ssh_config(5). The wildcard "*" can also be used in place of a port number to allow all ports. By default all port forwarding listen requests are permitted. Note that the GatewayPorts option may further restrict which addresses may be listened on. Note also that ssh(1) will request a listen host of `localhost` if no listen host was specifically requested, and this name is treated differently to explicit localhost addresses of `127.0.0.1` and `::1`.

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. An argument of "none" can be used to prohibit all forwarding requests. The wildcard '*' can be used for host or port to allow all hosts or ports, respectively. Otherwise, no pattern matching or address lookups are performed on supplied names. By default, all port forwarding requests are permitted.'

PermitRootLogin

Specifies whether a superuser (root) can login using `ssh`. The argument must be "yes" , "prohibit-password" (default), "forced-commands-only", or "no".

If this option is set to "prohibit-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.

PermitTTY

Specifies whether pty allocation is permitted. The default is 'yes'.

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`. Valid options are "yes", "no", or a pattern-list specifying which environment variable names to accept (for example "LANG,LC_*"). 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.

PermitUserRC

Specifies whether any `~/.ssh/rc` file is executed. The default is `yes`.

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 138.

PubkeyAcceptedKeyTypes

Specifies the key types that will be accepted for public key authentication as a comma-separated pattern list. Alternately, if the specified value begins with a '+' character, then the specified key types will be appended to the default set instead of replacing them. If the specified value begins with a '-' character, then the specified key types (including wildcards) will be removed from the default set instead of replacing them. If the specified list begins with a '^' character, then the specified key types will be placed at the head of the default set. The default for this option is as follows:

```
ecdsa-sha2-nistp256-cert-v01@openssh.com,
ecdsa-sha2-nistp384-cert-v01@openssh.com,
ecdsa-sha2-nistp521-cert-v01@openssh.com,
sk-ecdsa-sha2-nistp256-cert-v01@openssh.com,
ssh-ed25519-cert-v01@openssh.com,
sk-ssh-ed25519-cert-v01@openssh.com,
rsa-sha2-512-cert-v01@openssh.com,
rsa-sha2-256-cert-v01@openssh.com,
ssh-rsa-cert-v01@openssh.com,
ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521,
sk-ecdsa-sha2-nistp256@openssh.com,
ssh-ed25519,sk-ssh-ed25519@openssh.com,
rsa-sha2-512,rsa-sha2-256,ssh-rsa
```

The list of available key types may also be obtained using **ssh** `-Q` *PubkeyAcceptedKeyTypes*.

PubkeyAuthOptions

Sets one or more public key authentication options. The Supported keywords are: none (the default; indicating no additional options are enabled), touch-required and verify-required.

The touch-required option causes public key authentication using a FIDO authenticator algorithm (for example, ecdsa-sk or ed25519-sk) to always require the signature to attest that a physically present user explicitly confirmed the authentication (usually by touching the authenticator). By default, sshd(8) requires user presence unless overridden with an authorized_keys option. The touch-required flag disables this override.

The verify-required option requires a FIDO key signature attest that the user was verified, e.g. via a PIN.

Neither the touch-required or verify-required options have any effect for other, non-FIDO, public key types.

PubkeyAuthentication
Specifies whether public key authentication is allowed. The default is "yes".

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 file, or none to not use one. 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 130.

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.

RDomain
Specifies an explicit routing domain that is applied after authentication has completed. The user session, as well and any forwarded or listening IP sockets, will be bound to this rdomain(4). If the routing domain is set to %D, then the domain in which the incoming connection was received will be applied.

This option is not supported on z/OS UNIX.

SecurityKeyProvider
Specifies a path to a library that will be used when loading FIDO authenticator-hosted keys, overriding the default of using the built-in USB HID support.

Note: FIDO authenticator-hosted keys (tokens) are not supported on z/OS Unix,

SetEnv
Specifies one or more environment variables to set in child sessions started by sshd(8) as NAME=VALUE. The environment value may be quoted (e.g. if it contains whitespace characters). Environment variables set by SetEnv override the default environment and any variables specified by the user via AcceptEnv or PermitUserEnvironment.

StreamLocalBindMask
Sets the octal file creation mode mask (umask) used when creating a UNIX-domain socket file for local or remote port forwarding. This option is only used for port forwarding to a UNIX-domain socket file.

The default value is 0177, which creates a UNIX-domain socket file that is readable and writable only by the owner.

Note: Not all operating systems honor the file mode on UNIX-domain socket files.

StreamLocalBindUnlink
Specifies whether to remove an existing UNIX-domain socket file for local or remote port forwarding before creating a new one. If the socket file already exists and StreamLocalBindUnlink is not enabled,

sshd will be unable to forward the port to the UNIX-domain socket file. This option is only used for port forwarding to a UNIX-domain socket file.

The argument must be 'yes' or 'no'. The default is 'no'.

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). 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 Configuring the syslogd daemon in *z/OS Communications Server: IP Configuration Guide*.

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, or none to not use one. 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 128.

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 "no".

If this option is set to no (the default), then only addresses and not host names may be used in ~/.ssh/authorized_keys from **sshd_config** Match Host directives.

UsePAM
Not supported on z/OS UNIX. Enables PAM authentication (via challenge-response) and session set up. The default is "no".

VersionAddendum
Optionally specifies additional text to append to the SSH protocol banner sent by the server upon connection. The default is "none".

