Tectia® Server 6.8 for IBM z/OS

User Manual

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Tectia® Server 6.8 for IBM z/OS: User Manual

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Chapter 1 About This Document

This document describes using and configuring the Secure Shell client-side tools included in Tectia Server for IBM z/OS. It is meant for users and administrators of Tectia Server for IBM z/OS. The document also contains examples of using other Secure Shell client software to connect to a mainframe that runs Tectia Server for IBM z/OS.

This document contains the following information:

- Getting started
- Configuring Tectia client tools for z/OS
- Authentication
- System administration
- Transferring files using SFTP
- Tunneling
- Troubleshooting
- Using other Secure Shell clients
- Appendices, including command-line tool and audit message references

For general information on Tectia Server for IBM z/OS and its features, refer to *Tectia Server for IBM z/OS Product Description*.

Tectia Server for IBM z/OS Administrator Manual contains instructions for installing and configuring Tectia Server for IBM z/OS on mainframes.

1.1 Documentation Conventions

The following typographical conventions are used in Tectia documentation:

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Table 1.1. Documentation conventions

Convention	Usage	Example
Bold	Tools, menus, GUI elements and commands, command-line tools, strong emphasis	Click **Apply** or **OK**.
→	Series of menu selections	Select **File** → **Save**
`Monospace`	Command-line and configuration options, file names and directories, etc.	Refer to `readme.txt`
Italics	Reference to other documents or products, URLs, emphasis	See *Tectia Client User Manual*
`Monospace Italics`	Replaceable text or values	rename *`oldfile newfile`*
#	In front of a command, # indicates that the command is run as a privileged user (root).	`# rpm --install package.rpm`
$	In front of a command, $ indicates that the command is run as a non-privileged user.	`$ sshg3 user@host`
\	At the end of a line in a command, \ indicates that the command continues on the next line, but there was not space enough to show it on one line.	`$ ssh-keygen-g3 -t rsa \ -F -c mykey`

Note

A Note indicates neutral or positive information that emphasizes or supplements important points of the main text. Supplies information that may apply only in special cases (for example, memory limitations, equipment configurations, or specific versions of a program).

Caution

A Caution advises users that failure to take or to avoid a specified action could result in loss of data.

1.1.1 Operating System Names

When the information applies to several operating systems versions, the following naming systems are used:

- **Unix** refers to the following supported operating systems:
  - HP-UX
  - IBM AIX
  - Red Hat Linux, SUSE Linux
  - Linux on IBM System z
  - Solaris

  - IBM z/OS, when applicable; as Tectia Server for IBM z/OS is running in USS and uses Unix-like tools.

- **z/OS** is used for IBM z/OS, when the information is directly related to IBM z/OS versions.
- **Windows** refers to all supported Windows versions.

1.2 Customer Support

All Tectia product documentation is available at https://www.ssh.com/manuals/.

FAQ with how-to instructions for all Tectia products are available at https://answers.ssh.com/.

If you have purchased a maintenance agreement, you are entitled to technical support from SSH Communications Security. Review your agreement for specific terms and log in at https://support.ssh.com/.

Information on submitting support requests, feature requests, or bug reports, and on accessing the online resources is available at https://support.ssh.com/.

1.3 Terminology

The following terms are used throughout the Tectia Server for IBM z/OS documentation.

client computer
: The computer from which the Secure Shell connection is initiated.

Connection Broker
: The Connection Broker is a component included in the Tectia Server for IBM z/OS client tools. It consists of the **ssh-broker-g3** process and the **ssh-broker-ctl** control process. The Connection Broker handles all cryptographic operations and authentication-related tasks.

FTP-SFTP conversion
: Tectia SOCKS Proxy can automatically capture FTP connections on the client and convert them to SFTP and direct them to an SFTP server running Tectia Server, or another vendor's Secure Shell server software.

host key pair
: A public-key pair used to identify a Secure Shell server. The private key file is accessible only to the server. The public key file is distributed to users connecting to the server.

remote host
: Refers to the other party of the connection, client computer or server computer, depending on the viewpoint.

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scpg3
: A command-line Secure Shell client for secure copy. **scpg3** is a secure replacement for remote copy (**rcp**) and provides easy secure non-interactive file transfers.

Secure Shell client
: A client-side application that uses the Secure Shell version 2 protocol, for example **scpg3**, **sftpg3**, or **sshg3** of Tectia client tools for z/OS.

Secure Shell server
: A server-side application that uses the Secure Shell version 2 protocol.

server computer
: The computer on which the Secure Shell service is running and to which the Secure Shell client connects.

SFTP server
: A server-side application that provides a secure file transfer service as a subsystem of the Secure Shell server.

sftpg3
: A command-line Secure Shell client for secure file transfer. **sftpg3** is a secure replacement for FTP and provides a user interface for interactive file transfers and a batch mode for unattended file transfers.

SOCKS Proxy
: Tectia SOCKS Proxy is used for transparent FTP tunneling and FTP-SFTP conversion. It consists of the **ssh-socks-proxy** process and **ssh-socks-proxy-ctl** control process.

sshd2
: The main Secure Shell server daemon of Tectia Server for IBM z/OS.

sshg3
: A command-line Secure Shell client that can be used as a secure replacement for Telnet and other unsecured terminal applications. **sshg3** can also be used for remote command and job execution, and for creating secure tunnels for TCP applications.

Tectia client tools for z/OS
: Tectia Server for IBM z/OS includes client tools, which consist of the Connection Broker, Secure Shell command-line tools (sshg3, scpg3, sftpg3), auxiliary command-line tools, and the SOCKS Proxy .

Tectia client/server solution
: The Tectia client/server solution consists of Tectia Client, Tectia Server, and Tectia Server for IBM z/OS (including the Tectia Server for IBM z/OS client tools).

Tectia Server for IBM z/OS
: Tectia Server for IBM z/OS is a server-side component where Secure Shell clients connect to. It consists of two processes: **sshd2** and **ssh-certd** (the Certificate Validator). Tectia Server for IBM z/OS provides

normal Secure Shell connections and supports secure TN3270 connectivity, transparent FTP tunneling, FTP-SFTP conversion and enhanced file transfer features on IBM z/OS.

Tectia SSH Assistant
: The Tectia SSH Assistant ISPF application provides an interface for installing, configuring and running Tectia client tools for z/OS using traditional MVS tools (ISPF and JCL), without requiring the use of the Unix shell.

transparent FTP tunneling
: An FTP connection transparently encrypted and secured by a Secure Shell tunnel.

tunneled application
: A TCP application secured by a Secure Shell connection.

user key pair
: A public-key pair used to identify a Secure Shell user. The private key file is accessible only to the user. The public key file is copied to the servers the user wants to connect to.

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Chapter 2 Getting Started

This chapter provides information on how to get started with the client tools after the Tectia Server for IBM z/OS software has been successfully installed.

Tectia client tools for z/OS are based on Secure Shell (SecSh) technology and they allow secure file transfer and secure system administration over an unsecured network.

Tectia client tools for z/OS can connect to any standard Secure Shell server, including Tectia Server and OpenSSH.

2.1 Product Components

Tectia client tools for z/OS consist of the following components:

- The Connection Broker: **ssh-broker-g3**, **ssh-broker-ctl**
- Secure Shell command-line tools: **sshg3**, **scpg3**, **sftpg3**
- Auxiliary command-line tools: **ssh-broker-ctl probe-key**, **ssh-keygen-g3**, **ssh-keydist-g3**, **ssh-keyfetch**, **ssh-cmpclient-g3**, **ssh-scepclient-g3**, **ssh-certview-g3**, **ssh-ekview-g3**
- The SOCKS Proxy: **ssh-socks-proxy** (see ssh-broker-g3(1)), **ssh-socks-proxy-ctl** (see ssh-broker-ctl(1))

2.2 Environment Variables for Client Applications

The environment variables `_BPXK_AUTOCVT`, `_BPX_SHAREAS`, and `_BPX_BATCH_UMASK` must be set as shown in `SSHENV` and `sshsetenv` when running Tectia client tools for z/OS programs (see below).

The NAME=VALUE format (as in `SSHENV`) is used when the client or server programs are run under MVS, and the Bourne shell format (as in `sshsetenv`) is used when the programs are run from a USS command line.

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Note

The environment files must not contain line numbers or reading them will fail.

SSHENV:

```
_BPXK_AUTOCVT=ON ❶
_BPX_SHAREAS=NO ❷
_BPX_BATCH_UMASK=0022 ❸
SSH_DEBUG_FMT="%W(72)(2) %Dd/%Dt/%Dy %Dh:%Dm:%Ds:%Df %m/%s:%n:%f %M" ❹
_BPXK_JOBLOG=STDERR ❺
_EDC_ADD_ERRNO2=1 ❻
TZ=EST5EDT ❼
```

❶ *(Required)* `_BPXK_AUTOCVT=ON` activates automatic text conversion of tagged UNIX file system files. If the variable is not set correctly, **ssh-broker-g3** fails to start.

❷ *(Required)* `_BPX_SHAREAS=NO` defines that **ssh-broker-g3** and the client processes are run in separate address spaces.

❸ *(Required)* `_BPX_BATCH_UMASK` defines the permissions for newly created files.

❹ *(Optional)* `SSH_DEBUG_FMT` can be used to specify the format of the debug messages.

❺ *(Optional)* Setting `_BPXK_JOBLOG=STDERR` will cause job log messages to be written to the `STDERR` data set specified in the `BPXBATCH` job.

❻ *(Optional)* Setting `_EDC_ADD_ERRNO2=1` will cause `errno2` to be shown in debug and error messages.

❼ *(Optional)* Setting `TZ=EST5EDT` will set the timezone to Eastern Standard Time. For more information on the syntax of the TZ variable, see the *z/OS UNIX System Services Command Reference Appendix I. TZ environment variable.*

The Crypto Express Card (CEX) related environment variables (see Section 2.3.3) can have the following values:

```
SSH_CRYPTOCARD_CIPHER_IO_THRESHOLD=<0-65536>
SSH_CRYPTOCARD_MAC_GENERATE=YES|NO
```

sshsetenv:

```
export _BPXK_AUTOCVT=ON
export _BPX_BATCH_UMASK=0022
export _BPX_SHAREAS=NO
export SSH_DEBUG_FMT="%W(72)(2) %Dd/%Dt/%Dy %Dh:%Dm:%Ds:%Df %m/%s:%n:%f %M"
export _EDC_ADD_ERRNO2=1
export TZ=EST5EDT
```

(For a description of the variables, see **SSHENV** above.)

2.3 Running Client Programs

Tectia Server for IBM z/OS contains three client-side applications:

- **sshg3** is a secure replacement for Telnet and other unsecured terminal applications. **sshg3** can also be used for remote command and job execution, and creating secure tunnels for TCP applications.
- **scpg3** is a secure replacement for remote copy (**rcp**) and provides easy secure non-interactive file transfers.
- **sftpg3** is a secure replacement for FTP and provides a user interface for interactive file transfers and a batch mode for unattended file transfers.

The **ssh-broker-g3** component handles all cryptographic operations and authentication-related tasks for the **sshg3**, **scpg3**, and **sftpg3** client programs. Normally, the Connection Broker starts in the background automatically whenever one of the Tectia client programs is started, and stops when the client program is stopped.

It is also possible to start the Connection Broker separately from the USS command line. This way all Tectia client programs run by the user will use the same instance of **ssh-broker-g3**. See Section 2.4.1 for instructions.

The **ssh-socks-proxy** component is used for transparent FTP tunneling and FTP-SFTP conversion. For more information on the Tectia SOCKS Proxy, see *Tectia Server for IBM z/OS Administrator Manual*.

2.3.1 Under USS

Interactive remote sessions and file transfers can be used from Unix System Services shells. For example, OMVS, Telnet, or Secure Shell sessions can be used.

For information on the command syntax and options, see sshg3(1), scpg3(1), and sftpg3(1).

For information and examples on TCP tunneling, see Chapter 8.

For examples on remote command execution, see Section 5.2.

2.3.2 Under MVS

Tectia Server for IBM z/OS client-side applications can be executed in JCL by `BPXBATCH`, `BPXBATSL`, or `oshell`. **scpg3** uses the same syntax for interactive and unattended file transfers. **sftpg3** has a batch mode for non-interactive file transfers.

For ease of use, file transfer client applications can also be run using a file transfer JCL procedure provided in `<HLQ>.V681.SAMPLIB`.

User interaction is not possible when using unattended file transfers. For unattended use, users must be set up to use a non-interactive authentication method, such as public key without a passphrase.

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Because user interaction is not possible, the server host key must be stored on disk on the client before unattended file transfers will succeed. More information and examples on storing remote server keys can be found in Section 4.2 and Section 4.9.1.

For unattended and JCL PROC file transfer examples, see Section 6.6.2.

For using Secure Shell to run remote commands or jobs, see Section 5.2.

2.3.3 Enabling Use of IBM Crypto Express Card (CEX)

For client and socks proxy: Ciphers AES-CBC, AES-CTR, AES-GCM, and 3DES-CBC; Macs hmac-sha* are offloaded to CEX card if proper environment variables are set. CPACF will be used by default. See *Tectia Server for IBM z/OS Administrator Manual Appendix H* for instructions how to enable cryptographic hardware support with RACF commands.

CEX related environment variables are:

```
SSH_CRYPTOCARD_CIPHER_IO_THRESHOLD:
Specifies the minimum size of cipher request that will be routed to
IBM cryptographic co-processor card (CEX), if the card is available.
If the request size is less than the SSH_CRYPTOCARD_CIPHER_IO_THRESHOLD
value, the cipher request will be routed to CPACF facility.
Special values are
0                route all cipher requests to IBM cryptographic
co-processor card
65536 or higher  route all cipher requests to CPACF facility
```

If the variable is not defined, all cipher requests will use CPACF facility.

```
SSH_CRYPTOCARD_MAC_GENERATE:
Specifies whether to route MAC generation request to IBM cryptographic
co-processor card (CEX). If it is set to yes, MAC generation request will
route to IBM cryptographic co-processor card (CEX), if the card is
available.
```

If the variable is not defined, all MAC requests will use CPACF facility.