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, or none to not use one. 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 519. 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)
```

Tokens

Arguments to some keywords can make use of tokens, which are expanded at runtime:

%%
A literal '%'.

%F
The fingerprint of the CA key.

%f
The fingerprint of the key or certificate.

%h
The home directory of the user.

%i
The key ID in the certificate.

%K
The base64-encoded CA key.

%k
The base64-encoded key or certificate for authentication.

%s
The serial number of the certificate.

%T
The type of the CA key.

%t
The key or certificate type.

%U
The numeric user ID of the target user.

%u
The username.

The following is a list of option types and their accepted tokens:

- AuthorizedKeysCommand accepts the tokens %%, %f, %h, %k, %t, %U, and %u.
- AuthorizedKeysFile accepts the tokens %%, %h, and %u.
- AuthorizedPrincipalsCommand accepts the tokens %%, %F, %f, %h, %i, %K, %k, %s, %T, %t, %U, and %u.
- AuthorizedPrincipalsFile accepts the tokens %%, %h, %U, and %u.
- ChrootDirectory accepts the tokens %%, %h, %U, and %u.

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 quotation marks (") 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", "CPACF", "OpenSSL" or "ICSF". The default is "CPACF". Specifying "OpenSSL" requests all ciphers to be implemented using the statically linked LibreSSL cryptographic library. Specifying "CPACF" requests that supported ciphers be implemented using z/Architecture CPACF instructions, or otherwise by LibreSSL. 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 CPACF if available. Ciphers that are not supported by CPACF are implemented using ICSF if available, or otherwise using LibreSSL. 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. If FIPSMODE is not set to "yes" (the default), then `CiphersSource=CPACF` (the default) will generally result in the lowest CPU usage by OpenSSH. Ciphers supported by CPACF: "aes128-cbc", "aes192-cbc", "aes256-cbc", "aes128-ctr", "aes192-ctr", "aes256-ctr", "3des-cbc".

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 81. 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 quotation marks, when it appears in a configuration file, but these double quotation marks are optional if the option is specified on the **sshd** command line.

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 double quotation marks 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 standards, the RSA/DSA key size must be 2048 or greater. OpenSSH limits key sizes to 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. Typically, RSA 2048 bits are considered sufficient. As DSA 2048 is not supported by open group OpenSSH, z/OS OpenSSH may not communicate with open group OpenSSH if DSA 2048 key is used. It requires both client and server to be z/OS OpenSSH and running in FIPS mode, if DSA 2048 is used.

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 LibreSSL 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 LibreSSL. If ICSF is not available, all Key Exchange algorithms are implemented using LibreSSL. 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.

Notes:

- This keyword will not be supported in a Match block.
- Specifying ICSF for Kex algorithms does not force source=ICSF or MAC algorithms that are used as part of Key Exchange

MACsSource

Specifies the source used to implement the MAC algorithms specified by the sshd_config keyword MACs. Valid arguments are "any", "CPACF", "OpenSSL" or "ICSF". The default is "CPACF". Specifying "OpenSSL" requests all MAC algorithms to be implemented using the statically linked LibreSSL cryptographic library. Specifying "CPACF" requests that supported MAC algorithms be implemented using z/Architecture CPACF instructions, or otherwise by LibreSSL. 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 CPACF if available. MAC algorithms that are not supported by CPACF are implemented using ICSF if available, or otherwise using LibreSSL. 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. If FIPSMODE is not set to "yes" (the default), then MACsSource=CPACF (the default) will generally result in the lowest CPU usage by OpenSSH. MAC algorithms supported by CPACF: "hmac-sha1", , "hmac-sha2-256", "hmac-sha2-512" as well as the encrypt-then-mac variants of these: "hmac-sha1-etm@openssh.com", , "hmac-sha2-256-etm@openssh.com", "hmac-sha2-512-etm@openssh.com"

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 164.

Only the ServerSMF keyword can be used on the line following a Match keyword.

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.

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 172 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 192 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 14. OpenSSH files Quick Reference

Configuration files

Table 21 on page 199 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 on page 199 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)

Administrator-generated user files

Table 23 on page 199 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_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_ed25519_key	ssh-keygen	Host private ED25519 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_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_ed25519_key.pub	ssh-keygen	Host public ED25519 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 on page 200 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

Table 24. User-generated files (including permissions) (continued)

File	Produced by	Description	Permissions	Owner
~/.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
~/.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/id_dsa	ssh-keygen	User private DSA key file	600	User
~/.ssh/id_rsa	ssh-keygen	User private RSA key file	600	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
~/.ssh/id_ecdsa	ssh-keygen	User private ECDSA key file	600	User
~/.ssh/id_ecdsa.pub	ssh-keygen	User public ECDSA key	644	User
~/.ssh/id_ed25519	ssh-keygen	User private ED25519 key file	600	User
~/.ssh/id_ed25519.pub	ssh-keygen	User public ED25519 key	644	User

Chapter 15. 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 on page 203. For a list of record subtypes that OpenSSH supports, see "SMF 119 record subtypes for OpenSSH" on page 203.

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 on page 204 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 Configuration 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 on page 204 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

Table 27. Common TCP/IP identification section for OpenSSH (continued)

Offset	Name	Length	Format	Description
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 on page 205 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'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'0015'** (chacha20-poly1305@openssh.com)

Table 28. Common security section (continued)

Offset	Name	Length	Format	Description
74(x'4A')	SMF_119SSH_Cipher	2	Binary	Cipher type being used: Possible values when protocol version 2 (continued): **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'100E'** (aes128-ctr (ICSF)) **x'100F'** (aes192-ctr (ICSF)) **x'1010'** (aes256-ctr (ICSF)) **x'4005'** (3des-cbc (CPACF)) **x'400B'** (aes128-cbc (CPACF)) **x'400C'** (aes192-cbc (CPACF)) **x'400D'** (aes256-cbc (CPACF)) **x'400E'** (aes128-ctr (CPACF)) **x'400F'** (aes192-ctr (CPACF)) **x'4010'** (aes256-ctr (CPACF)) **x'4011'** (rijndael-cbc@lysator.liu.se (CPACF)) 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 (ICSF)) **x'2003'** (hmac-sha1-etm@openssh.com (ICSF)) **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)

Table 28. Common security section (continued)

Offset	Name	Length	Format	Description
76(x'4C')	SMF_119SSH_MAC	2	Binary	MAC algorithm being used (continued): **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) **x'4003'** hmac-sha1 (CPACF) **x'4006'** hmac-sha1-96 (CPACF) **x'4009'** hhmac-sha2-256 (CPACF) **x'400A'** hmac-sha2-512 (CPACF) **x'6003'** hmac-sha1-etm@openssh.com (CPACF) **x'6006'** hmac-sha1-96-etm@openssh.com (CPACF) **x'6009'** hmac-sha2-256-etm@openssh.com (CPACF) **x'600A'** hmac-sha2-512-etm@openssh.com (CPACF) 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	(None)
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'000C'** (diffie-hellman-group14-sha256) **x'000D'** (diffie-hellman-group16-sha512) **x'000E** (diffie-hellman-group18-sha512) **x'000F** (curve25519-sha256) **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.

Common login / failure section (subtype 94, 95, 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 and 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 204 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 205 for the contents of the security section.

Table 29 on page 211 shows the login failure section of this SMF record.

Table 29. Login and failure section (subtype 94, 95, 98)

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
44(x'2C')	SMF_119SSH_LFReason	2	Binary	Login failure reason (used in subtype 98 only): **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 **x'000E'** Public key length invalid in FIPS mode
46(x'2E')	Reserved	2	Binary	Reserved

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 30. 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')

Offset	Name	Length	Format	Description
Self-defining section	**Self-defining section**	**Self-defining section**	**Self-defining section**	**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
44(x'2C')	SMF_119SSH_S2Off	4	Binary	Offset to login and failure section
48(x'30')	SMF_119SSH_S2Len	2	Binary	Length of login and failure section
50(x'32')	SMF_119SSH_S2Num	2	Binary	Number of login and failure sections

Table 30. Client connection started record self-defining section (continued)

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 31. 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	**Self-defining section**	**Self-defining section**	**Self-defining section**	**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
44(x'2C')	SMF_119SSH_S2Off	4	Binary	Offset to login and failure section
48(x'30')	SMF_119SSH_S2Len	2	Binary	Length of login and failure section
50(x'32')	SMF_119SSH_S2Num	2	Binary	Number of login and failure sections

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 204 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 205 for the contents of the security section.

Table 32 on page 213 shows the server transfer completion record self-defining section.

Table 32. 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	**Self-defining section**	**Self-defining section**	**Self-defining section**	**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 33 on page 214 shows the server transfer completion specific section of this SMF record.

Table 33. 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
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

Table 33. Server transfer completion record specific section (continued)

Offset	Name	Length	Format	Description
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 34 on page 215 shows the host name section for the server transfer completion record.

Table 34. Server transfer completion record section: Host name

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FSHostname	*n*	EBCDIC	Host name

Table 35 on page 215 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 35. 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 36 on page 216 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.

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.

Table 36. Server transfer completion record section: Second associated 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 204 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 205 for the contents of the security section.

Table 37 on page 216 shows the client transfer completion record self-defining section.

Table 37. 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	**Self-defining section**	**Self-defining section**	**Self-defining section**	**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
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

Table 37. Client transfer completion record self-defining section (continued)

Offset	Name	Length	Format	Description
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 38 on page 217 shows the client transfer completion specific record of this SMF record.

Table 38. 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
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

Table 38. Client transfer completion record specific section (continued)

Offset	Name	Length	Format	Description
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 39 on page 218 shows the client transfer completion host name section.

Table 39. Client transfer completion host name section

Offset	Name	Length	Format	Description
0(x'0')	SMF_119SSH_FCHostname	*n*	EBCDIC	Client host name

Table 40 on page 218 shows the client transfer completion user name section.

Table 40. 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 41 on page 218 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 41. 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 42 on page 218 shows the client transfer completion target path name section. This section represents the target (remote) path name associated with the sftp subcommand.

Table 42. 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.

Server login failure (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 and 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 204 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 205 for the contents of the security section.

Table 43 on page 219 shows the login failure record self-defining section.

Table 43. 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	**Self-defining section**	**Self-defining section**	**Self-defining section**	**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

Chapter 16. 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.

Disabling SAF checks

Disabling SAF checks can improve performance for random number generation or when using ICSF to source algorithms. Beginning with ICSF FMID HCR77A1, SAF FACILITY Class resources CSF.CSFSERV.AUTH.CSFOWH.DISABLE and CSF.CSFSERV.AUTH.CSFRNG.DISABLE are introduced. If they are defined, no SAF authorization checks will be performed. Defining these may improve performance.

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.

Using CPACF (if available)

Using CPACF has been found to have improved performance and lower CPU usage over ICSF and LibreSSL.

z/OS OpenSSH will utilize CPACF when the hardware is available if the client, or server, or both, keywords `CiphersSource` and `MACsSource` are defined to "any" or "CPACF". When set to "any", CPACF will be tried first, followed by ICSF, and finally LibreSSL software. These keywords are defined in the zos_ssh_config and zos_sshd_config files for the client and server, respectively.

To verify, the client or server can be run in debug mode and it will indicate where the algorithms are being sourced. For example, an **`ssh -vvv`** trace would show something similar to the following:

```
...
debug1: mac_setup_by_alg: hmac-sha1 from source CPACF, used in non-FIPS mode
...
debug1: cipher_init: aes128-ctr from source CPACF, used in non-FIPS mode
...
```

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. See "Using hardware support to generate random numbers" on page 48 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 8, "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 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, 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.

11. **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.

12. **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, "~~".

13. **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
```

14. **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.

15. **Question:** When running sftp , 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.

16. **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.

    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.

17. **Question:** When I use ssh with the -s option to utilize a subsystem, my session hangs while logging on.

    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.

18. **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.

19. **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.)

20. **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 FOTS1373 Permission denied (publickey,password,keyboard-interactive). 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.

21. **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.

22. **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.

23. **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. 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).

24. **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.

25. **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 12, "OpenSSH command descriptions," on page 91.

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.
   a. Create directory /tmp/syslogd.

   ```
   mkdir /tmp/syslogd
   ```

   b. 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.

   c. Set the permission bits.