2.4 Running the Connection Broker

The Connection Broker component consists of two processes:

- **ssh-broker-g3**: the Tectia Connection Broker process
- **ssh-broker-ctl**: control process for the Connection Broker. It can be used, for example, to view the status of the Connection Broker, to stop the Connection Broker, or to load private keys to memory.

Normally, there is no need to start the **ssh-broker-g3** process separately. The **sshg3**, **scpg3**, and **sftpg3** client programs start it in the on-demand mode, and stop it when the client program is stopped. However, if you reconfigure Connection Broker settings, you must stop and start the Connection Broker.

If you are running several tunneling or file transfer jobs for a single user and do not want that a separate **ssh-broker-g3** process starts each time one of these jobs is run, you can start **ssh-broker-g3** in persistent mode. After that, all client programs run by the user will use the same instance of **ssh-broker-g3**. This saves system resources. The Connection Broker can be started manually under USS or by using a JCL script. You can find an example JCL script named `SSHBRKR` in `SAMPLIB`.

2.4.1 Starting ssh-broker-g3 Manually under USS

Under USS, the Connection Broker can be started by running the following command:

```
$ /opt/tectia/bin/ssh-broker-g3
```

For information on the Connection Broker command syntax and options, see ssh-broker-g3(1).

2.4.2 Stopping ssh-broker-g3

You can stop the Connection Broker by executing one of the following commands under USS:

```
$ /opt/tectia/bin/ssh-broker-g3 --exit
```

OR:

```
$ /opt/tectia/bin/ssh-broker-ctl stop
```

If you run **ssh-broker-ctl** using a different user ID than **ssh-broker-g3**, give also the `-a` (alias for `--broker-address`) option and run **ssh-broker-ctl** as a privileged user (root).

For example, when user *`SSHBRKR`* owns the **ssh-broker-g3** process:

```
# /opt/tectia/bin/ssh-broker-ctl -a /tmp/ssh-SSHBRKR/ssh-broker stop
```

2.4.3 Reconfiguring ssh-broker-g3

If you make changes to the `ssh-broker-config.xml` configuration file the changes will not take effect until the Connection Broker is reconfigured by stopping and starting the Connection Broker. After you have reconfigured the Connection Broker, existing connections will continue to use the old configuration settings while new connections will use the reconfigured settings.

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2.5 Connecting to a Remote Host

This section gives basic instructions on how you can log in from Tectia client tools for z/OS to a Secure Shell server with the default settings. The default settings on Tectia client tools for z/OS and Tectia Server for IBM z/OS allow login with passwords (Section 2.5.2) and public keys (Section 2.5.3).

2.5.1 Authenticating Remote Server Hosts

Remote Secure Shell servers are authenticated using either traditional public-key authentication or certificate authentication.

In public-key authentication the client trusts the server if it has a private key that matches one of the public keys in the global hostkeys directory (`/opt/tectia/etc/hostkeys`) or in the user's hostkeys directory (`$HOME/.ssh2/hostkeys`). When a server presents a key that is not in the hostkeys directories, the user verifies the fingerprint of the remote server's public key. When the user has approved the public key, it is stored in the user's hostkeys directory and will be used automatically thereafter.

The verification step requires user interaction, so even for users that are set up to run client programs unattended (Section 2.3.2), the first connection must be done by a person who logs in as the user, accesses the remote server, and goes through the fingerprint check dialog. The same steps must be repeated if the remote host's key is changed.

Optionally, the **ssh-broker-ctl probe-key** or **ssh-keyfetch** tool can be used for storing the remote server keys before the connections are made. See ssh-broker-ctl probe-key(1) and ssh-keyfetch(1) respectively.

For more information on server authentication using public keys, see Section 4.2.

2.5.2 Using Password Authentication

Password authentication is the most commonly used form of user authentication. It is enabled by default and uses the RACF system password of the user.

Note that when running Tectia client programs from the TSO OMVS pseudo-shell, the password that you type in will be shown on your screen in plaintext. You can avoid showing the password on your screen by invoking OMVS as follows:

```
TSO OMVS PF13(HIDE)
```

Start your client (in this example **sftpg3**) to request password:

```
sftpg3 --aa password hostname
username@hostname's password:
```

Press **P13** before typing in your password! This will temporarily hide the input data you type on the shell command line.

Other ways to avoid showing your password on the screen are using a real shell via telnet or SSH, or setting up public-key authentication using a private key without a passphrase.

There is one case where password authentication cannot be used in Tectia client tools for z/OS: When running Tectia client programs from JCL there is no facility for getting the password interactively from the user. You can have the password stored in a file or a data set (see Section 4.4.1), or preferably use public-key authentication and a private key without a passphrase (see Section 4.5).

For more information on password authentication, see Section 4.4.

2.5.3 Using Public-Key Authentication

In public-key authentication, the server authenticates the user by the presence of the user's public key in the user's `$HOME/.ssh2` directory on the server. The public key ties the user ID to the user's private key stored on the client.

Keys can be generated using the **ssh-keygen-g3** tool (ssh-keygen-g3(1)), and they can be distributed to the remote hosts using the **ssh-keydist-g3** tool (ssh-keydist-g3(1)).

For more information and examples on public-key authentication, see Section 4.5.

2.5.4 Logging in with Command-Line sshg3

You can connect to a remote host by using **sshg3** on the command line:

1. Enter the **sshg3** command using the following syntax:

   ```
   $ sshg3 <hostname>
   ```

   For example:

   ```
   $ sshg3 abc.example.com
   ```

   The basic syntax is:

   ```
   $ sshg3 user@host#port
   ```

   where:

   - `user` - Enter a user name that is valid on the remote host. The `user@` attribute is optional. If no user name is given, the local user name is assumed.
   - `host` - Enter the name of the remote host as an IP address, FQDN (fully qualified domain name), or short host name. The remote host must be running a Secure Shell version 2 server.
   - `port` - Enter the number of the Secure Shell listen port on the remote server. The `#port` attribute is optional. If no port is given, the default Secure Shell port 22 is assumed.

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If you have defined connection profiles in the `ssh-broker-config.xml` file, you can also connect by using the name of the connection profile, for example:

```
$ sshg3 profile1
```

In this case, the settings defined in the profile (host name, port, user name etc.) are used for the connection. For instructions on creating and editing the connection profiles, see the section called "The `profiles` Element".

For more information on the **sshg3** commands and options, see sshg3(1).

2. The server authentication phase starts. The server sends its public key to the client for validation (when server public-key authentication is used).

   Tectia client tools for z/OS checks if this key is already stored in your own host key directory. If not, the host key directory common to all users on your computer is checked next.

   If the host key is not found, you are asked to verify it.

   When Tectia client tools for z/OS receives a new host public key, a host identification message is displayed. For example:

```
$ sshg3 user@host
Host key not found from database.
Key fingerprint:
xecic-fifub-kivyh-kohag-zedyn-logum-pycuz-besug-galoh-gupah-xaxby
You can get a public key's fingerprint by running
% ssh-keygen-g3 -F publickey.pub
on the keyfile.
Are you sure you want to continue connecting (yes/no)?
```

   The message shows the fingerprint of the host's public key in the SSH Babble format that is a series of pronounceable five-letter words in lower case and separated by dashes.

3. Verify the validity of the fingerprint, preferably by contacting the administrator of the remote host computer by telephone.

   After the fingerprint has been verified and found to be correct, it is safe to save the key and continue connecting. You can also select to cancel the connection, or to proceed with the connection without saving the key.

   If you choose to save the server public key, relevant information about the key will be stored on the client host in directory `$HOME/.ssh2/hostkeys`. After the first connection, the locally stored information about the server public key will be used in server authentication.

   For more information on server authentication, see Section 4.2.

4. The user authentication phase starts. You will be prompted to authenticate yourself to the server with your password or with the passphrase of your private key (if your public key has already been uploaded to the server). The required authentication method depends on the server settings.

   After the server has successfully authenticated you, the Secure Shell connection to the server is opened.

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Chapter 3 Configuring Client Tools

This chapter gives instructions on the basic configuration settings of the Tectia client components on z/OS.

The authentication and connection profile settings for Tectia client tools for z/OS are made in the Connection Broker configuration, because the Connection Broker handles all cryptographic operations and authentication-related tasks for Tectia client tools for z/OS.

3.1 Client Configuration Files

The following files located in the `/opt/tectia/etc` directory are used to store the client configuration information:

- `/opt/tectia/etc/ssh-broker-config.xml`: the global Connection Broker configuration file
- `/opt/tectia/etc/ssh_ftadv_config`: the global file transfer advisor profile configuration file
- `/opt/tectia/etc/ssh-socks-proxy-config.xml`: the global SOCKS Proxy configuration file
- `/opt/tectia/etc/hostkeys`: the global directory for known remote server host keys

The user-specific configurations are stored in each user's `$HOME/.ssh2` directory:

- `$HOME/.ssh2/ssh-broker-config.xml`: the user-specific Connection Broker configuration file
- `$HOME/.ssh2/ssh_ftadv_config`: the user-specific file transfer advisor profile configuration file
- `$HOME/.ssh2/ssh-socks-proxy-config.xml`: the user-specific SOCKS Proxy configuration file
- `$HOME/.ssh2/hostkeys`: the user-specific directory for known remote server host keys
- `$HOME/.ssh2/identification`: the identification file used with public-key authentication
- `$HOME/.ssh2/random_seed`: the random number seed file for cryptographic operations

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3.1.1 Editing the Configuration Files

The default location for the configuration files is `/opt/tectia/etc` for the global configurations and `$HOME/.ssh2` for the user-specific configuration files. You can edit the `ssh-broker-config.xml` and `ssh-socks-proxy-config.xml` files with your favorite XML or text editor.

The Connection Broker configuration file `ssh-broker-config.xml` is a valid XML file. For a detailed description of the Connection Broker configuration options, see ssh-broker-config(5). For a quick reference to the configuration options, see Section A.2.

The SOCKS Proxy configuration file `ssh-socks-proxy-config.xml` is a valid XML file. For more information on the SOCKS Proxy configuration options for transparent tunneling, see ssh-broker-config(5) and *Tectia Server for IBM z/OS Administrator Manual*.

The `ssh_ftadv_config` configuration file contains file transfer profiles used by **scpg3** and **sftpg3**. The file does not exist by default, but can be enabled by copying the example profile file `/opt/tectia/etc/ssh_ftadv_config.example` to `/opt/tectia/etc/ssh_ftadv_config` (globally for all users) or to `$HOME/.ssh2/ssh_ftadv_config` (for a specific user). For more information on the file transfer advisor configuration options, see Section Section 10.4.2.

3.2 Environment Variables

In addition to the configuration file, also environment variables can be used to configure the clients. Environment variables override values specified in the configuration file.

For a list of file transfer environment variables, see Section 6.4.2.

3.3 Command-Line Options

In addition to the configuration file and environment variables, also command-line options can be used to configure the server. Command-line options override values specified in environment variables and the configuration file.

For a list of the available options, see sshg3(1), scpg3(1), and sftpg3(1)).

Chapter 4 Authentication

The Secure Shell protocol used by the Tectia client/server solution provides mutual authentication – the client authenticates the server and the server authenticates the client user. Both parties are assured of the identity of the other party.

The remote Secure Shell server host can authenticate itself using either traditional public-key authentication or certificate authentication.

Different methods can be used to authenticate Secure Shell client users. These authentication methods can be combined or used separately, depending on the level of functionality and security you want.

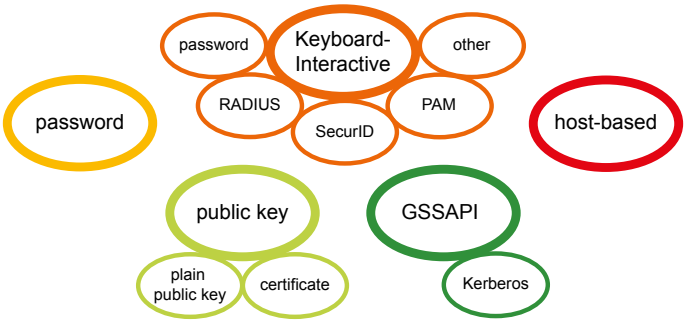

Figure 4.1. User authentication methods

User authentication methods used by the Tectia client on z/OS by default are: public-key, keyboard-interactive, and password authentication. In addition, the client supports host-based authentication.

When several interactive authentication methods are defined as allowed, Tectia client tools for z/OS will alternate between the methods and offers each of them in turn to the server in case the previous method failed. This makes it possible to define different authentication methods for different users, and they can be handled with the same server configuration.

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4.1 Supported User Authentication Methods

The following user authentication methods are supported in the Tectia client/server solution.

Table 4.1. User authentication methods supported by the Tectia client/server solution

Authentication method	Tectia Server			Tectia Client, and client tools on Server for IBM z/OS		
	Unix[a]	Windows	z/OS	Unix[a]	Windows	z/OS
Password	x	x	x	x	x	x
Public-key	x	x	x	x	x	x
Certificate	x	x	x[b]	x	x	x[b]
Host-based	x	x	x	x		x
Keyboard-interactive	x	x	x	x	x	x
PAM[c]	x			x	x	x
RSA SecurID[c]	x	x		x	x	x
RADIUS[c]	x	x		x	x	x
GSSAPI/Kerberos	x	x		x	x	

[a] Including Tectia Server for Linux on IBM System z.
[b] Including certificates in files and SAF certificates.
[c] Through keyboard-interactive.

4.2 Server Authentication with Public Keys in File

The server is authenticated with a digital signature based on a DSA, RSA or ECDSA public-key algorithm. At the beginning of the connection, the server sends its public key to the client for validation.