   ```
   chmod 644 /etc/syslog.conf
   ```

   d. 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 /etc/syslog.pid)
   ```

Results

When you are done, you have set up syslogd.

Chapter 17. 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 *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.

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 *z/OS OpenSSH User's Guide* for a list of options.

FOTS0105 key_to_blob failed: *error*

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: *error*

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_sshkey_write failed: *error*

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 *z/OS OpenSSH User's Guide* for the options description.

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 key *filename* failed: *error***

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 keys stored in the new format (-o).**

Explanation

Comments are only supported for keys stored in the new format (-o).

System action

Command ends.

User response

Check *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: *filename*

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0120 sshkey_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.

FOTS0123 Too many arguments.

Explanation

You specified arguments that are mutually exclusive.

System action

Command ends.

User response

Check *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 *z/OS OpenSSH User's Guide* for a list of options.

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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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*.

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 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 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.

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.

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 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 C/C++ Runtime Library Reference* for an explanation of the system error. 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 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 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 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.

FOTS0163 **Invalid DSA key length: 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 **unget: *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 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.

FOTS0170 **Invalid number: *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 *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 *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 *z/OS OpenSSH User's Guide* for valid **ssh-keygen** bits values, and try the request again.

FOTS0173 **Desired generator invalid: *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 *z/OS OpenSSH User's Guide* for valid **ssh-keygen** generator values, and try the request again.

FOTS0174 Invalid RSA key length: minimum is *bits* bits

Explanation

The **ssh-keygen** key length the key type must be at least the specified minimum 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 LibreSSL 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 LibreSSL 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 LibreSSL 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 LibreSSL 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 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 LibreSSL 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*: : unrecognised 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 *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 **Cannot load CA public key *filename*: *error***

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* ": *error***

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: *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 C/C++ Runtime Library Reference*

FOTS0195 **Couldn't certify key *key*: *error***

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 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 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.

FOTS0205 **poll: *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 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.

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 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 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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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.

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.

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.

FOTS0245 *function*: put key/comment: *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0246 *function*: sshkey_sign: *error*

Explanation

A key signature failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the validity of the key and retry.

FOTS0247 *function*: get key: *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0248 *function*: internal error: nentries *num*

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0249 ***function*: decode private key: *key***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0250 ***function*: bad lifetime constraint: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0251 ***function*: Unknown constraint *val***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0252 **bcrypt_pbkdf**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0253 ***function*: socket number *socknum* >= allocated *socks_allocated***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0254 ***function*: read error on socket *sock* (fd *sock_fd*): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0255 ***function*: no socket for fd *fdnum***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0256 ***function*: recallocarray failed**

Explanation

Internal error

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS0261 ***arg*: couldn't parse request: *arg***

Explanation

Internal error

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

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*: *error***

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*: *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 **sshkey_write: *error***

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: *error***

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 *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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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: *error***

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: *error***

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.

FOTS0338 **-*arg* flag already specified**

Explanation

An invalid option was specified on the ssh-add command.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *arg* and try the command again.

FOTS0339 **-P option already specified**

Explanation

An invalid option was specified on the ssh-add command.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the ssh-add command option and try the command again.

FOTS0340 ***function*: sshkey_cert_copy: *error message***

Explanation

An error occurred calling the sshkey_cert_copy function.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Refer to the error message for an explanation.

FOTS0341 **Failed to load certificate \"*cert_path*\": *error_message***

Explanation

An attempt to load a certificate failed in ssh-add.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Refer to the error message for an explanation.

FOTS0342 **Invalid combination of actions**

Explanation

An invalid combination of options specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the actions and try the command again.

FOTS0343 **Invalid hash algorithm \"*hash_algorithm*\"**

Explanation

An invalid argument was specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *hash_algorithm* and try the command again.

FOTS0347 **error fetching identities: *error_message***

Explanation

An error occurred listing the identities.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

If unable to resolve, contact your system programmer to report the problem.

FOTS0348 **Error connecting to agent: *error_message***

Explanation

An error occurred connecting to your authentication agent. Refer to *error_message* for more information.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

If unable to resolve, contact your system programmer to report the problem.

FOTS0349 Error loading key \"*path*\": *error_message*

Explanation

An error occurred loading a key file. Refer to the error message for additional information.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

If unable to resolve, 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.

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 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 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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your 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.

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 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 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 *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 *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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0723 Invalid timeout

Explanation

The timeout provided is not valid. It must be an octal number between 0 and INT_MAX.

System action

The program ends.

System programmer response

Follow the local procedures for reporting problems to IBM.

User response

Refer to *z/OS 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 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 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 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 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 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.

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 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 above.

System action

Command continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact the 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 *z/OS OpenSSH User's Guide* for a valid flag.

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 *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 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 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 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 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 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 initialise 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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.

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 canonicalize: *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.

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 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 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 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 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 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 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 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.

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 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 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 *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 programmer.

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 *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 response.

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.

FOTS0904 ***function*: RSA_blinding_on failed**

Explanation

A call to LibreSSL function RSA_blinding_on() failed.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Check LibreSSL function RSA_blinding_on() for more information.

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.

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.

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.

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.

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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. 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 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 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 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 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 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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS0980 ***function*: 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 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 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.

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 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 *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 *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 *z/OS OpenSSH User's Guide* on how to set environment variable DISPLAY. 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 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.

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.

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.

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.

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.

FOTS1014 ssh_rijndael_cbc: no context

Explanation

Internal error.

System action

The program continues.

$

User response

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.

FOTS1037 parse_prime: BN_new failed

Explanation

A call to LibreSSL 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.

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.

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.

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.

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.

FOTS1111 **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.

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.

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.

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.

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): *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 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 C/C++ Runtime Library Reference* for an explanation of the system error. 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.

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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1186 **Finished discarding for *ip_address* port *port***

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.

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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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 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).

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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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.

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 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 *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 *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 *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 *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 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 *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 *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.

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.

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.

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.

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 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 not 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.

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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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 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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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.

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.

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.

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.

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 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 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 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 sign using hostkey *key fingerprint* 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 the target server because it could not verify the host key.

System action

The program ends.

System programmer response

Verify that the server authentication setup is correct. Refer to "Setting up server authentication" on page 26.

User response

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 ***user@host*: Permission denied (*authlist*).**

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 function: 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 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 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 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.)

FOTS1392 *filename* line *line number*: Missing argument.

Explanation

While parsing the configuration file *filename*, ssh expected an 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*: unsupported option *option*.

Explanation

While parsing the configuration file *filename*, ssh expected an argument but instead encountered an unsupported option.

System action

The program ends.

System programmer response

Check the specified line number in the file for unsupported options.

User response

Check the specified line number in the file for unsupported options. 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

Check the specified line number in the file for syntax errors. Contact your system administrator if the configuration file is global.

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.

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.

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.

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.

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 ***function*: 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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.

$

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.

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 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 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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, follow local procedures for reporting problems to IBM.

FOTS1450 **Timeout before authentication for *remote_ip* port *port***