Server authentication is done during Diffie-Hellman key exchange through a single public-key operation. When public-key authentication is used to authenticate the server, the first connection is very important. During the first connection the client will display a message similar to the following:

```
Host key for the host "alpha" not found from database.

The fingerprint of the host public key is:
"xicec-kahog-kyvih-fufib-nyzed-logum-pycuz-besug-galoh-gupah-pyxax"

You can get a public key's fingerprint by running
% ssh-keygen-g3 -F publickey.pub
on the key file.

Please select how you want to proceed.
    cancel) Cancel the connection.
      once) Proceed with the connection but do not save the key.
      save) Proceed with the connection and save the key for future use.
```

Caution

Never save a host public key without verifying its authenticity!

To help you to verify the identity of the server host, the message displays a fingerprint of the host's public key. The fingerprint is represented using the SSH Babble format, and it consists of a series of pronounceable five-letter words in lower case and separated by dashes.

Verify the validity of the fingerprint, for example by contacting the administrator of the remote host computer (preferably by telephone) and asking the administrator to verify that the key fingerprint is correct. If the fingerprint is not verified, it is possible that the server you are connecting to is not the intended one (this is known as a *man-in-the-middle attack*).

After verifying the fingerprint, it is safe to continue connecting. Relevant information about the server public key will then be stored on the client-side machine. With Tectia client on z/OS, it is stored in the user's `$HOME/.ssh2/hostkeys` USS directory.

The stored information on the host keys is used in subsequent connections to those remote hosts. Tectia client tools for z/OS checks which type of a host key (DSA, RSA or ECDSA) it possesses for a particular server, and automatically chooses the key exchange algorithm to be used in the connection between the client and server accordingly. This makes it quicker to connect to hosts for which only one type of host key has been stored.

When **`auth-server-publickey`** is set to some other policy than `strict` (as it is by default), if logging is enabled for the Connection Broker, Tectia client tools for z/OS will log information about changed and new host public keys with their fingerprints in the syslog (on Unix) or Event Viewer (on Windows).

4.2.1 Host Key Storage Formats

When the host key is received during the first connection to a remote host (or when the host key has changed) and you choose to save the key, its file name is stored in hashed format, `keys_hhh...`, where `hhh` is a hash of the host port and name. The saved file contains a hash of the host's public key. A salt is included in the hash calculations. The value of the salt is stored in the file `salt` in the same directory as the host keys (`$HOME/.ssh2/hostkeys`). The hashed host key format is a security feature to make address harvesting on the hosts difficult.

In the plain (traditional) format, the name of a host key file includes the host's name and port, as in `key_22_host.example.com.pub`, and the file contains the host's public key in plaintext format.

The storage format can be controlled with the `filename-format` attribute of the **`known-hosts`** element of the `ssh-broker-config.xml` configuration file. The attribute value must be `plain` or `hash` (default).

```
<known-hosts path="$HOME/.ssh2/hostkeys" filename-format="plain" />
```

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If you are adding the keys manually, the keys should be named with the *key_<port>_<host>.pub* pattern, where *<port>* is the port the Secure Shell server is running on and *<host>* is the host name you use when connecting to the server (for example, *key_22_alpha.example.com.pub*).

If both the hashed and plaintext format keys exist, the hashed format takes precedence.

Note that the host identification is different based on the host name and port the client is connecting to. The host name can occur in four different formats:

- Fully qualified domain name (FQDN)
- Short host name
- IPv4 address
- IPv6 address

The host key for each name format has to be saved separately, as they are not mutually exchangeable.

The host key is saved under the host name format used in the login. For example, if you want to use all the host name formats when connecting to a remote host named *alpha*, connect to the host first with the following commands and save the host key under all four names:

- `sshg3 user@alpha`

  produces the key with the short host name (in plain format `key_22_alpha.pub`)

- `sshg3 user@alpha.example.com`

  produces the key with FQDN (in plain format `key_22_alpha.example.com.pub`)

- `sshg3 user@10.1.101.10`

  produces the key with IPv4 address (in plain format `key_22_10.1.101.10.pub`)

- `sshg3 user@fd00:10:1:103::1:2f69`

  produces the key with IPv6 address (in plain format `key_22_fd00001000010103000000000012f69.pub`)

When connecting to a server using its IPv6 address, the IPv6 address given to Tectia client tools for z/OS is canonicalized without the colons, and the canonical format is used in the known host key file name. For example, the plain format host key file for `::1#10022` would be `key_10022_00000000000000000000000000000001.pub`. The canonical format is also used in the process of saving and reading hashed host keys.

Also if you need to connect to the same host but different port, your client needs a separate host key for that purpose; for example *key_22_alpha.pub* and *key_222_alpha.example.com.pub*.

After the first connection, the locally stored information about the server public key will be used in server authentication.

4.2.2 Using the System-Wide Host Key Storage

If a host key is not found in the user-specific host key directory, it is next searched from the `/opt/tectia/etc/hostkeys` directory. Host key files are not automatically put in the system-wide directory but they have to be updated manually by the system administrator.

Storing Keys in the Hashed Format

To obtain and store hashed remote host keys in the system-wide storage you can either copy the keys manually from the server to the client or you can use the **ssh-keydist-g3** tool from the client machine.

To copy the keys manually:

1. Select a client-side user whose `$HOME/.ssh2/hostkeys` will be the basis for the system-wide `/opt/tectia/etc/hostkeys`. The user should have administrative privileges, as placing the keys to the system-wide location requires them.

   The same user account must also be used to maintain the system-wide `/opt/tectia/etc/hostkeys` later on if the host key on some server changes. The process is to maintain the user's host keys in the `$HOME/.ssh2/hostkeys` directory and then replicate the changes to the system-wide `/opt/tectia/etc/hostkeys` directory.

2. Make sure that the `$HOME/.ssh2/hostkeys` directory is empty when obtaining the keys for the first time, or that the saved host keys are intentional.

   If you need to obtain new keys later, the same `$HOME/.ssh2/hostkeys/salt` file has to be used.

3. Connect with Tectia client tools for z/OS to the remote server, verify the fingerprint, and save the key.

   Repeat this step as many times as there are remote servers. Note that you do not have to complete the user authentication, only the key exchange part of the Secure Shell connection.

4. Once you have obtained all the host keys you wish to maintain in the system-wide location, place the keys to the system-wide location, for example by running the following commands:

   ```
   # mkdir /opt/tectia/etc/hostkeys
   # cp -p $HOME/.ssh2/hostkeys/* /opt/tectia/etc/hostkeys
   ```

   Note that also the salt file (`$HOME/.ssh2/hostkeys/salt`) has to be copied so that Tectia client tools for z/OS is able to identify the hashed host keys. Also if multiple users contribute to the system-wide `/opt/tectia/etc/hostkeys` directory, they have to share the same `salt` file.

After creating the system-wide location for host keys, you can maintain it by using the **ssh-keygen-g3** tool.

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The following copy examples show the most frequently needed commands for host key storage maintenance. The commands use the user-specific hostkey storages (`$HOME/.ssh2/hostkeys` and possibly the `$HOME/.ssh/known_hosts` file) as the source. If keys are to be copied from a different source, you need to append an appropriate `--hostkeys-directory` or `--hostkey-file` option to the command.

To copy the key of a new host called 'alpha' from the user-specific hostkey storage to the system-wide directory, enter command:

```
# ssh-keygen-g3 --append=no --overwrite=no \
--copy-host-id alpha /etc/ssh2/hostkeys
```

In this case, because of `--overwrite=no`, if a key for server 'alpha' already exists, the command will fail and the key will not be updated.

To add additional keys to a known host, enter command:

```
# ssh-keygen-g3 --append=yes --copy-host-id alpha /etc/ssh2/hostkeys
```

To update the key of a known host, enter command:

```
# ssh-keygen-g3 --append=no --copy-host-id alpha /etc/ssh2/hostkeys
```

To remove a host from the known hosts list, enter command:

```
# ssh-keygen-g3 --hostkeys-directory /etc/ssh2/hostkeys \
--delete-host-id alpha
```

For more detailed information on the **ssh-keygen-g3** tool, see ssh-keygen-g3(1).

To store the keys using **ssh-keydist-g3**:

1. Run **ssh-keydist-g3** with the `-g` (alias for `--accept-hostkeys-globally`) option as a privileged user on the client, for example:

   ```
   # ssh-keydist-g3 -N -i -g -A /tmp/newkeys.log host1 host2 host3#222
   ```

   The `-N` option specifies that new host keys are accepted, and `-A` specifies a log file (in this example `/tmp/newkeys.log`) listing the accepted new host keys.

   Substitute the appropriate list of host names as the command arguments.

   The `-i` option specifies that the host keys are also stored using the IP addresses of the hosts. Transparent FTP tunneling and FTP-SFTP conversion require that the keys are stored using the IP address. However, the host keys are not automatically stored using the long host name. If you want to do also that, specify the long host name in addition to the short host name as an argument for **ssh-keydist-g3**.

2. After the transfer, verify the fingerprints of the keys from the log file `/tmp/newkeys.log`.

For more information on the **ssh-keydist-g3** options, see ssh-keydist-g3(1).

Storing Keys in the Plain Format

To obtain and store traditional (plain) remote host keys in the system-wide storage you can either copy the keys manually from the server to the client or you can use the **ssh-keydist-g3** tool from the client machine.

To copy the keys manually:

1. As a server-side user, copy the `/opt/tectia/etc/hostkey.pub` file from the server as `key_<port>_<hostname>.pub` to the `/opt/tectia/etc/hostkeys/` directory on the client.

   You can do this as a non-privileged user on the server but you must be a privileged user, for example `root`, on the client.

2. Use secure means to transfer the file or verify that the fingerprint matches after the transfer with the **ssh-keygen-g3** option `-F` (or `--fingerprint`), for example on Tectia Server on Unix:

   ```
   $ ssh-keygen-g3 -F /etc/ssh2/hostkey.pub
   ```

   On the client:

   ```
   # ssh-keygen-g3 -F /opt/tectia/etc/hostkeys/key_<port>_<hostname>.pub
   ```

   Note that the identification is different based on the host and port the client is connecting to. Also connection with IP is considered a different host as well as connection to same host but different port. You can copy the same traditional `key_<port>_<hostname>.pub` to all these different names.

To store the keys using **ssh-keydist-g3**:

1. Run **ssh-keydist-g3** with the `-F plain` (`-F` is equal to `--accepted-host-key-filename-format`) and `-g` options as a privileged user on the client, for example:

   ```
   # ssh-keydist-g3 -N -F plain -g -A /tmp/newkeys.log host1 host2 host3#222
   ```

   Substitute the appropriate list of host names as the command arguments. In the example above, the following host keys are fetched:

   ```
   key_22_host1.pub
   key_22_host2.pub
   key_222_host3.pub
   ```

2. After the transfer, verify the fingerprints of the keys from the log file `/tmp/newkeys.log`.

For more information on the **ssh-keydist-g3** options, see ssh-keydist-g3(1).

4.2.3 Resolving Hashed Host Keys

Tectia client tools for z/OS includes a tool to resolve which hashed host key belongs to which server. As there can be several server host keys stored on the client-side host, and the file name does not show the server name, it is sometimes necessary to check if a certain server public key is stored on the client host.

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On the command line, the command syntax is:

```
ssh-keygen-g3 -F host_name[#port]
```

For example:

```
ssh-keygen-g3 -F examplehost#222
```

The *host_name* can be the fully qualified domain name, short host name, or the IP address of the remote host. The *port* definition is optional in the command. If no port is given, the default Secure Shell port 22 is assumed.

The tool shows the location, fingerprint (in the SSH babble format) and type (RSA, DSA or ECDSA) of the requested host's public key or keys. For example:

```
ssh-keygen-g3 -F examplehost
Fingerprint for key 'examplehost':
  (from location
   /home/user44/.ssh2/hostkeys/keys_bf53882dc47bb767edf161a4f636917f8358d635)
xuvin-zitil-ducid-gevil-vysok-buviz-nynun-pinat-tylev-gusez-dyxix (RSA)
```

If no keys are found for the given server, the **ssh-keygen-g3** `-F` command will report where it looked for the keys, and will conclude as follows:

```
/ No keys found from any key directories or known_hosts files.
```

You can define several file locations to be checked for host keys. For more information, see Section 4.2.4.

4.2.4 Using the OpenSSH `known_hosts` File

Tectia client tools for z/OS supports also the OpenSSH-style `known_hosts` file that contains the public key data of known server hosts, and reads the file by default from the default location, from the user-specific file `$HOME/.ssh/known_hosts` or from the system-wide file `/etc/ssh/ssh_known_hosts`. Both hashed and plain-format host keys are supported.

In case you wish to define other files to be used for the known host keys, you can specify the files in the Connection Broker configuration file `ssh-broker-config.xml` by using the **`known-hosts`** element. Several file locations can be defined to be checked for known host keys, and the Connection Broker will read them in the order they are defined in the `ssh-broker-config.xml` file. Since the configuration file settings will override the default behavior, you need to define also the default locations of the OpenSSH-style `known_hosts` file, in case you want them all to be read. For example:

```
<general>
  ...
  <known-hosts path="/home/username/.ssh/known_hosts" />
  <known-hosts path="/etc/ssh/ssh_known_hosts" />
  <known-hosts path="/home/.ssh2/hostkeys" />
  <known-hosts path="/u/username/.ssh2/hostkeys" />
</general>
```

You can disable OpenSSH `known_hosts` file handling by defining an empty setting: `known-hosts path=""`. After this, only the Tectia-related hostkey directories will be used.

The OpenSSH `known_hosts` file is never automatically updated by Tectia client tools for z/OS. New host keys are always stored in the Tectia `$HOME/.ssh2/hostkeys` directory or in the directory configured as the last one in `ssh-broker-config.xml`. See **`known-hosts`** for details.