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 *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 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 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 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 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 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.

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 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.

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.

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 *z/OS OpenSSH User's Guide* for more information on sshd -g.

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 *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.

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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS1504 ***function*: 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 ***function*: 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.

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 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 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 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 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 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.

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 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**.

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**.

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**.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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 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 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 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.

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 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 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 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 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 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 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.

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 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 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 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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact

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.

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.

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 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 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.

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*: sshkey_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.

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: *err_msg***

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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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.

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.

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: *error_message***

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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 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.

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 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: received *received_version*, expected *expected_version*

Explanation

SSH version is not correct.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

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.

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 for key *key type fingerprint*

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 *function*: sshkey_sign failed: *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.

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 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 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 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 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 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 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.

FOTS1794 **filename does not match request**

Explanation

The received filename does not match the requested.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Verify that remote host is trusted.

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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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 *num* to read from PRNG**

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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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.

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.

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.

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.

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.

FOTS1923 ***function*: 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.

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.

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.

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.

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 *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.

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 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 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 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

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.

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 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 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 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 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 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 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 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.

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.

function*: read: bad msg_len *msg_len

FOTS2058

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.

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_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.

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.

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 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.

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 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 ***function*: 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.

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 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.

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.

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.

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 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.

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.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

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 ***function*: 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 ***function*: 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 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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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* port *port***

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* port *port***

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* port *port***

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* port *remote_port* 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* port *remote_port* 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 *remote_ip* port *remote_port*: *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 *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.

FOTS2165 **ROOT LOGIN REFUSED FROM *ipaddr* port *port***

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 **Invalid user *username* from *ipaddr* port *port***

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.

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.

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.

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.

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.

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 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 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.

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 pty. The system error is displayed with this message.

System action

The program continues.

System programmer response

Refer to *z/OS 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 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 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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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.

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 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.

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 *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 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 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 *z/OS OpenSSH User's Guide* for more information on the ssh_config XAuthLocation keyword.

FOTS2214 **Timeout, server *server* not responding.**

Explanation

The **ssh** session 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 *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 *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 *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 (*path* >= *num* bytes)**

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 *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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2221 **Bad forwarding close specification.**

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 *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 *z/OS OpenSSH User's Guide* for more information on the **ssh** command line options.

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.

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 *z/OS OpenSSH User's Guide* for more information on the ssh_config XAuthLocation keyword.

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 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.

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 client**

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 C/C++ Runtime Library Reference* for an explanation of the system error. 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 *z/OS OpenSSH User's Guide* for more information on the ssh_config Tunnel 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 *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 *z/OS OpenSSH User's Guide* for more information on the ssh_config RekeyLimit 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 *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 *z/OS OpenSSH User's Guide* for more information on the ssh_config SendEnv 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 *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 *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 *z/OS OpenSSH User's Guide* for more information on the ssh_config TunnelDevice keyword. If unable to resolve, contact your system 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 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 *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 *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 *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 *z/OS OpenSSH User's Guide* for more information on the **ssh** command line options.

FOTS2263 Execute local command

Explanation

Help was requested for the **ssh** command line options.

System action

The program continues.

User response

Refer to *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 *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 *z/OS OpenSSH User's Guide* for more information on the **ssh** -t option.

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 *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 *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 *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 *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: *error_message***

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 *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 *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 *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 *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 *z/OS OpenSSH User's Guide* for more information on the keyword. If unable to resolve, 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.

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 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 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 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 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 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 *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 *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 *z/OS OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword and to *z/OS 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 *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 *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 *z/OS OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. Refer to *z/OS 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 *z/OS OpenSSH User's Guide* for more information about the sshd_config ChrootDirectory keyword. Refer to *z/OS 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 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 *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.

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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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.

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 *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 *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 *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 *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* by user *user* 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 *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.

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.

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 *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 **Unable to parse certificate options: "*option_name*"**

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 **Unable to parse "*name*" section: "*error*"**

Explanation

Unable to parse certificate option.

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 source-address 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 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS2404 **SSH protocol v.1 is no longer supported**

Explanation

SSH protocol 1 is not longer supported.

System action

The program ends.

User response

Correct the program and try again.

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.

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 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 canonicalize 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 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 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 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.

FOTS2524 **Too many matches for \"*filename*\".**

Explanation

The filename matched to many source files.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Narrow the set of matching files and try the command again.

FOTS2525 **Can't ls: Too many matches for \"*path*\"**

Explanation

The path matched too many files.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Narrow the set of matching files and try the command again.

FOTS2526 ***function*: couldn't decode attrib: *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2527 ***function*: nonsensical number of entries**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2528 **Couldn't sync file: *error_message***

Explanation

The server failed to synchronize the file. See the error message for more information.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2529 **\"*arg*\" has negative size**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2530 **ftruncate \"*arg*\": *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2531 **Couldn't sync file \"*filename*\": *error_message***

Explanation

the fsync system call failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2532 **destination file bigger or same size as source file**

Explanation

An error occurred attempting to resume a file transfer.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2533 **\"*path*\" exists but is not a directory**

Explanation

path is a file. Cannot make a directory.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try again.

FOTS2534 **Unknown extended request \"*operation*\"**

Explanation

An unsupported operation was received.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2535 **Received extended request before init**

Explanation

Received an invalid request.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2536 **Received *request* request before init**

Explanation

Received an invalid request.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2537 **Invalid query type**

Explanation

An invalid value was specified for the -Q option.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try again.

FOTS2538 **Permitted requests already set**

Explanation

Allowlisted requests already specified.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try again.

FOTS2539 **Refused requests already set**

Explanation

Blocklisted requests already specified.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try again.

FOTS2540 ***function*: sshbuf_check_reserve failed: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2541 ***function*: sshbuf_check_reserve: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2548 **Multiple paths match, 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.

FOTS2549 **Ensure the remote shell produces no output for non-interactive sessions.**

Explanation

The remote shell cannot write to stdout when running an SFTP session.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Confirm that the remote shell does not produce output during initialization for non-interactive sessions then retry

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 *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 *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 *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 *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 *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 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 *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 *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 *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 controller process. (*error_message*)**

Explanation

The controller 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 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 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 *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. 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 *z/OS OpenSSH User's Guide* for information on setting up OpenSSH to collect OpenSSH client connection 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 *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.

FOTS2819 **zERT SIOCSECATTR failed: *system error***

Explanation

A failure occurred due to an error in the ioctl() system call used to record zERT information for this connection. The system error is displayed with the message.

System action

The program continues.

System programmer response

Refer to *z/OS C/C++ Runtime Library Reference* for an explanation of system error. If unable to resolve, follow local procedures for reporting problems to IBM.

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 *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 *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 *z/OS OpenSSH User's Guide* for information on the correct format when specifying a key ring and certificate label.

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 *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 *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.

FOTS2921 ***function*: error: gsk_copy_public_key_info(): (*status*) *error_message***

Explanation

An error occurred in a systems SSL function.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2922 ***function*: error: gsk_copy_private_key_info(): (*status*) *error_message***

Explanation

An error occurred in a systems SSL function.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2923 ***function*: Public key not available; key ring '*key_ring*' with label '*label*' is not a certificate**

Explanation

The specified key ring is not valid.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Specify a valid key ring and try the request again.

FOTS2924 **Can not use KeyRing \"*key_ring label*\" DSA key (*L*, *N*) in non-FIPS mode**

Explanation

FIPS mode is required.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2925 ***arg*: gsk_factor_public_key failed (*arg*). *arg*.**

Explanation

Internal error

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2926 ***arg*: gsk_get_ec_parameters_info failed (*arg*). *arg*.**

Explanation

Internal error

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2927 ***arg*: ECDSA key ring key with curve id (*arg*) is not supported**

Explanation

This is not a supported key

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Choose a supported key and retry.

FOTS2928 ***arg*: failed to validate public ECDSA key**

Explanation

The key is was not validated

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Ensure that the key is not corrupted and retry. If unable to resolve, contact your system programmer.

FOTS2929 ***arg*: gsk_factor_private_key failed (*arg*). *arg*.**

Explanation

Internal error

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS2930 ***arg*: failed to validate private ECDSA key**

Explanation

The key is was not validated

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Ensure that the key is not corrupted and retry. If unable to resolve, contact your system programmer.

FOTS2931 ***arg*: key type *arg* ecdsa_nid *arg* is not supported in FIPS mode**

Explanation

The key type is not supported while running in FIPS mode. If the key type is for an ecdsa key, then the specific ecdsa nid type is given.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Retry with a supported key type. If unable to resolve, contact your system programmer.

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 *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 *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 *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 CPACF/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 CPACF if available or otherwise OpenSSL. The problem occurred in *function*.

System action

The program continues.

System programmer response

See *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 *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* or cannot be used to support it in FIPS mode**

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 *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_id*, 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 *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 *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 are implemented using LibreSSL. 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 *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 *line_number*.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3014 ***function*: missing or invalid context**

Explanation

An unexpected error occurred while using a CPACF function. The required context structure was not available or was incorrect. The problem 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 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 specified and retry.

FOTS3104 addr_match_cidr_list: empty entry in list *network_list*

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 specified 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 specified 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 specified 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 specified 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 authenticate 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.

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.

FOTS3128 ***function*: *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.

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.

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.

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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3199 ***function*: *OpenSSL function* 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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve,follow local procedures for reporting problems to IBM.

FOTS3213 ***filename* line *line_number* : AuthorizedPrincipalsCommand must be an absolute path**

Explanation

The program must be specified with an absolute path.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the *path* and try the command again.

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 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 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.

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 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 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 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 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 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 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 usable 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.

FOTS3240 ***function*: getcwd: *system error***

Explanation

Internal error.

System action

The program ends.

System programmer response

Refer to *z/OS 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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 *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 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: *err_msg***

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.

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 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 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 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 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 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 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 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 *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.

FOTS3280 ***function*: copy key: *err***

Explanation

A failure occurred while attempting to demote a public key once it has been used for authentication.

System action

The program ends.

System programmer response

If unable to resolve, 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.

FOTS3281 ***function*: append method: *arg***

Explanation

Internal Error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3282 ***function*: append key: *arg***

Explanation

Internal Error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3283 ***function*: auth_method_info contains \**

Explanation

An invalid newline was encountered in auth_method info

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the auth_method and try the command again.

FOTS3284 ***function*: append method info: *arg***

Explanation

Internal Error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3285 ***function*: unsupported public key algorithm: *algorithm***

Explanation

The requested public key algorithm is not supported by this version of OpenSSH.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a supported public key algorithm and retry.

FOTS3286 **Refusing RSA key because peer uses unsafe signature format**

Explanation

RSA key authentication has been refused because the remote system is using an unsafe signature format.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a supported authentication method and retry.

FOTS3287 ***function*: key type *key_type* not in HostbasedAcceptedKeyTypes**

Explanation

The selected key_type is not in the list of allowed HostbasedAcceptedKeyTypes.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Either add key_type to the HostbasedAcceptedKeyTypes list in sshd_config or specify a key_type already on the list and retry.

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.

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.

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 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.

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 *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 *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 *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 terminals.

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 *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 *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 *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 *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 *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 *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 *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 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 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.

FOTS3340 **DISPLAY "*display*" invalid; disabling X11 forwarding**

Explanation

Client X11 display forwarding was requested, but the format of the DISPLAY environment variable was not valid.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the DISPLAY environment variable and retry.

FOTS3341 ***function*: display name too long**

Explanation

The specified DISPLAY environment variable value is too long.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Check that the value of DISPLAY environment variable is valid and try again.

FOTS3342 ***function*: mkdtemp: *error message***

Explanation

The mkdir() system call failed. 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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3343 ***function*: xauthfile path too long**

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.

FOTS3344 ***function*: cmd 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.

FOTS3345 ***filename* line *line_number* : '*attribute*' cannot be combined with other Match attributes**

Explanation

A ssh_config keyword in file *filename* at line *line_number* is incorrect.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Verify the attribute and correct the configuration.

FOTS3346 ***filename* line *line_number* : Bad Match condition**

Explanation

Match block syntax is incorrect in the in file *filename* at line *line_number*.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Verify the match block syntax and correct the configuration.

FOTS3347 **One or more attributes required for Match**

Explanation

One or more attributes are required for the Match block.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Specify at least one attribute.

FOTS3348 ***filename* line *line_number*: bad include path *path*.**

Explanation

The include path specified is not valid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *path* and try the configuration again.

FOTS3349 *filename* line *line_number* : glob failed for *path*.

Explanation

The include path specified is not valid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *path* and try the configuration again.

FOTS3350 *filename* line *line_number* : match exec '*command*' error

Explanation

An error occurred executing *command*.

System action

The program ends.

User response

Correct the *command* and try the configuration again.

FOTS3351 *filename* line *line_number* : Bad mask.

Explanation

An invalid value specified for StreamLocalBindMask.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the mask value and try the configuration again.

FOTS3352 *filename* line *line_number*: Missing StreamLocalBindMask argument.

Explanation

The StreamLocalBindMask argument is required.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Specify the argument and try the configuration again.

FOTS3353 *filename* line *line_number*: Invalid ProxyJump \"*host*\"

Explanation

An invalid jump host specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *host* and try the configuration again.

FOTS3354 *filename* line *line_number*: Too many certificate files specified (max *max_files*).

Explanation

Too many certificate files have been specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the number of files and try the configuration again.

FOTS3355 *filename* line *line_number* : empty hostname suffix

Explanation

The hostname suffix has not been specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *hostname* and try the configuration again.

FOTS3356 ***filename* line *line_number*: hostname suffix \"*suffix*\" contains consecutive separators**

Explanation

The hostname suffix is invalid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *suffix* and try the configuration again.

FOTS3357 ***filename* line *line_number*: hostname suffix \"*arg*\" contains invalid characters**

Explanation

The hostname suffix is invalid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *suffix* and try the configuration again.

FOTS3358 ***filename* line *line_number*: hostname suffix \"*arg*\" starts with invalid character**

Explanation

The hostname suffix is invalid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *suffix* and try the configuration again.

FOTS3359 ***filename* line *line_number*: too many hostname suffixes.**

Explanation

Too many hostname suffixes have been specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the number of *suffixes* and try the configuration again.

FOTS3360 ***filename* line *line_number*: too many permitted CNAMEs.**

Explanation

Too many values specified for CanonicalizePermittedCNAMEs.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *CNAMEs* and try the configuration again.

FOTS3361 ***filename* line *line_number*: Invalid permitted CNAME \"*cname*\"**

Explanation

The specified CNAME is invalid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *cname* and try the configuration again.

FOTS3362 ***function*: kex_assemble_names failed**

Explanation

The kex_assemble_names 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.

FOTS3363 **command '*command*' exited abnormally**

Explanation

The command exited abnormally.

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.

FOTS3364 **Host directive not supported as a command-line option**

Explanation

Host directive not supported as a command-line option.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Remove the *Host* directive and try the command again.

FOTS3365 **Identity file path *path* too long**

Explanation

The specified path name is too long.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *path* and try the configuration again.

FOTS3366 **Include directive not supported as a command-line option**

Explanation

Include directive not supported as a command-line option.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Remove the *Include* and try the command again.

FOTS3367 **Too many recursive configuration includes**

Explanation

Too many recursive includes found processing the configuration file.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *includes* and try the configuration again.

FOTS3368 ***filename* line *line_number*: Invalid hash algorithm \"*arg*\".**

Explanation

An invalid algorithm for FingerprintHash specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *algorithm* and try the configuration again.

FOTS3369 **Too many certificate files specified (max *max_files*)**

Explanation

Too many certificate files have been specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Reduce the number of certificate files and try the configuration again.

FOTS3370 **Unable to execute '*command*': *error_message***

Explanation

The command failed. See the *error_message* for an explanation.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the *command* and try the configuration again.

FOTS3371 **Invalid DenyUsers pattern \"*pattern*\"**

Explanation

The pattern is invalid.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the *pattern* and try the configuration again.

FOTS3372 **Invalid AllowUsers pattern \"*pattern*\"**

Explanation

The pattern is invalid.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the *pattern* and try the configuration again.

FOTS3373 **maximum authentication attempts exceeded for *user* from *reomte_ip* port *reomte_ip* ssh2**

Explanation

The user has exceeded the maximum number of permitted login attempts.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3374 ***function*: fingerprint key: *error_message***

Explanation

A failure occurred making a fingerprint from a key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3375 **Authentication key *key_type fingerprint* revoked by file *filename***

Explanation

The key has been revoked.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3376 **Error checking authentication key *key_type fingerprint* in revoked keys file *filename*: *error_message***

Explanation

An error occurred validating a key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3377 **reverse mapping checking getaddrinfo for *name* [*ip_address*] failed.**

Explanation

The reverse mapping check for hostname failed. Using the ip address.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3378 **Address *ip_address* maps to *name*, but this does not map back to the address.**