4.3 Server Authentication with Certificates

Server authentication with certificates happens similarly to server authentication with public keys, except that the possibility of a man-in-the-middle attack during the first connection to a particular server is eliminated. The signature of a certification authority in the server certificate guarantees the authenticity of the server certificate even in the first connection.

A short outline of the server authentication process with certificates is detailed below:

1. The server sends its certificate (which contains a public key) to the client. The packet also contains random data unique to the session, signed by the server's private key.

2. As the server certificate is signed with the private key of a certification authority (CA), the client can verify the validity of the server certificate by using the CA certificate.

3. The client checks that the certificate matches the name or the IP address of the server. When endpoint identity check is enabled in the Connection Broker configuration (in the `ssh-broker-config.xml` file with the **`cert-validation`** attribute `end-point-identity-check`) the client compares the server's host name or IP address to the Subject Name or Subject Alternative Name (DNS Address) specified in the server certificate.

   If endpoint identity check is disabled in the Connection Broker configuration, the fields in the server host certificate are not verified and the certificate is accepted based on the validity period and CRL check only.

   Caution

   Disabling the endpoint identity check on the client is a security risk. Then anyone with a certificate issued by the same trusted CA that issues the server host certificates can perform a man-in-the-middle attack on the server.

   Endpoint identity check can also be configured to make Tectia client tools for z/OS ask the user to either accept or cancel the connection if the server's host name does not match the one in the certificate.

4. The client verifies that the server has a valid private key by checking the signature in the initial packet.

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During authentication the system checks that the certificate has not been revoked. This can be done either by using the Online Certificate Status Protocol (OCSP) or a certificate revocation list (CRL), which can be published either in an LDAP or HTTP repository.

OCSP is automatically used if the certificate contains a valid **Authority Info Access** extension, or an OCSP responder has been separately configured. If no OCSP responder is defined or the OCSP connection fails, CRLs are used. If LDAP is used as the CRL publishing method, the LDAP repository location can also be defined in the `ssh-broker-config.xml` file.

Tectia Server for IBM z/OS includes two implementations of certificate authentication. One is based on keys and X.509 certificates in files and software cryptography. This is the same implementation that is available in Tectia products on other platforms. The other implementation is based on keys and certificates managed by the z/OS System Authorization Facility (SAF) and cryptographic operations handled by the z/OS Integrated Cryptographic Service Facility (ICSF).

The Tectia validation can use CA certificates stored in file (Section 4.3.1) or in SAF (Section 4.3.2), or the SAF validation can be used alone (Section 4.3.3).

SAF Validation

SAF does a limited form of certificate checking that only determines which SAF user is the owner of the certificate. SAF does not check the contents of the certificate, such as the validity period, or check for certificate revocation. Instead of revoking a certificate the site can reduce the user's access rights in SAF.

A trusted key provider must be configured under `general/known-hosts/`**`key-store`** if (only) SAF certificate checking is to be used. If at least one of these elements is configured, SAF validation will be used and Tectia validation will not be used.

To enable SAF checking of remote Secure Shell servers, their certificates can be entered into SAF as SITE keys and placed on a key ring for the trusted key provider.

Tectia Certificate Validation

The Tectia Certificate Validator does a full validation of the certificate and can be configured to use external PKI services such as LDAP servers that store revocation information.

When a trusted key provider is configured under `general/cert-validation/`**`key-store`**, the Tectia Certificate Validator takes its trusted CA certificates from SAF, otherwise they are read from files.

4.3.1 CA Certificates Stored in File

To configure the client to trust the server's certificate by using CA certificates stored in a file, perform the following tasks. Replace the names and IDs with those appropriate to your system:

1. Copy the CA certificate(s) to the client machine. You can either copy the X.509 certificate(s) as such, or you can copy a PKCS #7 package including the CA certificate(s).

   Certificates can be extracted from a PKCS #7 package by specifying the `-7` option with **ssh-keygen-g3**.

2. Define the CA certificate(s) to be used in host authentication in the `ssh-broker-config.xml` file under the `general` element:

```
<cert-validation end-point-identity-check="yes"
                 socks-server-url="socks://fw.example.com:1080">
  <ldap-server address="ldap://ldap.example.com:389" />
  <ocsp-responder url="http://ocsp.example.com:8090" validity-period="0" />
  <ca-certificate name="ssh_ca1"
                  file="ssh_ca1.crt"
                  disable-crls="no"
                  use-expired-crls="100" />
</cert-validation>
```

   The client will only accept certificates issued by the defined CA(s).

   You can disable the use of CRLs by setting the `disable-crls` attribute of the **`ca-certificate`** element to `"yes"`.

   Note

   CRL usage should only be disabled for testing purposes. Otherwise it is highly recommended to always use CRLs.

   Define also the LDAP server(s) or OCSP responder(s) used for CRL checks. If the CA services (OCSP, CRLs) are located behind a firewall, define also the SOCKS server.

   Defining the LDAP server is not necessary if the CA certificate contains a `CRL Distribution Point` or an `Authority Info Access` extension.

3. Setting the certificate authentication method either under default settings (`default-settings/server-authentication-methods`) or per connection profile (`profiles/profile/server-authentication-methods`) defines that the server must authenticate with a certificate or else the authentication will fail.

```
<server-authentication-methods>
  <auth-server-certificate />
</server-authentication-methods>
```

For more information on the configuration file options, see ssh-broker-config(5).

4.3.2 CA Certificates Stored in SAF

To configure the client to trust the server's SAF certificate by using Tectia validation, perform the following tasks. Replace the names and IDs with those appropriate to your system:

1. Get the CA certificate and store it to a data set, for example `'HOSTCA.CRT'`.

2. To add the CA certificate into SAF, give the following TSO commands:

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```
RACDCERT CERTAUTH ADD('HOSTCA.CRT') TRUST WITHLABEL('HOSTCA')
RACDCERT ID(SSHD2) ADDRING(SSH-HOSTCA)
RACDCERT ID(SSHD2) CONNECT(ID(SSHD2) CERTAUTH LABEL('HOSTCA')
  RING(SSH-HOSTCA) USAGE(CERTAUTH))
RACDCERT ID(SSHD2) LISTRING(SSH-HOSTCA)
```

3. For the settings to take effect, give the following TSO command:

```
SETROPTS RACLIST(DIGTCERT) REFRESH
```

4. Define the z/OS SAF external key provider that contains the CA certificates in the `general/cert-validation/`**`key-store`** element:

```
<cert-validation end-point-identity-check="yes"
             socks-server-url="socks://fw.example.com:1080">
  <ldap-server address="ldap://ldap.example.com:389" />
  <ocsp-responder url="http://ocsp.example.com:8090" validity-period="0" />
  <key-store type="zos-saf"
             init="KEYS(ID(SSHD2) RING(SSH-HOSTCA)) TRUST-ANCHORS"
             disable-crls="no"
             use-expired-crls="0" />
</cert-validation>
```

   Define also the LDAP server(s) or OCSP responder(s) used for CRL checks. If the CA services (OCSP, CRLs) are located behind a firewall, define also the SOCKS server.

   Defining the LDAP server is not necessary if the CA certificate contains a `CRL Distribution Point` or an `Authority Info Access` extension.

5. Setting the certificate authentication method either under default settings (`default-settings/server-authentication-methods`) or per connection profile (`profiles/profile/server-authentication-methods`) defines that the server must authenticate with a certificate or else the authentication will fail.

```
<server-authentication-methods>
  <auth-server-certificate />
</server-authentication-methods>
```

For more information on the configuration file options, see ssh-broker-config(5). For information on the format of the external key initialization string, see the section called “Key Store Configuration Examples”.

4.3.3 Server Certificates Stored in SAF

Note

If there is at least one `general/known-hosts/key-store` element configured, SAF validation will be used and Tectia validation will not be used. This is different from Tectia Server for IBM z/OS

version 5.x, where you could specify `saf,tectia`, and both validations were performed and both had to succeed.

To configure the client to trust the server's SAF certificate by using SAF validation only, perform the following tasks. Replace the names and IDs with those appropriate to your system:

1. Get the server host certificate and store it to a data set, for example `'SERVER1.CRT'`.

2. To add the server certificate into SAF, give the following TSO commands:

```
RACDCERT ID(USER) ADD('SERVER1.CRT') TRUST WITHLABEL('SERVER1')
RACDCERT ID(USER) ADDRING(SSH-HOSTKEYS)
RACDCERT ID(USER) CONNECT(ID(USER) LABEL('SERVER1') RING(SSH-HOSTKEYS)
  USAGE(PERSONAL))
RACDCERT ID(USER) LISTRING(SSH-HOSTKEYS)
```

3. For the settings to take effect, give the following TSO command:

```
SETROPTS RACLIST(DIGTCERT) REFRESH
```

4. Define the z/OS SAF external key provider that contains the server host certificates in the `general/known-hosts/`**`key-store`** element:

```
<known-hosts>
...
  <key-store type="zos-saf"
             init="KEYS(ID(USER) RING(SSH-HOSTKEYS))" />
</known-hosts>
```

For more information on the configuration file options, see ssh-broker-config(5). For information on the format of the external key initialization string, see the section called “Key Store Configuration Examples”.

4.4 User Authentication with Passwords

The password authentication method is the easiest to implement, as it is set up by default. Since all communication is encrypted, passwords are not available for eavesdroppers.

To enable password authentication on the client, the `authentication-methods` element of the `ssh-broker-config.xml` file must contain an `auth-password` element:

```
<authentication-methods>
...
  <auth-password />
</authentication-methods>
```

Other authentication methods can be listed in the configuration file as well. Place the least interactive method first (password is usually the last one).

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4.4.1 Password Stored in a File or Data Set

Password authentication normally requires user interaction. For situations where user interaction is not possible, for example when running Tectia client programs from JCL, you can have the password stored in a file or data set.

With **sshg3**, **scpg3**, and **sftpg3**, use the `--password=file://FILE` option to provide the password. With **ssh-keydist-g3**, use the `--password-file FILE` option to provide the password.

Note

When storing a password in a file or data set, make sure that the access permissions are correct.

For non-interactive batch jobs, we recommend that you use public-key authentication without a passphrase, or host-based authentication. These methods provide more security than a password stored in a file.

Password Stored in a File

To set up authentication with a password stored in a file:

1. Create a file, for example `/home/userid/passwd_file`.
2. The file must be readable to the user that created it only:

   ```
   $ chmod 600 /home/userid/passwd_file
   ```

3. Edit the file with your favorite text editor to contain one line with your password on the remote system, for example:

   ```
   MyPasS
   ```

To use the password stored in a file, for example with **sftpg3**, run the following:

```
$ sftpg3 --password=file:///home/userid/passwd_file
```

Password Stored in a Data Set

To set up authentication with password stored in a data set:

1. Allocate a data set or a data set member, for example:

   ```
   //'USERID.PASSWD'
   ```

2. Make sure that the data set is accessible only by the correct user ID.
3. Edit the password data set to contain your password on the remote system. The format of the password data set is one line containing only the password. For example:

```
MyPasS
```

To use the password stored in a data set, for example with **sftpg3**, run the following:

```
$ sftpg3 --password=file://"//'USERID.PASSWD'"
```

4.5 User Authentication with Public Keys in a File

Public-key authentication is based on the use of digital signatures. Each user creates a pair of key files. One of these key files is the user's public key, and the other is the user's private key. The server knows the user's public key, and only the user has the private key.

The key files must be stored in a location where the user has the `write` rights, (and `read` rights), but that is not accessible to others. These user-specific rights are required for the `key.pub` file, the `authorized_keys` directory, and for the `authorization` file, if used.

When the user tries to authenticate, the client sends a signature to the server, and the server checks for matching public keys. If the key is protected with a passphrase, the server requests the user to enter the passphrase.

Caution

Do not store your private keys in a location accessible to other users.

To use public-key authentication with Tectia client tools for z/OS, do the following actions:

1. Generate a key pair with **ssh-keygen-g3** (see Section 4.5.1).
2. Upload your public key to the remote host computer (see Section 4.5.2).

For instructions on using public-key authentication to connect from other hosts to Tectia Server for IBM z/OS, see Section 10.1.

In the instructions in the following sections,

- `Server` is the remote host running the Secure Shell server that you are trying to connect to.
- `ServerUser` is the user name on `Server` that you are logging in as.
- `Client` is the host running the Secure Shell client (Tectia client tools for z/OS).
- `ClientUser` is the user name on `Client` that should be allowed to log in to `Server` as `ServerUser`.

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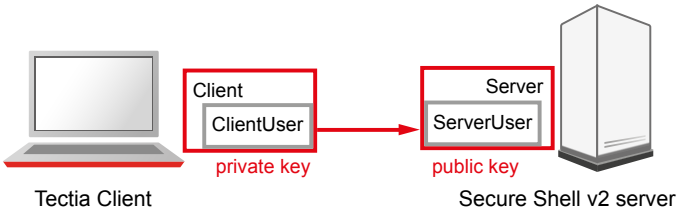

Figure 4.2. User public-key authentication

The instructions assume that `ClientUser` is allowed to log in to `Server` as `ServerUser` using some other authentication method (usually password).

4.5.1 Creating Keys with ssh-keygen-g3 on z/OS

To create a public key pair, run **ssh-keygen-g3** on `Client`:

```
$ ssh-keygen-g3
Generating 2048-bit rsa key pair
   9 oOo.oOo.oOo
Key generated.
2048-bit rsa, ClientUser@Client, Wed Feb 2 2016 12:09:46 +0200
Passphrase :
Again :
Private key saved to  /home/ClientUser/.ssh2/id_rsa_2048_a
Public key saved to   /home/ClientUser/.ssh2/id_rsa_2048_a.pub
```

When run without options, **ssh-keygen-g3** asks for a passphrase for the new key. Enter a sufficiently long (20 characters or so) sequence of any characters (spaces are OK).

The new authentication key pair consists of two separate files. One of the keys is your private key which must *never* be made available to anyone but yourself. The private key can only be used together with the passphrase.

The key pair is by default stored in your `$HOME/.ssh2` directory (created by **ssh-keygen-g3** if it does not exist previously).

In the example above, the private key file is `id_rsa_2048_a`. The public key file is `id_rsa_2048_a.pub`, and it can be distributed to other computers.

By default, **ssh-keygen-g3** creates a 2048-bit RSA key pair. DSA or ECDSA keys can be generated by specifying the `-t` option with **ssh-keygen-g3**. Key length can be specified with the `-b` option. For automated jobs, the key can be generated without a passphrase with the `-P` option, for example:

```
$ ssh-keygen-g3 -t ecdsa -b 384 -P
```

For more information on the **ssh-keygen-g3** options, see ssh-keygen-g3(1).

4.5.2 Uploading Public Keys from z/OS to Remote Host

All commands in this section are shown using **sshg3** and **scpg3** from the machine running Tectia client tools for z/OS. Server-side configuration can also be done by logging in to the remote server and entering the commands locally.

To enable public-key authentication with your key pair:

1. Place your keys in a directory where the Connection Broker can locate them.

   By default, the Connection Broker attempts to use each key found in the `$HOME/.ssh2` directory.

   You can also add other directory locations for keys using the `general/key-stores/key-store` element in the `ssh-broker-config.xml` file. See the section called "Key Store Configuration Examples".

2. (*Optional*) Create an identification file.

   Using the `identification` file is not necessary if all your keys are stored in the default directory and you allow all of them to be used for public-key and/or certificate authentication. If the `identification` file does not exist, the Connection Broker attempts to use each key found in the default directory. If the `identification` file exists, the keys listed in it are attempted first.

   Create a file called `identification` in your `$HOME/.ssh2` directory, for example:

   ```
   $ cd $HOME/.ssh2
   $ echo "IdKey id_rsa_2048_a" >> identification
   ```

   You now have an identification file that consists of one line that denotes the file containing your private key:

   ```
   IdKey       id_rsa_2048_a
   ```

   The identification file can contain several key IDs. For more information on the syntax of the identification file, see `$HOME/.ssh2/identification`.

3. Connect to `Server` using some other authentication method and create a `.ssh2` (and `.ssh2/authorized_keys`), or a `.ssh` directory under your home directory if it does not exist already.

   Depending on the server version the remote host is running, run one of the following commands:

   - Tectia Server on Unix or z/OS:

     ```
     $ sshg3 ServerUser@tectia_server mkdir .ssh2
     ```

     If you do not want to use an authorization file on Tectia Server 5.x or later on Unix, create also the `authorized_keys` directory:

     ```
     $ sshg3 ServerUser@tectia_unix mkdir .ssh2/authorized_keys
     ```

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- Tectia Server on Windows:

```
$ sshg3 ServerUser@tectia_win "cmd /c mkdir .ssh2"
```

If you do not want to use an authorization file on Tectia Server 5.x or later on Windows, create also the `authorized_keys` directory:

```
$ sshg3 ServerUser@tectia_win "cmd /c mkdir .ssh2/authorized_keys"
```

- OpenSSH server on Unix or z/OS:

```
$ sshg3 ServerUser@open_server mkdir .ssh
```

4. Copy the public key to `Server`.

Keys created with **ssh-keygen-g3** on z/OS are stored in the EBCDIC format. When the public key is transferred to a Unix or Windows server, it must be converted to ASCII format. This can be done by specifying the `-a` option with **scpg3**.

If public-key authentication is configured between mainframe servers, conversion is not needed.

Depending on the server version the remote host is running, do one of the following actions:

- Tectia Server 5.x or later on Unix and Windows:

Use SCP to upload your public key to the server, to your `authorized_keys` directory (by default `$HOME/.ssh2/authorized_keys` on Unix servers, or `%USERPROFILE%\.ssh2\authorized_keys` on Windows servers):

```
$ scpg3 -a id_rsa_2048_a.pub ServerUser@tectia_server:.ssh2/authorized_keys/
```

- Tectia Server 4.x on Unix and Windows:

Use SCP to upload your public key to the server (by default to the `$HOME/.ssh2` directory on Unix and to the `%USERPROFILE%\.ssh2` directory on Windows servers):

```
$ scpg3 -a id_rsa_2048_a.pub ServerUser@tectia4x_server:.ssh2/
```

- Tectia Server for IBM z/OS:

Use SCP to upload your public key to the server (by default to the `$HOME/.ssh2` directory):

```
$ scpg3 id_rsa_2048_a.pub ServerUser@tectia_zos:~/.ssh2/
```

- OpenSSH server on Unix:

Use SCP to upload your public key to the server, to your `$HOME/.ssh` directory:

```
$ scpg3 -a id_rsa_2048_a.pub ServerUser@open_unix:.ssh/
```

- OpenSSH server on z/OS:

  Use SCP to upload your public key to the server, to your `$HOME/.ssh` directory:

  ```
  $ scpg3 -a id_rsa_2048_a.pub ServerUser@open_zos:.ssh/
  ```

5. Create an `authorization` or `authorized_keys` file on `Server`.

   Depending on the server version the remote host is running, do one of the following actions:

   - Tectia Server 5.x or later on Unix and Windows do not require an authorization file if the public keys are stored in the user's `authorized_keys` directory. However, an authorization file may be optionally used. See instructions for creating the file below in the Tectia Server 4.x information.

   - Tectia Server 4.x on Unix and Windows and Tectia Server for IBM z/OS require an `authorization` file stored in the user's `.ssh2` directory. The authorization file specifies the public keys that are authorized for login.

     Add the key entry to the authorization file. On a Unix or z/OS server:

     ```
     $ sshg3 ServerUser@tectia_server "echo Key id_rsa_2048_a.pub >> \
     .ssh2/authorization"
     ```

     On a Windows server:

     ```
     $ sshg3 ServerUser@tectia4x_win "cmd /c echo Key id_rsa_2048_a.pub >> \
     .ssh2\authorization"
     ```

     An example authorization file is shown below (by default `$HOME/.ssh2/authorization` on Unix and z/OS servers, and `%USERPROFILE%\.ssh2\authorization` on Windows servers):

     ```
     Key     id_rsa_2048_a.pub
     ```

     This directs Tectia Server to use `id_rsa_2048_a.pub` as a valid public key when authorizing your login.

   - OpenSSH server requires that the public key is converted to the OpenSSH public-key file format and stored in the `authorized_keys` file in the user's `.ssh` directory.

     Convert the public key to the OpenSSH public-key file format on the server and append it to your `$HOME/.ssh/authorized_keys` file. This can be done with a remote command on an OpenSSH server as follows:

     ```
     $ sshg3 ServerUser@open_server "ssh-keygen -i -f .ssh/id_rsa_2048_a.pub >> \
     .ssh/authorized_keys"
     ```

6. Make sure that public-key authentication is enabled in the `ssh-broker-config.xml` file (it is enabled by default).

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```
<authentication-methods>
  <auth-publickey />
...
</authentication-methods>
```

Other authentication methods can be listed in the configuration file as well. Place the least interactive method first.

Assuming `Server` is configured to allow public-key authentication to your account, you should now be able to log in from `Client` to `Server` using public-key authentication.

Try to log in:

```
Client$ sshg3 Server
```

You should be prompted for the passphrase of the private key. After you have entered the passphrase, a Secure Shell connection will be established.

4.5.3 Using Keys Generated with OpenSSH

Tectia client tools for z/OS supports also user key pairs generated with OpenSSH. The OpenSSH keys can be specified in the `ssh-broker-config.xml` file by using the **`key-stores`** element. An example configuration is shown below:

```
<key-stores>
  <key-store type="software"
             init="key_files(/home/exa/keys/id_rsa.pub,/home/exa/keys/id_rsa)" />
  <key-store type="software"
             init="directory(path(/home/exa/.ssh))" />
</key-stores>
```

This example adds a key called `id_rsa` and all keys from the user's default OpenSSH key directory (`.ssh` under the user's home directory).

The public key can be uploaded to the server the same way as with standard SSH2 keys. See Section 4.5.2.

4.6 User Authentication with Certificates

Certificate authentication is technically a part of the public-key authentication method. The signature created with the private key and the verification of the signature using the public key (contained in the X.509 certificate when doing certificate authentication) are done identically with conventional public keys and certificates. The major difference is in determining whether a specific user is allowed to log in with a specific public key or certificate. With conventional public keys, every server must have every user's public key, whereas with certificates the users' public keys do not have to be distributed to the servers - distributing the public key of the CA (self-signed certificate) is enough.

In brief, certificate authentication works as follows:

1. The client sends the user certificate (which includes the user's public key) to the server. The packet also contains data unique to the session and it is signed by the user's private key.

2. The server uses the CA certificate (and external resources as required) to check that the user's certificate is valid.

3. The server verifies that the user has a valid private key by checking the signature in the initial packet.

4. The server matches the user certificate against the rules in the server configuration file to decide whether login is allowed or not.

The Tectia Server for IBM z/OS client programs use SAF certificates when the configuration includes certificate authentication and a private key provider. The configuration specifies which keys and certificates the client will offer.

When using a certificate, the client can start authentication without presenting a user name. If the user name given by the user matches the value of the `IdentityDispatchUsers` option in the server configuration, the name retrieved from SAF will be used. However, it is not allowed to change the user ID during the authentication process. For example, if the server requires first certificate authentication and then password authentication, the user must give the password for the user that SAF determines from the certificate.

4.6.1 Certificates Stored in File

To configure the client to authenticate itself with an X.509 certificate, perform the following tasks:

1. Enroll a certificate for yourself. This can be done, for example, with the **ssh-cmpclient-g3** or **ssh-scep-client-g3** command-line tools.

   Example: Key generation and enrollment using **ssh-cmpclient-g3**:

   ```
   $ ssh-cmpclient-g3 INITIALIZE
   -P generate://ssh2:passphrase@rsa:2048/user_rsa \
   -o /home/user/.ssh2/user_rsa -p 62154:ssh \
   -s 'C=FI,O=SSH,CN=user;email=user@example.org' \
   -S http://fw.example.com:1080 http://pki.example.com:8080/pkix/ \
   'C=FI, O=SSH, CN=Test CA 1'
   ```

2. Place your keys and certificates in a directory where the Connection Broker can locate them.

   By default, the Connection Broker attempts to use each key found in the `$HOME/.ssh2` directory.

   You can also add other directory locations for keys using the `general/key-stores/key-store` element in the `ssh-broker-config.xml` file. See the section called “Key Store Configuration Examples”.

3. (*Optional*) Create an identification file.

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Using the `identification` file is not necessary if all your keys are stored in the default directory and you allow all of them to be used for public-key and/or certificate authentication. If the `identification` file does not exist, the Connection Broker attempts to use each key found in the default directory. If the `identification` file exists, the keys listed in it are attempted first.

Specify the private key of your software certificate in the `$HOME/.ssh2/identification` file (the `CertKey` option works identically with the `IdKey` option):

```
CertKey     user_rsa
```

The certificate itself will be read from `user_rsa.crt`.

For more information on the syntax of the identification file, see `$HOME/.ssh2/identification`.

4. Make sure that public-key authentication is enabled in the `ssh-broker-config.xml` file (it is enabled by default).

```
<authentication-methods>
  <auth-publickey />
...
</authentication-methods>
```

Other authentication methods can be listed in the configuration file as well. Place the least interactive method first.

4.6.2 Certificates Stored in SAF

To use SAF certificates for user authentication, do the following steps. Replace the names and IDs with those appropriate to your system:

1. To create a user key in SAF, give the following TSO commands:

```
RACDCERT ID(USER) GENCERT SUBJECTSDN(CN('User') OU('RD') O('EXAMPLE'))
  SIZE(1024) WITHLABEL('USER')
RACDCERT ID(USER) LIST
```

2. Give the following TSO command to generate the certification request:

```
RACDCERT ID(USER) GENREQ(LABEL('USER')) DSN('USER.CRT.REQ')
```

3. Use the PKCS #10 certification request in the data set `'USER.CRT.REQ'` to enroll the certificate. The actual steps depend on your CA setup.

4. After the enrollment is completed, store the received certificate to a data set, for example `'USER.CRT'`.

5. To connect the new certificate to a key ring, give the following TSO commands:

```
RACDCERT ID(USER) ADD('USER.CRT') TRUST WITHLABEL('USER')
RACDCERT ID(USER) ADDRING(USER)
```

```
RACDCERT ID(USER) CONNECT(ID(USER) LABEL('USER') RING(USER)
  USAGE(PERSONAL))
RACDCERT ID(USER) LISTRING(USER)
```

6. For the settings to take effect, give the following TSO command:

```
SETROPTS RACLIST(DIGTCERT) REFRESH
```

7. Define the z/OS SAF external key provider and its initialization string with the `general/key-stores/key-store` element in the `ssh-broker-config.xml` file:

```
<key-stores>
 <key-store type="zos-saf"
            init="KEYS(ID(%U) RING(%U))" />
</key-stores>
```

The initialization string can contain special strings in the key specification that are mapped according the following list:

- `%U` = user name
- `%IU` = user ID
- `%IG` = user group ID

8. Make sure that public-key authentication is enabled in the `ssh-broker-config.xml` file (it is enabled by default).

```
<authentication-methods>
  <auth-publickey />
...
</authentication-methods>
```

Other authentication methods can be listed in the configuration file as well. Place the least interactive method first.

For more information on the configuration file options, see ssh-broker-config(5). For information on the format of the external key initialization string, see the section called “Key Store Configuration Examples”.

4.7 Host-Based User Authentication

Host-based authentication uses the public host key of the client machine to authenticate a user to the remote server. The remote Secure Shell server can be either a Unix, Windows, or z/OS server.