Explanation

Address not found in the reverse map check on the hostname. Using the ip address.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3379 ***function*: sshbuf_fromb failed**

Explanation

Failure reading from internal buffer.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3380 **Certificate has multiple force-command options**

Explanation

The certificate has multiple force-command options.

System action

Authentication fails for this certificate; the program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Verify that the certificate file has not been corrupted.

FOTS3381 ***function*: sshbuf_dup_string failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3382 ***function*: method not in AuthenticationMethods**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3383 ***function*: failed: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3384 ***function*: sshpkt_get_u8 failed: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3385 ***function*: sshpkt_get_cstring failed: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3386 ***arg*: could not parse key: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3387 **Refusing RSA key because client uses unsafe signature scheme**

Explanation

RSA key authentication has been refused because the remote system is using an unsafe signature scheme.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a supported authentication method and retry.

FOTS3388 **refusing previously-used *key_type* key**

Explanation

The key was refused because it has already been used.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a another authentication method and retry.

FOTS3389 ***function*: key type *key_name* not in PubkeyAcceptedKeyTypes**

Explanation

The type of the named key is not in the accepted list for public key authentication.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a another authentication method or update the PubkeyAcceptedKeyTypes configuration and retry.

FOTS3390 ***function*: sshbuf_put session id: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3391 ***function*: sshbuf_put_string session id: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3392 ***function*: build packet failed: *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3393 **No user for AuthorizedPrincipalsCommand specified, skipping**

Explanation

The AuthorizedPrincipalsCommandUser property is not set.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the AuthorizedPrincipalsCommandUser property and try again.

FOTS3394 **AuthorizedPrincipalsCommandUser \"*user*\" not found: *arg***

Explanation

The user specified on the AuthorizedPrincipalsCommandUser is not found.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Specify a valid user for the AuthorizedPrincipalsCommandUser property and try the configuration again.

FOTS3395 **AuthorizedPrincipalsCommand \"*command*\" contains invalid quotes**

Explanation

The command contains invalid quotes.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try the configuration again.

FOTS3396 **AuthorizedPrincipalsCommand \"*command*\" yielded no arguments**

Explanation

The command did not have arguments.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try the configuration again.

FOTS3397 ***function*: sshkey_fingerprint failed**

Explanation

A failure occurred creating a fingerprint from a key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS3398 ***arg*: sshkey_to_base64 failed: *arg***

Explanation

Internal error.

System action

The program ends.

User response

Contact your system programmer to report the problem.

FOTS3399 ***arg*: percent_expand failed**

Explanation

An error occurred parsing command arguments.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the *command* and try the configuration again.

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.

FOTS3416 *key_file*:*line_number* 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 *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 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 *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 *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.

FOTS3425 key bits exceeds maximum *num*

Explanation

The key size in bits exceeds the maximum allowed for the selected key type.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Update the size and retry.

FOTS3426 Load key \"*keyfile*\": *error*

Explanation

The key contained in keyfile could not be loaded.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Confirm that the file contains a valid key and retry.

FOTS3427 PEM_write_DSAPublicKey failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3428 ***function*: sshbuf_from failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3429 **sshkey_new_private failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3430 **generate RSA parameters failed: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3431 **sshkey_new failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3432 ***path* is not a key file.**

Explanation

The file pointed to by path does not contain a key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the path and retry.

FOTS3433 **Could not save your public key in *prvtmp*: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3434 **sshkey_generate failed: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3435 **sshkey_from_private failed: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3436 **write key failed: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3437 **key close failed: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3438 **Unable to move *file* into position: *error***

Explanation

The public key file could not be written.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the file permissions and retry.

FOTS3439 ***path*:*line*: ignoring host name with wildcard: *hostpattern***

Explanation

Ignoring already hashed host

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

No action required.

FOTS3440 *file*:*line*: invalid line

Explanation

The file has an invalid host entry.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the entry and retry.

FOTS3441 *file* is not a valid known_hosts file.

Explanation

The file is not a valid known_host file.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the file and retry.

FOTS3442 Not replacing existing known_hosts file because of errors

Explanation

Errors occurred processing entries for the known_hosts file, so it will not be updated.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the prior errors and retry.

FOTS3443 Host *hostname* not found in *identityfile*

Explanation

A delete host request failed because it was not found in the file.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the request and retry.

FOTS3444 Failed to load key *keyfile*: *error*

Explanation

An error occurred attempting to load the private key from keyfile.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the file and retry.

FOTS3445 Failed to read v2 public key from \"*keyfile*\": *error*.

Explanation

Could not load the key from keyfile

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the file and retry.

FOTS3446 Cannot load private key \"*keyfile*\": *error*.

Explanation

A private key could not be loaded from keyfile.

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 keyfile contains a valid private key and is readable and retry.

FOTS3447 Cannot use public key for CA signature: *error*

Explanation

Unable to access the authentication socket.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3448 Retrieve agent key list: *err*

Explanation

Unable to retrieve keys from the agent.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3449 CA key *keyname* not found in agent

Explanation

The CA key was not found in the agent

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Confirm that the agent has the CA key and retry.

FOTS3450 CA key type *catype* doesn't match specified *keytype*

Explanation

Key type mismatch.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Confirm the CA keytype and retry.

FOTS3451 sshkey_from_private (ca key): *error*

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3452 **Couldn't certify key *key* via agent: *error***

Explanation

An error occurred certifying the key via the agent.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Confirm that the agent contains the key and retry.

FOTS3453 **sshbuf_new failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3454 **sshkey_from_private failed: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3455 **Unable to save public key to *keyfile*: *error***

Explanation

An error occurred attempting to write the keyfile

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the filesystem space and permissions and retry.

FOTS3456 **Invalid start point.**

Explanation

An error invalid cvalue was specified.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command value and try again.

FOTS3457 **Too many certificate principals specified**

Explanation

A certificate contains too many principles.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

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.

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.

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.

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.

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3526 **Unable to load KRL: *error***

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: *error***

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 C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS3529 **revoking certificates 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 **revoking certificates by key ID 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.

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 **sshkey_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: *****error***

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: *****error***

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 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*****: *****error***

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 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*: *error*

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.

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.

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 *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 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 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 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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 *z/OS OpenSSH User's Guide* for more information on using the ControlPath and ControlMaster options. 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.

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.

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.

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.

Refer to *z/OS 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.

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.

FOTS3753 ***function*: allocation 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.

FOTS3754 ***function*: sshbuf_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.

FOTS3755 ***function*: invalid list *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.

FOTS3756 ***function*: overflow**

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.

FOTS3757 ***function*: channel *channel*: *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.

FOTS3758 ***function*: sshbuf_putf: *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.

FOTS3759 ***function*: sshbuf_dup_string**

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.

FOTS3760 ***function*: channel *channel*: open: *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.

FOTS3761 ***function*: channel *channel*: no remote 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.

FOTS3762 ***function*: channel *channel*: consume: *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.

FOTS3763 ***function*: channel *channel*: append reply: *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.

FOTS3764 ***function*: channel *channel*: rdynamic: *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.

FOTS3765 ***function*: channel *channel*: reply *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.

FOTS3766 ***function*: channel *channel*: confirm: *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.

FOTS3767 ***function*: channel *channel*: failure: *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.

FOTS3768 ***function*: channel *channel*: put datagram: *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.

FOTS3769 ***function*: channel *channel*: put data: *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.

FOTS3770 ***function*: channel *channel*: ignore: *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.

FOTS3771 ***function*: channel *channel*: append: *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.

FOTS3772 ***function*: channel *channel*: get datagram: *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.

FOTS3773 ***function*: channel *channel*: datagram: *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.

FOTS3774 ***function*: channel *channel*: data: *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.

FOTS3775 ***function*: channel *channel*: consume: *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.

FOTS3776 ***function*: channel *channel*: get data: *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.

FOTS3777 ***function*: channel *channel*: append datagram: *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.

FOTS3778 ***function*: channel *channel*: append data: *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.

FOTS3779 ***function*: channel *channel*: adjust *adjust* overflows remote window *remote window***

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.

FOTS3780 ***function*: request streamlocal: *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.

FOTS3781 ***function*: request tcpip-forward: *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.

FOTS3782 ***function*: send cancel: *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.

FOTS3783 ***function*****: channel *****channel*****: send window-change: *****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.

FOTS3784 ***function*****: channel *****channel*****: send x11-req: *****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.

FOTS3785 ***function*****: *****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.

FOTS3786 **channel *****channel*****: decode socks4: user not nul terminated**

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.

FOTS3787 **channel *****channel*****: decode socks4a: host not nul terminated**

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.

FOTS3788 ***function*****: malformed message: *****error message***

Explanation

A malformed message was read from client.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3789 ***function*: short message**

Explanation

A short message was read from client.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3790 ***function*: parse error *error message***

Explanation

An error occurred parsing a client message.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3791 ***function*: compose error *error message***

Explanation

An error occurred writing a message to the client.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3792 ***function*: unsupported request *error message***

Explanation

An unsupported request was received from the client.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3793 ***function*: tcpip-forward for *host*: bad port *port***

Explanation

A bad forwarding port received.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3794 ***function*: send *error message***

Explanation

An error occurred on send.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3795 ***function*: alloc reply**

Explanation

An error occurred during allocation.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3796 ***function*: no packet**

Explanation

An error occurred receiving a packet.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3797 ***function*: compose for muxclient *error message***

Explanation

An error occurred preparing a message to send.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3798 ***function*: parse id: *error message***

Explanation

An error occurred parsing the channel id from a packet.

System action

The program continues.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3799 ***function*: bad channel id *channel id*: *error message***

Explanation

An error occurred parsing the channel id from a packet.

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 LibreSSL 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.

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 Administration" 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* for further error information.

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.

FOTS3835 **Badly formed OID received**

Explanation

An object of type SSH_GSS_OIDTYPE was expected for GSSAPI user authentication, but the object presented was not valid.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Confirm that the user is defined correctly and retry.

FOTS3836 **GSSAPI MIC check failed**

Explanation

The verification of the cryptographic signature for a GSSAPI message failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check that the credential is valid and not expired and retry.

FOTS3837 ***function*:*line error***

Explanation

The GSSAPI call failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3838 **Bad ASN.1 length layout detected**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3839 **Bad ASN.1 length detected: *length***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3840 **Unable to parse GSS Kerberos AP-REQ: *reason***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3841 **Cannot initialize krb5 context**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3845 **mkstemp(): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3846 **fchmod(): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3847 **krb5_cc_new_unique(): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3848 **krb5_cc_gen_new(): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3849 **ssh_krb5_cc_gen(): unknown error: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3850 **ssh_krb5_cc_gen(): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3851 **krb5_parse_name(): unknown error: *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3852 **krb5_parse_name(): *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3853 **krb5_cc_initialize(): unknown error: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3854 krb5_cc_initialize(): *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3855 gss_krb5_copy_ccache() failed

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3856 krb5_cc_resolve(): unknown error: *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3857 krb5_cc_resolve(): *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3858 krb5_cc_get_principal(): unknown error: *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3859 krb5_cc_get_principal(): *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3860 krb5_cc_unparse_name(): unknown error: *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3861 krb5_cc_unparse_name(): *error*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS3862 gss_krb5_copy_ccache() failed. Sorry

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

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 available. 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.

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 LibreSSL 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.

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.

FOTS4001 ***function*: parse id: *channel id***

Explanation

An error occurred parsing the channel id from a packet.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4002 ***function*: parse data: *error message***

Explanation

An error occurred parsing data from a packet.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4003 ***function*: append: *error message***

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 system programmer.

FOTS4004 ***function*: window/maxpacket: *error message***

Explanation

An invalid open confirmation message was received.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4005 ***function*: reason: *error message***

Explanation

An invalid open failure message message was received.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4006 ***function*: message/lang: *error message***

Explanation

An invalid open failure message was received.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4007 ***function*: adjust: *error message***

Explanation

An invalid window adjust message was received.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4008 **Local connecting path too long: *path***

Explanation

An invalid path was specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the path and retry.

FOTS4009 ***function*: unexpected channel 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.

FOTS4010 **No forward path name.**

Explanation

A forwarding path was not specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the path and retry.

FOTS4011 **Local listening path too long: *path***

Explanation

The forwarding path is invalid.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the path and retry.

FOTS4012 ***function*: no path specified.**

Explanation

The forwarding path was not specified.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the path and retry.

FOTS4013 ***name*: *error message***

Explanation

The name is not valid

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Correct the name value and retry.

FOTS4014 **Couldn't obtain random bytes (error 0x*arg*)**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4015 ***function*: reallocarray failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4016 ***arg*: sshbuf_new**

Explanation

TInternal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4017 ***function*: packet parsing: *err***

Explanation

An Internal Error Occurred.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4018 ***function*: key_from_blob: *err***

Explanation

An Internal Error Occurred.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4019 ***function*: buffer error: *err***

Explanation

An Internal Error Occurred.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4020 ***function*: sshkey_fingerprint fail**

Explanation

A failure occurred making a fingerprint from a key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4021 ***function*: *id*: bad id: channel free**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4022 **Non-public channel *id*, type *type*.**

Explanation

Private channels cannot receive protocol messages.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4023 **channel_send_open: *id*: bad id**

Explanation

Bad channel id.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4024 ***function*: *id*: unknown channel id**

Explanation

Bad channel id.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4025 ***function*: channel *id*: send *error_message***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4026 ***function*: alloc**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4027 ***arg*: parse tcode: *arg***

Explanation

Received an invalid extended data message.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4028 **channel *id*: rcvd too much extended_data *data_len*, win *local_window***

Explanation

Too much extended data received.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

None.

FOTS4029 **channel *id*: open failed: *reason***

Explanation

Channel open failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

None

FOTS4030 **WARNING: Server requests forwarding for unknown path *path***

Explanation

Internal error occurred. The displayed *path* is not permitted for forwarding.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4031 **Received request to connect to host *host* port *port*, but the request was denied.**

Explanation

The connection was administratively prohibited.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

None.

FOTS4032 **Received request to connect to path *arg*, but the request was denied.**

Explanation

The connection was administratively prohibited.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

None.

FOTS4033 **match_filter_list failed**

Explanation

No match found. Refer to debug level 2 messages for more detail.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4034 **No supported ciphers found**

Explanation

No supported ciphers found in the proposed list.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4035 **No supported PK algorithms found**

Explanation

No supported PK algorithms found in the proposed list.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4036 **No supported key exchange algorithms found**

Explanation

No supported key exchange algorithms found in the proposed list.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4037 **moduli:*line_number*: type is not *error_code***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4038 **moduli:*line_number*: invalid moduli tests flag**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4039 **moduli:*line_number*: invalid primality trial count**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4040 **moduli:*line_number*: invalid prime length**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4041 **moduli:*line_number*: truncated**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4042 moduli:*line_number*: could not parse generator value

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4043 moduli:*line_number*: could not parse prime value

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4044 moduli:*line_number*: prime has wrong size: actual *actual* listed *listed*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4045 invalid public DH value: negative

Explanation

Invalid public DH value.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4046 invalid public DH value: <= 1

Explanation

Invalid public DH value.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4047 invalid public DH value: >= p-1

Explanation

Invalid public DH value.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4048 invalid public DH value (*arg*/*arg*)

Explanation

Invalid public DH value.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4049 *function*: packet_get_string_ptr 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.

FOTS4050 *function*: channel *id*: no remote_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.

FOTS4051 *function*: recallocarray failed nold = *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.

FOTS4052 *function*: couldn't parse message: *message*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4053 ***arg*: parse key: *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4054 ***function*: calloc failed**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4055 ***arg*: cannot prepare packet: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4056 ***arg*: sshkey_putb: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4057 ***arg*: sshpkt_put_string: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4058 ***arg*: sshpkt_send: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4059 **moduli:*line_number*: generator is invalid**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4060 **WARNING: could not open *path* (*error_message*), using fixed modulus**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4061 ***function*: sshkey_fingerprint_raw: *err***

Explanation

OpenSSH failed to create a fingerprint for the key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4062 **is_numeric_hostname called with NULL hostname**

Explanation

The hostname specified is NULL.

System action

The program continues, but DNS fingerprint processing is disabled.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4063 **Error calculating key fingerprint.**

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.

FOTS4064 **Could not obtain seed from PRNGd**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4065 ***function*: ssh_hmac failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4066 ***function*: host_hash failed**

Explanation

Internal error

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4067 ***function*: sshkey_write failed: *error_message***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4068 ***function*: mkstemp: *error_message***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4069 ***function*: unlink *path*: *error_message***

Explanation

System error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4070 ***function*: link *path* to *path*: *error_message***

Explanation

System error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4071 ***function*: rename \"*path*\" to \"*path*\": *error_message***

Explanation

System error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4072 ***function*: unlink \"*path*\": *error_message***

Explanation

System Error

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4073 ***fuction*: sshkey_new failed**

Explanation

Internal error. Memory allocation failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4074 ***function*: nul byte in *string***

Explanation

Received message has an invalid format.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4075 ***function*: no kex**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4076 ***function*: requested twice**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to report the problem.

FOTS4077 gss_init_context failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4078 kexgss_client: BN_new failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4079 *function*: kex_derive_keys_bn() failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4080 kexgss_server: BN_new failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4081 kexgss_server: BN_bin2bn failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4082 *function*: giant len *length*

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4083 **Couldn't open logfile *filename*: *error***

Explanation

An error occurred opening the file specified for stderr redirection.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and retry.

FOTS4084 ***function*: invalid format**

Explanation

Unable to expand escape characters. An invalid format 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.

FOTS4085 ***function*: \"*path*\" too long for Unix domain socket**

Explanation

The path specified for a Unix domain socket is too long.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the path and retry.

FOTS4086 **unlink(*path*): *error***

Explanation

The path specified for a Unix domain socket could not be unlinked prior to use.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the permissions of path and retry.

FOTS4087 ***function*: cannot bind to path: *path***

Explanation

A socket could not be bound for the path specified for a Unix domain socket.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error associated with the preceding bind() error message and retry.

FOTS4088 ***function*: cannot listen on path: *path***

Explanation

A listen operation could not be performed on a socket for Unix domain socket associated with path.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error associated with the preceding listen() error message and retry.

FOTS4089 ***function*: sshbuf_put_u8: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4090 ***function*: malloc failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4091 ***function*: inconsistent flags**

Explanation

An attempt to run a subprocess failed due to incorrect stdout disposition.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the flags and retry.

FOTS4092

Explanation

An attempt to run a subprocess failed due to incorrect stdout disposition.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the flags and retry.

FOTS4093 ***tag* path is not absolute**

Explanation

An attempt to run a binary failed due to the path associated with tag not being absolute.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Supply an absolute path for the binary and retry.

FOTS4094 **Could not stat *tag* \"*path*\": *error***

Explanation

Could not verify the path associated with tag when attempting to run a subprocess.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Verify the path and retry.

FOTS4095 **Unsafe *tag* \"*path*\": *error***

Explanation

One or more components of path does not have the proper file ownership.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the ownership and retry.

FOTS4096 ***tag* exec \"*command*\": *error***

Explanation

A request to execute a subprocess failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and retry.

FOTS4097 ***tag command* exited on signal *signal***

Explanation

A subprocess request exited due to a signal.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and retry.

FOTS4101 **AuthorizedKeysCommand \"*command*\" contains invalid quotes**

Explanation

The command contains invalid quotes.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try the configuration again.

FOTS4102 **AuthorizedKeysCommand \"*command*\" yielded no arguments**

Explanation

The command contains no arguments.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try the configuration again.

FOTS4103 ***function*: invalid key ID**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4104 ***function*: bad data length: *length***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4105 ***function*: no hostkey for index *num***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4106 ***function*: couldn't prepare private key proof buffer: *err***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4107 ***function*: bad data length: *dlen*, hostkey proof len *plen***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4108 ***function*: password authentication not enabled**

Explanation

The client requested password authentication but it is not enabled on this server.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer to enable password authentication, or use a supported authentication method.

FOTS4109 ***function*: passed a SSH_BUG_RSASIGMD5 key**

Explanation

The client supplied a key that is not supported.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a supported key and retry.

FOTS4110 ***function*: packet_set_state: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4111 **kex_assemble_names failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4112 ***function*: missing host in PermitOpen**

Explanation

PermitOpen specified without a host.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and try the configuration again.

FOTS4113 ***arg*: bad port number in PermitOpen**

Explanation

PermitOpen specified with a bad port.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and try the configuration again.

FOTS4114 **'all' cannot be combined with other Match attributes**

Explanation

The single token *All* matches all criteria so it cannot be specified with other patterns.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and try the configuration again.

FOTS4115 ***filename* line *line_number*: \"any\" must appear alone in AuthenticationMethods**

Explanation

When the single token *any* is specified, other values are not permitted.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and try the configuration again.

FOTS4116 ***filename* line *line_number*: Missing StreamLocalBindMask argument.**

Explanation

The StreamLocalBindMask argument is required.

System action

The program ends.

System programmer response

Follow local procedures for reporting problems to IBM.

User response

Specify the argument and try the configuration again.

FOTS4117 ***filename* line *line_number*: Bad mask.**

Explanation

The value specified for StreamLocalBindMask is invalid.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the argument and try the command again.

FOTS4118 ***function*: couldn't parse key: *hostkey***

Explanation

Error parsing hostkeys while handling the protocol extension for proving host keys.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4119 ***function*: unknown host *hostkey* key**

Explanation

Unknown hostkey received while handling the protocol extension for proving host keys.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4120 ***function*: get_state failed: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4121 ***function*: invalid forwarding type *fwdtype***

Explanation

An unsupported forwarding type was requested

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a supported forwarding type and retry.

FOTS4122 ***function*: streamlocal and dynamic forwards are mutually exclusive**

Explanation

Non compatible forwarding types were selected

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select compatible forwarding types and retry.

FOTS4123 ***function*: invalid listen port *port***

Explanation

A non stream local port >= 65536 was selected

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a port < 65536 and retry.

FOTS4124 ***function*: invalid connect port *port***

Explanation

A non stream local port >= 65536 was selected

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Select a port < 65536 and retry.

FOTS4125 ***function*: missing connect host**

Explanation

Non dynamic port forwarding was selected but no connect host supplied.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Specify a connect host and retry.

FOTS4126 **function: requested *fwdtype* failed**

Explanation

A request of fwdtype failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4127 Stop listening request sent.

Explanation

An exit request was sent to the master process of the specified multiplexed connection.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

No response required.

FOTS4128 *function*: can't retrieve hostkey *arg*

Explanation

Error retrieving hostkey while handling the protocol extension for proving host keys.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4129 *arg*: couldn't prepare signature: *arg*

Explanation

Error occurred preparing signature while handling the protocol extension for proving host keys.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4130 *arg*: sshbuf_put_u32: *arg*

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4131 *arg*: close: *arg*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4132 Invalid X11 forwarding data

Explanation

Invalid X11 forwarding data

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the error and try the command again.

FOTS4133 **Client version \"*version*\" uses unsafe RSA signature scheme; disabling use of RSA keys**

Explanation

The client is connecting with an unsafe RSA signature.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Choose a supported RSA signature and try the command again.

FOTS4134 **Client version \"*version*\" uses unsafe key agreement; refusing connection**

Explanation

The client is connecting with an invalid key agreement.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4135 ***file* line *line*: Bad key types '*keytype*'.**

Explanation

The key type specified is not valid.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the key type and retry.

FOTS4136 ***file* line *line*: invalid AllowUsers pattern: \"*pattern*\"**

Explanation

The argument to AllowUsers is not valid

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the pattern and retry.

FOTS4137 ***file* line *line*: invalid DenyUsers pattern: \"*pattern*\"**

Explanation

The argument to DenyUsers is not valid

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4138 ***file* line *line*: missing AuthorizedKeysCommandUser argument.**

Explanation

No user specified for the option.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Supply a username and retry.

FOTS4139 ***file* line *line*: missing AuthorizedPrincipalsCommandUser argument.**

Explanation

No user specified for the option.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Supply a username and retry.

FOTS4140 ***file* line *line*: no AuthenticationMethods specified**

Explanation

No argument specified for the option

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Supply the authentication methods and retry.

FOTS4141 ***arg*: RAND_bytes failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4142 **Could not get agent socket: *error_message***

Explanation

Failed to get authentication socket.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4143 ***arg*: couldn't put hostkey *arg*: *arg***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4144 ***arg*: no hostkeys**

Explanation

No hostkeys were found when informing the client of all hostkeys

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4145 **too many host certificates.**

Explanation

Too many host certificate files.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and try again.

FOTS4146 **AuthorizedPrincipalsCommand set without AuthorizedPrincipalsCommandUser**

Explanation

AuthorizedPrincipalsCommandUser must be specified when AuthorizedPrincipalsCommand is defined.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Specify a user for AuthorizedPrincipalsCommandUser and try the configuration again.

FOTS4147 **Could not connect to agent \"*arg*\": *arg***

Explanation

Could not connect to the specified authentication socket.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4148 **sshkey_fingerprint failed**

Explanation

A failure occurred creating a fingerprint from a key.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4149 **Unable to get agent socket: *error_message***

Explanation

Failed to get authentication socket.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4150 **kex_setup: *error_message***

Explanation

Key exchange failed.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4151 openpty: *error_message*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4152 openpty returns device for which ttyname fails.

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4153 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.

FOTS4154 ssh_packet_set_connection failed

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4155 *function*: bad key blob: *error_message*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4156 kex_setup: *arg*

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4201 ***function*: kex_start_rekex: *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.

FOTS4202 ***function*: hostfile_replace_entries failed: *message***

Explanation

An error occurred when ssh attempted to update the user's known_hosts file after key verification.

System action

The known_hosts file is not updated, but the program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4203 **Server failed to confirm ownership of private host keys**

Explanation

The ssh server failed to confirm the ownership of one or more private host keys during a hostkey request.

System action

The known_hosts file is not updated, but the program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4204 ***function*: ssh->kex->session_id_len == 0**

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.

FOTS4205 ***arg*: failed to prepare signature: *arg***

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.

FOTS4206 ***function*: server gave bad signature for *type* key *num***

Explanation

An error occurred during hostkey verification.

System action

The known_hosts file is not updated, but the program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4207 ***arg*: ctx->nnew == 0**

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.

FOTS4208 ***function*: ndone = ctx->nnew (*ndone* / *ctx->nnew*)**

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.

FOTS4209 ***function*: server already sent hostkeys**

Explanation

It is an error for the ssh server to send hostkeys more than once.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4210 ***function*: received duplicated *name* host key**

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4211 ***function*: recallocarray failed nkeys = *num***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4212 ***arg*: hostkeys_foreach failed: *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4213 ***function*: host \"*hostname*\" cname \"*canonicalname*\" too long (max *len*)**

Explanation

The host's canonical name was too long.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4214 ***function*: host \"*hostname*\" addr \"*hostaddr*\" too long (max *len*)**

Explanation

The host address was too long.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4215 ***progname*: Could not resolve host \"*hostname*\"**

Explanation

The supplied hostname could not be resolved

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Verify the hostname and retry.

FOTS4216 **Couldn't allocate session state**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4217 **no support for PKCS#11.**

Explanation

A PKCS#11 option was specified, but not supported.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Remove the option and retry.

FOTS4218 **Only a single -J option permitted**

Explanation

Multiple -J (ProxyJump) arguments were supplied, but only one is supported.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Respecify the command with only one argument and retry.

FOTS4219 **Cannot specify -J with ProxyCommand**

Explanation

The -J (ProxyJump) command cannot be specified when a ProxyCommand is used.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Remove one of the options and retry.

FOTS4220 **Invalid -J argument**

Explanation

An invalid ProxyJump argument was specified with the -J command.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the argument and retry.

FOTS4221 **inconsistent options: ProxyCommand+ProxyJump**

Explanation

The ProxyJump option cannot be specified when a ProxyCommand is used.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Remove one of the options and retry.

FOTS4222 **ProxyCommand=- and ProxyUseFDPass are incompatible**

Explanation

The ProxyCommand option with "-" as an argument cannot be specified with the ProxyUseFDPass option.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the options and retry.

FOTS4223 **Invalid number of ConnectionAttempts**

Explanation

The number of ConnectionAttempts must be greater than zero

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the option and retry.

FOTS4224 **Cannot execute command-line and remote command.**

Explanation

Both a RemoteCommand option and command line command were specified, but only one is allowed.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Correct the command and retry.

FOTS4225 ***function*: mux digest failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4226 **Error: remote port forwarding failed for listen path *listen_path***

Explanation

A remote forwarding request failed for listen path *listen_path*.

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.

FOTS4227 **Warning: remote port forwarding failed for listen path *arg***

Explanation

A remote forwarding request failed for listen path *listen_path*.

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.

FOTS4228 **stdio forwarding failed**

Explanation

The requested "-W" option failed.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4229 ***arg*: too many certificates**

Explanation

The number of certificate files specified exceeded the maximum allowed by OpenSSH.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Reduce the number of files and retry.

FOTS4230 **bindresvport_sa: af=*family error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4231 **Server version \"*arg*\" uses unsafe key agreement; refusing connection**

Explanation

The server is an older version of ssh and has not provided a safe key environment.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4232 **Server version \"*arg*\" uses unsafe RSA signature scheme; disabling use of RSA keys**

Explanation

The server is an older version of ssh and does not offer a safe RSA signature capability.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

No action required.

FOTS4233 ***function*: sshkey_from_private: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4234 ***function*: fingerprint host key: *error***

Explanation

An attempt to take the fingerprint of the host key failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4235 ***function*: fingerprint CA key: *error***

Explanation

An attempt to take the fingerprint of a CA key failed.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4236 **Host key *type fingerprint* revoked by file *filename***

Explanation

The host key has been revoked.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4237 **Error checking host key *type fingerprint* in revoked keys file *filename*: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4238 ***function*: kex_names_cat**

Explanation

Internal error.

System action

The program ends.

User response

Contact your system programmer.

FOTS4239 ***function*: kex_assemble_namelist**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4240 **kex_prop2buf: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4241 **Authentication failed.**

Explanation

The client failed to connect to the server because no authentication method was successful.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the log for authentication failures (running with debug messages active if necessary) and identify failed authentication methods that should have worked. Correct and retry or use a different authentication method.

FOTS4242 **Mismatch; try again, EOF to quit.**

Explanation

The confirmation password supplied does not match the original.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Retry the operation.

FOTS4243 ***function*: private key *identityfile* contents do not match public**

Explanation

The key contained in the identityfile does not match the public key.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Verify the contents of the identityfile and retry.

FOTS4244 ***function*: signing failed: *error***

Explanation

An error occurred attempting to sign.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Check the error and correct if possible, otherwise, contact your system programmer.

FOTS4245 ***function*: exec(*program*): *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4246 ***function*: waitpid *pid*: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4247 ***function*: exited abnormally**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4248 ***function*: exited with status *status***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4249 ***function*: sshkey_to_blob: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4250 ***function*: packet error: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4291 **hostname contains invalid characters**

Explanation

The supplied hostname contains invalid characters.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Verify the program and retry.

FOTS4292 **remote username contains invalid characters**

Explanation

The supplied remote hostname contains invalid characters.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Verify the program and retry.

FOTS4301 **write_checkpoint: temp pathname too long**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4302 **mkstemp(*arg*): *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4303 **write_checkpoint: fdopen: *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4304 **failed to write to checkpoint file '*arg*': *arg***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4305 **Failed to load checkpoint from '*arg*'**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4306 ***function*: send CHANNEL_EOF: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4307 **channel *num*: chan_shutdown_write: close() failed for fd *fdnum*: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4308 **channel *num*: chan_shutdown_read: shutdown() failed for fd *fdnum* [i*inum* o*onum*]: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4309 **channel *num*: chan_shutdown_read: close() failed for fd *fdnum*: *error***

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4310 ***function*: ssh_packet_set_connection failed**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4311 ***function*: could not allocate state**

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4312 ***function*: cipher_init failed: *error***

Explanation

Internal error.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4313 **Warning: *wmsg***

Explanation

A cipher warning was detected during newkeys.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Address the warning if possible and retry.

FOTS4314 **xreallocarray: out of memory (*elements* elements of *bytes* bytes)**

Explanation

Unable to allocate the requested storage.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4315 **xrecallocarray: out of memory (*elements* elements of *bytes* bytes)**

Explanation

Unable to allocate the requested storage.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4316 ***function*: private key material is not available for key ring key (*key*)**

Explanation

Invalid argument.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4317 ***function*: BN_CTX_new failed**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4318 ***function*: BN_CTX_get failed**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4319 ***function*: group is not a prime field**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4320 ***function*: EC_POINT_get_affine_coordinates_GFp**

Explanation

Internal error.

System action

The program continues.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Contact your system programmer.

FOTS4321 ***function*: initgroups(*pw_name*, *gid*) : *error_message***

Explanation

initgroups() system call failed.

System action

The program ends.

System programmer response

If unable to resolve, follow local procedures for reporting problems to IBM.

User response

Refer to *z/OS C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, contact your system programmer.

FOTS4322 **session timed out**

Explanation

The session timed out.

System action

The program ends.

System programmer response

Follow the local procedures for reporting problems to IBM.

User response

Refer to *z/OS C/C++ Runtime Library Reference* for an explanation of the system error. If unable to resolve, 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)

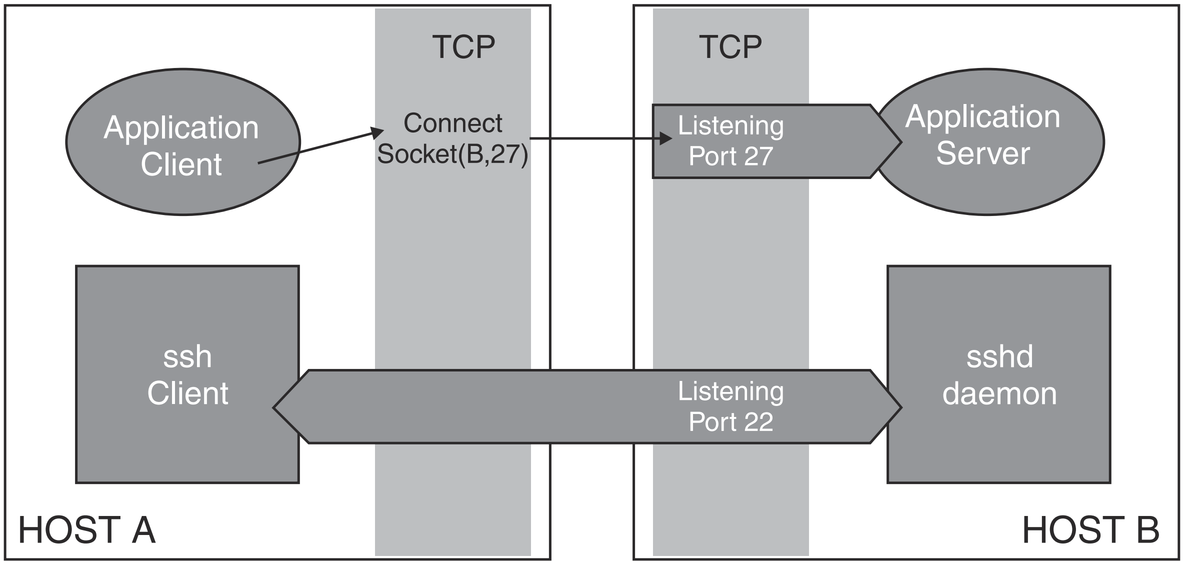

Figure 8. OpenSSH - without TCP port forwarding

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 on page 517. 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 518). 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 518. 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 518.

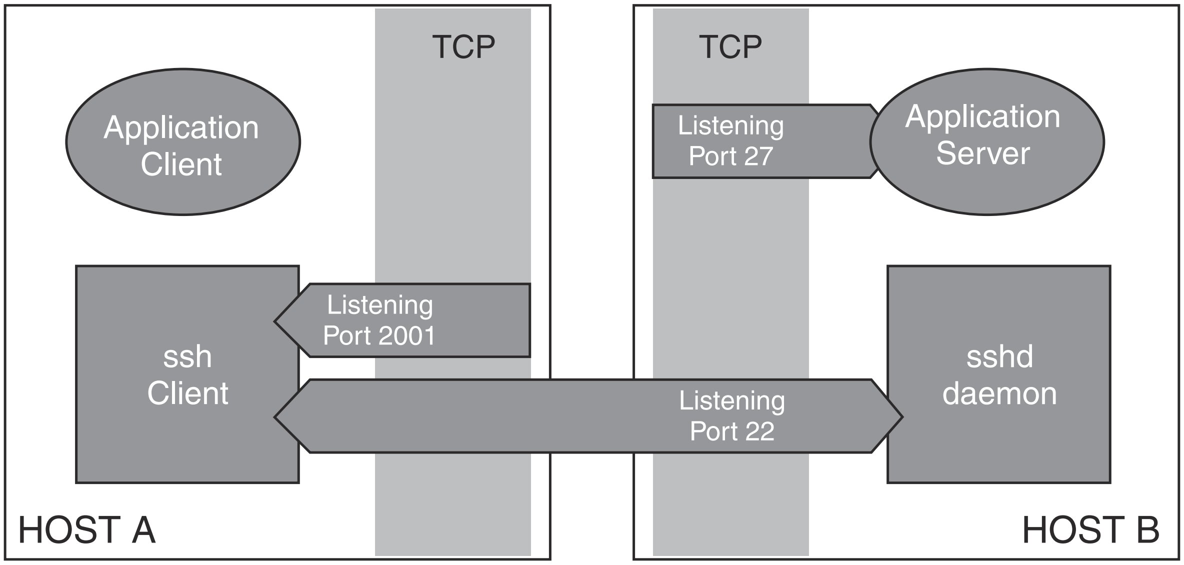

Figure 9. The ssh client is listening on port 2001 for a connection

The TCP application wants to contact the server through a SSH connection.

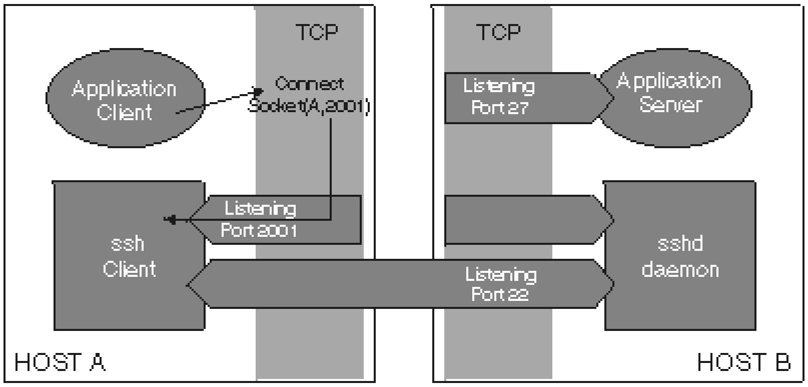

Figure 10. The application is connecting to port 2001 on the local host (Host A)

ssh forwards the data through an SSH tunnel; sshd delivers to server.

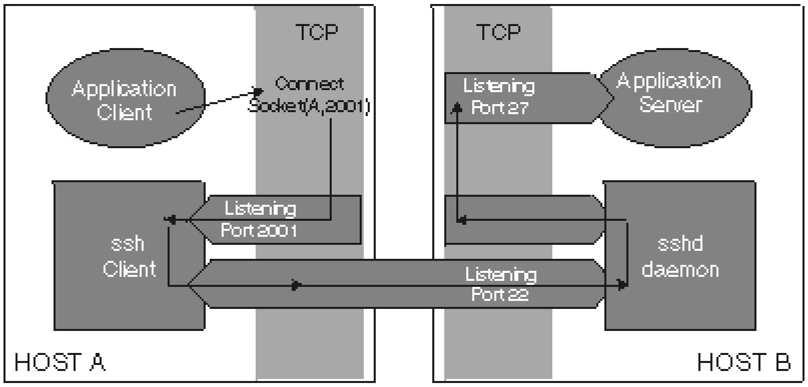

Figure 11. The ssh client accepts the connection on port 2001, forwards the application's data to sshd on Host B, sshd then forwards the data to the application's server, listening on Port 27

Appendix C. RFCs and Internet drafts

The Internet Engineering Task Force (IETF) (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.
- UMAC: Message Authentication Code using Universal Hashing, RFC 4418, 2006.
- The Secure Shell (SSH) Public Key Subsystem, RFC 4819, 2007.
- AES Galois Counter Mode for the Secure Shell Transport Layer Protocol, RFC 5647, 2009.
- 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 Internet Engineering Task Force (IETF) (www.ietf.org) for a list of drafts.

Appendix D. Accessibility

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Programming Interface Information

This publication documents intended Programming Interfaces that allow the customer to write programs that use the OpenSSH portion of Ported Tools for z/OS.

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Glossary

This glossary defines technical terms and abbreviations used in the OpenSSH portion of the IBM Ported Tools for z/OS documentation.

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 The CERT Division (www.cert.org/about).

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

Product Number: 5655-ZOS

SC27-6806-60