Setting up host-based authentication usually requires administrator (root) privileges on the server. The setup is explained in the *Tectia Server for IBM z/OS Administrator Manual*.

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4.8 User Authentication with Keyboard-Interactive

Keyboard-interactive is a generic authentication method that can be used to implement different types of authentication mechanisms. Any currently supported authentication method that requires only the user's input can be performed with keyboard-interactive.

The supported submethods of keyboard-interactive depend on the Secure Shell server. Commonly supported submethods include password, RSA SecurID, RADIUS, and PAM authentication.

Note

The client cannot request any specific keyboard-interactive submethod if the server allows several optional submethods. The order in which the submethods are offered depends on the server configuration. However, if the server allows, for example, the two optional submethods SecurID and password, the user can skip SecurID by pressing enter when SecurID is offered by the server. The user will then be prompted for a password.

To enable keyboard-interactive authentication on Tectia client tools for z/OS, make sure that you have the following line in the `ssh-broker-config.xml` file:

```
<authentication-methods>
...
  <auth-keyboard-interactive />
...
</authentication-methods>
```

4.9 Distributing Public Keys Using the Key Distribution Tool

File transfer processing on mainframes is usually non-interactive. This means that the host keys of the remote servers must be stored in a way that user interaction is not needed during the batch process, and that both users and processes use non-interactive authentication methods for user authentication.

You can use **/opt/tectia/bin/ssh-broker-ctl** to fetch remote-host keys. Then use the key-distribution tool **/opt/tectia/bin/ssh-keydist-g3** for storing multiple remote host keys to user-specific or common key store and setting up public-key authentication to multiple hosts.

For more information about the **ssh-broker-ctl probe-key** and **ssh-keydist-g3** options, see ssh-broker-ctl probe-key(1) and ssh-keydist-g3(1) respectively.

Most of the examples in this section are executed from Unix shell (for example, OMVS shell), but the same commands can also be run in JCL using `BPXBATCH`.

4.9.1 Fetching Remote Server Keys

Tectia client tools for z/OS must have the remote server public keys or public key hash values available in order to authenticate the remote server they are connecting to. The keys or key hash values can be stored in the mainframe user's `$HOME/.ssh2/hostkeys` directory or in the `/opt/tectia/etc/hostkeys` directory which is common for all the users. The key distribution tool can be used to retrieve multiple remote host keys and store the keys or key hash values to the user's host key directory or to the system-wide key store that is available for all the users.

For more information about hashed host key format, see Section 4.2.1.

Note

We recommend using **ssh-broker-ctl** for fetching remote server keys. **ssh-keydist-g3** key fetching is being obsoleted.

Examples of Fetching Remote Server Keys

The following examples illustrate using commands **ssh-keydist-g3** and **ssh-broker-ctl probe-key** for fetching remote server host keys.

Caution

When **ssh-keydist-g3** is run with the `-N` (alias for `--accept-host-keys`) option, it accepts the received host keys automatically without prompting the user. You should verify the validity of keys after receiving them or you risk being subject to a man-in-the-middle attack. Similar risk is also applied to **ssh-broker-ctl probe-key**.

Example 1: ssh-keydist-g3 Using USS

This example is run under the USS shell. Multiple host keys are fetched in verbose mode and saved in plain format under the user's `$HOME/.ssh2/hostkeys` directory. The host keys are also saved using the IP addresses of the hosts. The log is stored under `/tmp`. The log will list the accepted keys and their fingerprints. You should verify them after running the command.

```
$ ssh-keydist-g3 --verbose --accept-host-keys --accept-host-keys-also-by-ip \
--accepted-host-key-filename-format plain \
--accepted-host-key-log /tmp/newhosts.log \
host1 host2 host3
```

Example 2: ssh-keydist-g3 Using JCL

This example `HOSTSAVE` from `<HLQ>.V681.SAMPLIB` presents a JCL script that does the same steps as the USS command in Example 1 above (the options are given in short format):

```
//HOSTSAV EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM  DD  *
```

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```
PGM /opt/tectia/bin/ssh-keydist-g3
  -v -N -F plain -i -A /tmp/newhosts.log
  host1 host2 host3
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//*
```

Example 3: ssh-broker-ctl Using USS

For example, adding the host key of `server.example.com`:

```
$ ssh-broker-ctl probe-key --add-hostkey server.example.com#22
```

You may provide the expected fingerprint of the host key with `--hostkey-fp`. In this case, the host key is only added if its fingerprint matches what you provided with `--hostkey-fp`:

```
$ ssh-broker-ctl probe-key \
--hostkey-fp=bffe87e2469e4e2025ff6893dbe1e31f9b2f32ae \
--add-hostkey server.example.com#22

Server hostkey: 256 bit ecdsa key
SHA-1: bffe87e2469e4e2025ff6893dbe1e31f9b2f32ae
xitod-vecev-bocyn-vybad-bemaz-zepan-fikae-cumyc-zeked-zysup-dafyx
Server hostkey saved.
```

Example 4: ssh-broker-ctl Using JCL

You can also use ssh-broker-ctl via JCL, similar to the following:

```
//HOSTSAVF JOB ,,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//             NOTIFY=&SYSUID
//*
//* HOSTSAF - Store host keys of remote Secure Shell servers
//*
//* Copyright (c) 2019 SSH Communications Security Corporation.
//* This software is protected by international copyright laws.
//*                    All rights reserved.
//*
//* This example uses the ssh-broker-ctl utility to fetch and
//* store the host keys of remote Secure Shell servers.
//*
//* This example:
//* - Connects to remote Secure Shell servers host1, host2, and host3
//*   and saves the host keys in plain format under the user's USS
//*   home directory $HOME/.ssh2/hostkeys/. The host keys are also
//*   saved using the IP addresses of the hosts.
//*
//* Required SSHENV environment variables are defined using
//* the STDENV DD card.
//* Modify the DD statement according to your environment.
```

```
//*
//*
//        EXPORT SYMLIST=*
//SAVEKEY PROC HOST=,PORT=22
//HOSTSAV EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM  DD  *,SYMBOLS=JCLONLY
PGM /opt/tectia/bin/ssh-broker-ctl probe-key
  --write-key=.ssh2/hostkeys/key_&PORT._&HOST..pub
  &HOST.#&PORT
//STDENV   DD  *
_BPX_BATCH_UMASK=0077
//         DD  DSN=<HLQ>.V669.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//        PEND
//SAVE1    EXEC SAVEKEY,HOST='host1'
//SAVE2    EXEC SAVEKEY,HOST=12.34.56.78,
//             PORT=12345
//SAVE3    EXEC SAVEKEY,HOST='host3'
//*
```

Example 5: Saving Multiple Server Host Keys for one IP address

In the use case where one has multiple servers behind one IP address, for example, behind a load balancer.

You will need the host keys from all the servers behind that one IP address and copy those into one file. If you can connect directly to all servers, you can fetch the keys:

```
$ ssh-broker-ctl probe-key --write-hostkey=key_22_server1_address.pub server1_address
$ ssh-broker-ctl probe-key --write-hostkey=key_22_server2_address.pub server2_address
```

You can then merge the keys:

```
$ cat key_22_server1_address.pub key_22_server2_address.pub >> key_22_load_balancer_fqdn.pub
```

The Connection Broker will then select the correct server host key found in the merged file for the connection.

4.9.2 Distributing Mainframe User Keys

Administrators and other people can use passwords or public-key pairs with a passphrase-protected private key to access remote machines with Tectia clients from a Telnet or Secure Shell session. They can also use public-key pairs with a null passphrase if they want to run the Tectia client programs in JCL.

Mainframe batch users are accounts that represent applications or subsystems, not people. They are set up with public-key pairs with a null passphrase to enable non-interactive access through JCL to remote servers. One key pair is generated for each batch user. If the batch user has a shared home directory, the key is placed in the shared `$HOME/.ssh2` directory, otherwise it is copied to the user's home directories on all the LPARs.

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When **ssh-keygen-g3** is run with the `-P` option, which requests a null passphrase, it can be run in JCL. It must be run under the batch user's user ID in order for the file permissions to be set properly. For more information on the **ssh-keygen-g3** options, see ssh-keygen-g3(1).

The batch user accesses the remote machine using an account created and administered on the remote machine. The remote user name may either be the same as the batch user's RACF user ID, or the same but in lower case, or a different user name. Several batch users may use the same remote account. One batch user may use separate accounts on one remote machine for different accesses.

Each batch user's public key must be distributed to all the remote accounts it will be accessing. The way the public key is set up differs between Tectia and OpenSSH. The **ssh-keydist-g3** script must be told which type of server the remote machine has. The server must be running when **ssh-keydist-g3** is run.

ssh-keydist-g3 uses password authentication for this initial access to the remote server. The password for the remote account can be entered in a data set or in a file. See the section called "Password Stored in a File" and the section called "Password Stored in a Data Set" for instructions. The file name is entered as one of the options in the **ssh-keydist-g3** command.

The other options needed on the **ssh-keydist-g3** command line are the remote account user name, the remote host DNS name or IP address, and the type of the remote Secure Shell server (Tectia Server on Unix, Tectia Server on Windows, Tectia Server for IBM z/OS on mainframe, or OpenSSH on Unix).

Examples of Distributing User Keys

The following examples illustrate using **ssh-keydist-g3** for distributing user keys.

Example 1: Public-Key Upload to Unix OpenSSH Server from USS Shell

This command creates a 1024-bit RSA key with an empty passphrase and uploads it to a Unix server running OpenSSH, including the necessary conversions. Public-key upload uses password-from-file for authentication. A log of the operation is stored under `/tmp`. The example assumes that the server host key has already been fetched and verified.

```
$ ssh-keydist-g3 --key-type rsa --key-bits 1024 --empty-passphrase \
   --remote-user userid --password-file /home/userid/passwd_file \
   --user-key-log /tmp/my_log_file --openssh-unix open_server.example.com
```

Example 2: Public-Key Upload to Unix OpenSSH Server Using JCL

This example `KEYDIST` from `<HLQ>.V681.SAMPLIB` presents a JCL script that does the same steps as the USS command in *Example 1* above (options are given in short format):

```
//KEYDIST EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM  DD  *
PGM /opt/tectia/bin/ssh-keydist-g3
  -t rsa -b 1024 -P
  -u userid -p //'USERID.PASSWD'
  -U /tmp/my_log_file
```

```
  -O host1.example.com
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//
```

Example 3: Public-Key Distribution to Multiple Hosts from USS Shell

This example distributes an existing public key to several remote hosts automatically. Individual user names can be defined for each server. Server type (Tectia Unix, Tectia Windows, Tectia z/OS, or OpenSSH) needs to be defined with the flags: `-S`, `-W`, `-Z`, or `-O`. The example assumes that the relevant server host keys have already been fetched and verified.

In this example you can find four server "blocks":

- `-O -u user1 open_server.example.com`
- `-S -u user2 tectia_unix.example.com`
- `-W -u user2 tectia_win.example.com`
- `-Z -u user3 tectia_zos.example.com`

A password file is defined for each separate user ID. *`user2`* is assumed to have the same password on Unix and Windows. A log of the operation is stored under `/tmp`.

The command is as follows:

```
$ ssh-keydist-g3 -f /home/userid/.ssh2/id_rsa_2048_a.pub \
   -U /tmp/userkeys.log \
   -p /home/userid/passwd_file1 \
   -O -u user1 open_server.example.com \
   -p /home/userid/passwd_file2 \
   -S -u user2 tectia_unix.example.com \
   -W -u user2 tectia_win.example.com \
   -p /home/userid/passwd_file3 \
   -Z -u user3 tectia_zos.example.com
```

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Chapter 5 System Administration

Secure system administration is a common use case for Secure Shell.

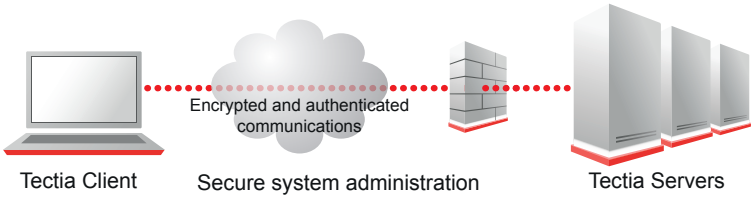

Figure 5.1. Secure system administration

The server settings may limit the services that are accessible via Secure Shell. For example, the Secure Shell server may deny terminal access and allow only file transfer or tunneling. The restrictions from the server perspective are described in the *Tectia Server for IBM z/OS Administrator Manual*.

5.1 Defining Shell Access

5.1.1 Setting Codepage for Remote Account

By default Tectia Server for IBM z/OS uses IBM-1047 as the codepage when connecting a user to an application. The application is typically `/bin/sh`. For interoperability with diverse SSH client programs, Tectia uses ISO8859-1 on the line.

You can change the codepage with command **chcp**. If the session on the server is started up with a terminal and with `ShellConvert=yes`, the **chcp** command can be used to change the Transfer CCS and the Account CCS during that session. However, it is not possible to change to using a translation table or to change the line delimiters.

The codepage change happens on the outbound stream starting from the output of the **chcp** command and on the next prompt. On the inbound stream, the codepage is changed starting with the character following the character that ends the command.

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5.2 Running Remote Commands

sshg3 can be used to run remote commands or jobs.

For example, to display the operating system version and other details of a remote host, execute the following command:

```
$ sshg3 user1@host1.example.com "uname -a"
```

More example commands are shown in the following sections.

5.2.1 Remote Command Examples from USS

Example 1: Remote command for creating directory `testdir` on a remote Unix system:

```
$ sshg3 user1@unix.example.com mkdir testdir
```

Example 2: Remote command for creating a directory on a remote Windows system:

```
$ sshg3 user2@windows.example.com "cmd /c mkdir testdir"
```

Note that quotes (`"`) are needed around remote Windows commands when they are run from the USS shell.

Example 3: Multiple commands can be separated using a semicolon:

```
$ sshg3 user1@unix.example.com "cd /tmp; ls -l test.*; rm test.txt"
```

Note that quotes (`"`) are needed around multiple remote commands when they are run from the USS shell.

5.2.2 Remote Command Examples using JCL

Example 1: JCL with remote command for creating a directory on a remote Unix system:

```
//SSH EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM DD *
PGM /opt/tectia/bin/sshg3 user1@unix.example.com
mkdir testdir
//STDENV DD DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT DD SYSOUT=*
//STDERR DD SYSOUT=*
//STDIN DD DUMMY
//
```

(Use this JCL to complete the following examples.)

Example 2: Remote command for creating a directory on a remote Windows system. Use the following as input data for the STDPARM DD in Example 1:

```
PGM /opt/tectia/bin/sshg3 user2@windows.example.com
cmd /c mkdir testdir
```

Note that quotes (") are not needed when commands are run from JCL

Example 3: Multiple commands. Use the following as input data for the STDPARM DD in Example 1:

```
PGM /opt/tectia/bin/sshg3 user1@unix.example.com
cd /tmp;
ls -l test.*;
rm test.txt
```

Note that quotes (") are not needed around multiple remote commands when they are run from JCL.

5.3 Managing JCL Jobs over SFTP

Tectia Server for IBM z/OS provides the functionality for managing JCL jobs remotely. The JCL scripts are transferred to the z/OS MVS Job Entry Subsystem (JES) using SFTP. The JES interface of Tectia Server for IBM z/OS provides the following functions:

- Submitting a job
- Receiving the spool output of a job
- Deleting jobs
- Displaying the status of all of the user's jobs

Either a file transfer advice string (FTADV) or the SFTP **site** command is required to interface with JES instead of the file system. For more information on the FTADV/**site** parameters, see Section 6.4.1.

In the following sections, examples are presented on how to manage JCL jobs over SFTP using three different clients: Tectia **sftpg3**, Tectia **scpg3** and OpenSSH **sftp**.

5.3.1 Tectia sftpg3

Submitting a Job

The following examples show how to submit a job for execution and receive a notification of the ID assigned to the submitted job. In the examples it is assumed that the JCL script `br14.jcl` with the following contents is stored in the directory `/home/user1/src/jcl/` on a Unix host:

```
//USERJ0  JOB ,,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//            NOTIFY=&SYSUID
//*
//STEP00  EXEC PGM=IEFBR14
//
```

Example 1. Interface with JES using a file transfer advice string:

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```
$ sftpg3 user1@mf_server ❶
sftp> sput /home/user1/src/jcl/br14.jcl /ftadv:filetype=jes,c=ISO8859-1,d=IBM-1047/ ❷
br14.jcl                           |   100B |      29B/s | TOC: 00:00:03 | 100%
07.57.19 JOB03198  $HASP100 USERJ0   ON INTRDR              FROM STC03197 USER17
07.57.20 JOB03198  IRR010I  USERID USER1   IS ASSIGNED TO THIS JOB.
JOBID=JOB03198 ❸
```

❶ Open an SFTP session from your client to the target server (in this example `mf_server`).

❷ Submit the job (`/home/user1/src/jcl/br14.jcl`) using **sput**. Use a file transfer advice string to set file type to JES and to specify code set conversion. In this example the code set is ISO8859-1 during the transfer and the server should store the data set with the IBM-1047 code set.

❸ At the end of the output you can see the job ID (`JOB03198`) that was assigned to the job.

Example 2. Interface with JES using the **site** command:

```
$ sftpg3 user1@mf_server ❶
sftp> ascii ❷
File transfer mode is now ascii.
sftp> site filetype=JES ❸
sftp> sput /home/user1/src/jcl/br14.jcl ❹
br14.jcl                           |   100B |      33B/s | TOC: 00:00:02 | 100%
06.54.20 JOB03384  $HASP100 USERJ0   ON INTRDR              FROM STC03354 USER16
06.54.21 JOB03384  IRR010I  USERID USER1   IS ASSIGNED TO THIS JOB.
JOBID=JOB03384 ❺
```

❶ Open an SFTP session from your client to the target server (in this example `mf_server`).

❷ Set the file transfer mode to ASCII.

❸ Run **site** to set file type to JES.

❹ Submit the job using **sput**.

❺ At the end of the output you can see the job ID (`JOB03384`).

Retrieving the Spool Output of a Job

To retrieve the spool output of a submitted job, run the **get** command with the job's ID.

Example 1. Interface with JES using a file transfer advice string to specify the file type and code set conversion:

```
sftp> get /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/JOB03198
JOB03198                           |  1.1kB |     431B/s | TOC: 00:00:02 | 100%
```

Example 2. Interface with JES using the **site** command:

```
sftp> ascii ❶
File transfer mode is now ascii.
sftp> site filetype=JES ❷
sftp> get JOB03384 ❸
JOB03384                           |  2.2kB |     831B/s | TOC: 00:00:02 | 100%
sftp> site filetype=SEQ ❹
```

❶ Set file transfer mode to ASCII.

❷ Run the **site** command to change file type to JES.

❸ Retrieve the job.

❹ Return to accessing the normal file system.

Deleting Jobs

To delete a job (in this example `JOB03198`), use the **rm** command and an advice string to set file type to JES:

```
sftp> rm /ftadv:filetype=JES/JOB03198
```

Listing Jobs

Example 1. To display the status of all the jobs that are on the JES spool for your user ID, enter the following command:

```
sftp> ls /ftadv:filetype=JES/
```

Example 2. To list jobs in the long name format, enter:

```
sftp> ls -l /ftadv:filetype=JES/
```

Example 3. To list the contents of a specific job (in this example `JOB03419`) in the long name format:

```
sftp> ls -l /ftadv:filetype=JES/JOB03419/ ❶
/FTADV:filetype=JES//u/home/user1/JOB03419/:
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
JOB03419 USER1   USERJ0   A        J      0000
  0002          JES2     JESMSGLG    18       1048 UA       133
  0003          JES2     JESJCL       6        299 V        136
  0004          JES2     JESYSMSG     9        559 VA       137
```

❶ Note the required trailing slash after the job ID.

5.3.2 Tectia scpg3

Submitting a Job

Example 1. Copy `br14.jcl` to `mf_server` using the `-a` option to enable automatic ASCII-EBCDIC conversion:

```
scpg3 -a /home/user1/src/jcl/br14.jcl mf_server#22:/ftadv:filetype=JES/
```

Example 2. If `-a` is not used, code set conversion must be specified in the advice string (in this example the code set during the transfer is ISO8859-1 and the server should store the data set with the IBM-1047 code set):

```
scpg3 ~/src/jcl/br14.jcl mf_server#22:/ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/
br14.jcl                            |   104B |      34B/s | TOC: 00:00:02 | 100%
07.32.28 JOB03390  $HASP100 USERJ0   ON INTRDR                  FROM STC03356 USER19
```

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```
07.32.29 JOB03390  IRR010I  USERID USER1   IS ASSIGNED TO THIS JOB.
JOBID=JOB03390
```

Retrieving the Spool Output of a Job

Retrieve the spool output for `JOB03390`, performing automatic code set conversion with the `-a` option:

```
scpg3 -a mf_server#22:/ftadv:filetype=JES/JOB03390 .
```

5.3.3 OpenSSH sftp

Submitting a Job

Submit a job using **put** and a file transfer advice string (`/ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/`) to set file type to JES and specify code set conversion. In this example the code set is ISO8859-1 during the transfer and the server should store the data set with the IBM-1047 code set:

```
put /home/user1/src/jcl/br14.jcl /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/
```

Or, alternatively:

```
cd /ftadv:filetype=JES/ ❶
put /home/user1/src/jcl/br14.jcl ./ftadv:C=ISO8859-1,D=IBM-1047/ ❷
03.05.03 JOB03361  $HASP100 USERJ0   ON INTRDR   FROM STC03352 USER13
03.05.04 JOB03361  IRR010I  USERID USER1    IS ASSIGNED TO THIS JOB.
Couldn't close file: End of file ❸
```

❶ Set file type to JES.

❷ Submit the job using **put**; use an advice string to specify code set conversion.

❸ All SFTP clients are not able to retrieve the job ID. If you want to see it, please use Tectia **sftpg3**.

Retrieving the Spool Output of a Job

Retrieve the spool output of a job with the ID `JOB03361` using **get** and a file transfer advice string to specify file type and code set conversion:

```
get /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/JOB03361
```

As an alternative you can first **cd** to JES and then run **get**:

```
cd /ftadv:filetype=JES/
get ./ftadv:C=ISO8859-1,D=IBM-1047/JOB03361
```

Deleting Jobs

Example 1. To delete a job (`JOB01234`), run **rm** and use an advice string to set file type to JES:

```
rm /ftadv:filetype=jes/JOB01234
```

Example 2. To delete all jobs with IDs that begin with `JOB012`, enter the following command (the wildcard `*` is escaped with a backslash (\) in order to leave file name globbing to the server):

```
rm /ftadv:filetype=jes/JOB012\*
```

When you issue the **rm** command on a job, all spool output related to the job is deleted.

Listing Jobs

Example 1. To list jobs in the long name format, enter:

```
ls -l /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/%
```

Or, alternatively:

```
cd /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/
ls
ls -l
```

Example 2. To list the spool output of a specific job (`JOB03361`), enter:

```
ls -l /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/JOB03361/
```

Or, alternatively:

```
cd /ftadv:filetype=JES,C=ISO8859-1,D=IBM-1047/JOB03361/
ls -l
```

You should see this type of output:

```
JOB03361 USER1    USER1D   A        J      0000
0002          JES2     JESMSGLG    19       1100 UA       133
0003          JES2     JESJCL       8        390 V        136
0004          JES2     JESYSMSG    15        817 VA       137
0102          S1       SYSPRINT     5        416 VBA      137
```

Note

A workaround for third-party clients has been provided for the case where a previous 'cd' command is ignored when a subsequent 'get' or 'put' operand begins with a file transfer advice string '/ftadv:.../'. These clients do not prefix their 'cwd' onto the operand because the initial '/' causes it to be interpreted as an absolute path. The 'ftadv' string may now begin with a leading dot './ftadv:.../', allowing the operand to be interpreted as a relative path.

5.4 Securing the Client

By default, the configuration of Tectia client tools for z/OS is aimed toward usability. If you want to have a minimal, high-security configuration, you have to disable some functionality.

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Connecting to servers whose administrator you do not trust and who may be malicious is a significant security risk. Avoid it. However, there are a few ways to reduce the risk.

5.4.1 Disabling Agent Forwarding

By default, when you have an agent running, the agent connection will be forwarded to the server side. This is for convenience, so that a system administrator (or a power user) can easily connect from machine to machine.

If the server's administrator is malicious, he can use your agent to sign requests. This will not allow access to the private key, but will cause a security risk, because the malicious admin can then connect with your credentials anywhere where they are accepted.

If you do not trust the server, disable agent forwarding in the `ssh-broker-config.xml` file (either under `default-settings` or per each connection `profile`):

```
<forwards>
  <forward type="agent" state="off" />
  ...
</forwards>
```

On the command line, the `-a` option has the same effect:

```
$ sshg3 -a host3.example.com
```

See **forwards** for more information.

Chapter 6 Secure File Transfer Using SFTP

Tectia client tools for z/OS provide security to existing FTP file transfers by applying the Secure File Transfer Protocol (SFTP) instead of FTP, or by using tunnels that encrypt the connection from the FTP client to the FTP server.

Unattended, automated file transfers between servers can be secured with the versatile command-line SFTP and SCP tools that apply the SFTP protocol.

For easier migration, Tectia client tools for z/OS provide automatic FTP-SFTP conversion and transparent FTP tunneling. In these cases, no changes to the existing FTP client applications and scripts are required, and they can remain being used as before.

This chapter deals with secure file transfer using the SFTP command-line tools. For information on FTP-SFTP conversion and transparent FTP tunneling, see *Tectia Server for IBM z/OS Administrator Manual*.

6.1 Native z/OS FTP commands versus Tectia SFTP commands

Tectia client tools for z/OS convert the unsecured FTP subcommands to secure SFTP commands according to the following table:

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Table 6.1. Comparison between native z/OS FTP subcommands and SFTP commands

z/OS FTP subcommand	Tectia SFTP command	Description
ascii	ascii	Change the data transfer type to ASCII
binary	binary	Change the data transfer type to image
cd *directory*	cd *directory*	Change the working directory or file group on the remote host:
cd /mydir/test	cd /mydir/test	- when the remote end is Unix
	cd //	- when the remote end is mainframe, go to MVS-level *prefix.**
cd 'my.dataset.cntl'	cd //'my.dataset.cntl'	Define an absolute data set
cd my.dataset.cntl	cd //my.dataset.cntl	Define a relative data set
delete *foreign_file*	rm [options...] *foreign_file*	Delete the foreign_file (or a directory with the `rm` command)
delete *your_file.txt*	rm *your_file.txt*	Delete a file
	rm *yourdir*	Delete a directory
dir *name* (DISK	ls	View directory contents. See the options in the `ls` command
lcd *directory*	lcd *directory*	Change the current working directory on the local host
lcd 'my.dataset.cntl'	cd //'my.dataset.cntl'	Define an absolute data set
lcd my.dataset.cntl	cd //my.dataset.cntl	Define a relative data set
lmkdir *directory* (LIKE *remote_directory*	lmkdir *directory*	Make a directory on the remote host
lmkdir example	lmkdir example	When the local dir is MVSUSER.FTP. then MVSUSER.FTP.EXAMPLE is created
locsite *parameters...*	lsite *parameters...*	Define parameters for controlling the file transfer. Many of the parameters are the same. See the manual.
ls *name* (DISK	ls [-R] [-l] [-S] [-r] [-p] [-z|+z] [*file...*]	List only the names of a set of remote files, file group, or directory
ls bart	ls bart	
	ls //'USER1.TEST.PS.'	List all MVS data sets with prefix USER1.TEST.PS
	ls //__USER1.TEST.PS.	List all MVS data sets with prefix USER1.TEST.PS (for a client that does not send the / character)
	ls -l	Extended list command
ls bart (DISK		SFTP has no option to store the output
get *srcfile dstfile* (REPLACE	sget [options...] *srcfile* [*dstfile*]	

z/OS FTP subcommand	Tectia SFTP command	Description
get myfile	sget myfile	
mget *foreign_file* (REPLACE	mget [options...] *file*	Copy multiple files from a remote host to your local host, and create a corresponding number of local files. For SFTP 'replace' is the default!
mget *foreign_file*	mget --overwrite=no *foreign_file*	Note: The defaults are different!
mkdir *directory* (LIKE *local_directory*)	mkdir *directory*	Create a directory on the remote host
mkdir 'MY.TEST.PDS'	mkdir //'MY.TEST.PDS'	Create a partitioned data set on the remote host
mput *local_data_set* (REPLACE	mput [options...] *file*	Copy multiple data sets from your local host to the remote host. For SFTP 'replace' is the default!
mput *foreign_file*	mput --overwrite=no *foreign_file*	Note: The defaults are different!
open *hostname portnumber*	open *hostname* | -l	Open a connection to the given host, or to local host: `open -l`
open *remhost*	open *REMUSER@remhost*	Open a connection to a remote host
put *srcfile dstfile* (REPLACE	sput [options...] *srcfile* [*dstfile*]	
put 'myfile.dataset.cnt' c:\bart.txt	sput //'myfile.dataset.cnt' c:\bart.txt	The mainframe data set specification syntax can be different per client
	sput /ftadv:P=TEXT/__DATASET.TXT file.txt	When advice is used, the preferred data set specification is different
rename *oldfile newfile*	rename *oldfile newfile*	Rename a file
IBM z/OS: `For MVS data sets`, if the data set that is specified by the *newfile* value already exists, the server rejects the rename request. `For z/OS UNIX files and named pipes`, if the file that is specified by the *newfile* value already exists, the existing file is replaced. **Tectia**: Tries to rename the *oldfile* to *newfile*. If the new file already exists, the files are left intact.		
sendsite	not applicable	Toggle the automatic sending of the SITE commands when sending a data set to a foreign host.
quit	quit	
bye	bye	The same as quit.

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6.2 Secure File Transfer with scpg3 and sftpg3 Commands

Tectia client tools for z/OS provides commands **scpg3** (secure copy) and **sftpg3** for secure file transfer. These command-line clients apply the Secure File Transfer Protocol (SFTP).

When files are being uploaded with commands **scpg3** and **sftpg3**, the files have the `TRUNCATE` flag on. The file size is shown as 0 until the file transfer has been completed.

These secure file transfer commands rely on the Connection Broker to take care of the cryptographic operations and authentication tasks, so they start the Connection Broker (the **ssh-broker-g3** process) in run-on-demand mode, if the Connection Broker is not running already.

In case the **scpg3** and **sftpg3** command-line clients are used in scripts that start several file transfer commands at the same time, the Connection Broker must already be running in the background. Since the Connection Broker takes a few seconds to become up and running, make sure the scripts are not started immediately, because they can fail if the Connection Broker is still starting.

To start the Connection Broker, run the **ssh-broker-g3** command. For more information, see ssh-broker-g3(1).

6.2.1 Using scpg3

scpg3 is used to securely copy files over the network. **scpg3** uses **ssh-broker-g3** to provide a secure transport using the Secure Shell version 2 protocol. The remote host(s) must be running a Secure Shell version 2 server with the **sftp-server** (or **sft-server-g3**) subsystem enabled.

The basic syntax of **scpg3** is:

```
scpg3 user@source:/directory/file user@destination:/directory/file
```

scpg3 can be used to copy files in either direction; from the local system to the remote system or vice versa. Copies between two remote hosts are also permitted. Local paths can be specified without the *`user@system:`* prefix. Relative paths can also be used, they are interpreted in relation to the user's home directory.

Tectia Server for IBM z/OS uses the user's Unix System Services (USS) home directory as the default file transfer home location. The environment variable `SSH_SFTP_HOME_MVS` in the user's `$HOME/.ssh2/environment` file on the server can be used to control this location. For more information, see Section 6.4.2.

Windows paths should be preceded by a slash ("`/`"). For example, copying a local file to a remote Windows server:

```
scpg3 localfile user@destination:/C:/directory/file
```

For more information on the command-line options, see scpg3(1).

6.2.2 Using sftpg3

sftpg3 is an FTP-like client that can be used for secure file transfers over the network. **sftpg3** uses **ssh-broker-g3** to provide a secure transport using the Secure Shell version 2 protocol.

Even though it functions like **ftp**, **sftpg3** does not use any FTP daemon or FTP client for its connections. **sftpg3** can be used to connect to any host that is running a Secure Shell version 2 server with the **sftp-server** (or **sft-server-g3**) subsystem enabled.

The basic syntax of **sftpg3** is:

```
sftpg3 user@host
```

sftpg3 has two connection end points, local and remote, and both of them can be connected to other hosts than the Tectia client tools for z/OS host. By default, the local end point is connected to the file system of the Tectia client tools for z/OS host and the remote end point is connected to the host defined on the command line (or left unconnected if no host is defined on the command line).

When started interactively, **sftpg3** displays a prompt where the SFTP commands can be entered, much like in the traditional **ftp** program. It is also possible to start **sftpg3** non-interactively with a batch file that contains the commands to be run.

For more information on the command-line options and commands, see sftpg3(1).

6.2.3 Enhanced File Transfer Functions

The following enhanced file transfer features are available with FTP-SFTP conversion and with the **scpg3** and **sftpg3** command-line tools of Tectia client tools for z/OS:

- Checkpoint/restart for transferring large HFS files (with any IETF-compliant SSH server)
- Prefix for ensuring that a file is fully transferred before it is used (with any IETF-compliant SSH server)
- Streaming for improved file transfer speed (with Tectia Servers)

For information on the commands, see scpg3(1) and sftpg3(1).

6.3 Handling MVS Data Sets and HFS File System Access

This section describes how access to MVS data sets and Hierarchical File System (HFS) files is handled with Tectia client tools for z/OS.

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6.3.1 Data Set and HFS File System Access

z/OS has both MVS data sets, and HFS files. As both types must be accessed by the SFTP server, there must be a mechanism for distinguishing between them. Traditionally, MVS data sets in z/OS are accessed using the file name format `"//'NAME.OF.MVS.DATASET'"`, while HFS files are accessed using the file name format `/path/to/hfs/file`.

In z/OS, if a data set name is not enclosed in single quotes, the user prefix is added in front of the data set name. For example, if user `USER1` has a data set `DATASET.NAME1`, the user can access it using the data set name `//DATASET.NAME1`. It is also possible to use an absolute prefixed name `"//'USER1.DATASET.NAME1'"`.

z/OS has also library data sets, whose members are accessed using the data set name `"//DATASET.NAME1(MEMBER1)"`.

Note that the MVS data set names mentioned above are placed within regular quotation marks (`" "`). This must be done in shell commands (for example when using **scpg3**), to prevent the single quotes and parentheses in the data set names from being interpreted by the shell. Alternatively, you can use backslashes (\) to escape the single quotes and parentheses, for example `//\'USER1.DATASET.NAME1\'` or `//DATASET.NAME1\(MEMBER1\)`.

Note

For more information related to dataset access and third-party file transfer clients, see Section 10.3.1

System Symbol Resolution

Tectia for z/OS supports the resolution of z/OS system symbols appearing in file-transfer operands. The symbols are those defined to the z/OS as documented in the MVS Initialization and Tuning Reference. They can be viewed in the SDSF SYM panel.

In terms of implementation, the dataset structure fields name, DSN, volumes, owner, and like, are the object of the process of symbol resolution by Tectia for z/OS.

Note that in JCL, JES symbol resolution will be performed on JCL statements, and on in-stream data (DD *) if the SYMBOLS parameter is coded, and that this resolution occurs prior to that performed by Tectia for z/OS.

System symbols can be used in data set names and volume serial numbers. The symbols are resolved on the host where the data set resides.

The following JCL examples show how system symbols can be used with Tectia. The first shows JES resolution of the set-symbol &MLQ in a DD statement:

```
//SFTP     JOB ,,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//             NOTIFY=&SYSUID
//*
//    SET MLQ=D&LYYMMDD..T&HHMMSS
```

```
//*
//SFTPG3  EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/sftpg3 -B //DD:BATCHIN
//TESTDD   DD  DISP=(NEW,CATLG,DELETE),
//             SPACE=(CYL,(10,5),RLSE),
//             DSN=USER.TEST.SFTP.&MLQ
//SYSTSPRT DD  SYSOUT=*
//STDOUT   DD  SYSOUT=*
//STDENV   DD  DSN=SSZ.VXXX.PARMLIB(SSHENV),DISP=SHR
//BATCHIN  DD  *
  open  <user>@<ip_address>
  sget 'USER.DATASET'    +
       //DD:testdd
quit
/*
```

The second shows Tectia for z/OS resolution of system symbols in the STDIN in-stream data, without coding the SYMBOLS parameter:

```
//SFTP     JOB ,,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//             NOTIFY=&SYSUID
//*
//SFTPG3  EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/sftpg3 -B //DD:STDIN
    <user_id>@<ip_address>
//STDENV   DD  DSN=SSZ.VXXX.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDIN    DD  *
sput test_put.txt //'USER.DATASET.PUT.D&LYYMMDD..T&HHMMSS'
sget test_get.txt //'USER.DATASET.GET.D&LYYMMDD..T&HHMMSS'
/*
```

Case-Sensitivity of HFS and MVS Names

HFS file names are case-sensitive. For example, `/tmp/MYFILE` and `/tmp/myfile` result in two different files.

MVS data set names are case-insensitive. For example `//'USER1.DATASET.NAME1'` and `//'user1.dataset.name1'` are handled the same way.

6.3.2 Data Set Access Using DD Cards

When running the client programs **scpg3** and **sftpg3** in JCL, the `_BPX_SHAREAS` environment variable must be set to `no`. Local data sets can be allocated by using DD cards. For the DD cards to work, `BPXBATSL` must be used instead of `BPXBATCH`. `BPXBATSL` uses local spawn and forces **scpg3** and **sftpg3** to run in the original address space where the DD information is available.

The following **sftpg3** commands cannot be used with DD names:

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- **rm** (remove file)
- **rename**
- **mkdir**
- **rmdir**

Empty data sets cannot be read when referred to by DD names.

For correct syntax, see the **SCPPUT** and **SCPGET2** examples in Section 6.6.2.

6.3.3 Accessing Generation Data Groups (GDG)

Tectia Server for IBM z/OS supports generation data groups defined in ICF. Reading GDG ALLs is not supported. Tectia Server for IBM z/OS will not create GDG bases or model data sets.

Note

Tectia file transfers are atomic. Running "`sget gdg.base(0) file1`" two times in succession might retrieve different files. A loop of "`sput file1 gdg.base(+1)`" commands might fill the GDG with identical files and roll off all the previous generations.

Navigating

sftpg3 allows you to navigate to a GDG base and to a prefix of a base.

Listing

Generation data sets (GDSs) are normal data sets. The long name format (`ls -l`) will show all details.

Listing a base with `-l` will show full details of the GDSs. The listing may contain data sets that are not in the GDG index but do have data set names that have the GDG name as a prefix.

It is possible but not recommended to use data set names which have the GDG base name as a prefix but are not GDS names. For example:

```
sftp> cd //'USER1.GENGRP'
MVS prefix `'USER1.GENGRP.'' is the current directory.
The working directory `'USER1.GENGRP.'' is a generation data group.
'USER1.GENGRP.'
sftp> ls -l
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
S6SYS1 Jan 03 2007 VB     1000 27998 PS       50001  G0006V00.IMPOSTOR
S6SYS1 Jan 02 2007 VB     1000 27998 PS       50001  G0007V00
S6SYS1 Jan 02 2007 VB     1024 27998 PS       50001  G0008V09
S6SYS1 Jan 02 2007 VB     1024 27998 PS       50001  G0077V99
S6SYS1 Jan 02 2007 VB     1024 27998 PS       50001  G0088V99
```

```
S6SYS1 Jan 04 2007 VB     1024 27998 PS       50001  G0100V00
S6SYS1 Jan 02 2007 FB       80 27920 PS       50001  GARBAGE
```

You cannot navigate to a prefix that ends in a `GnnnnVnn` qualifier. Thus you cannot do "`cd G0006V00`" or "`ls //'USER1.GENGRP.G0006V00'`" in the example above.

If the GDG has the `NOSCRATCH` option, GDSs are retained when they are rolled off. **sftpg3** shows data sets based on the prefix - it does not show which data sets are in the GDG and which are not.

Access by Relative Data Set Name

scpg3 and **sftpg3** give full access with relative generation numbers for reading and writing. For example, to read the previous and the latest generation, and create a new generation, do the following:

```
sftp> cd //'ABC.XYZ'
sftp> sget '-1' /tmp/yesterday
sftp> sget 0 /tmp/current
sftp> sput /tmp/new '+1'
```

z/OS may require you to specify a model data set when creating a new GDS. Tectia does not support the `DCB=dsn` specification, but you can use the `LIKE` attribute. Specify it with a file transfer advice string:

```
sftp> sput /tmp/new /ftadv:LIKE=USER1.GENGRPM.MODEL/'+1'
```

Alternatively, you can specify it with the **site** command (in **sftpg3**):

```
sftp> site LIKE=USER1.GENGRPM.MODEL
sftp> sput /tmp/new '+1'
```

Note

GDG ALL is not supported (that is, reading all the generations as a concatenation).

A new GDS is rolled in immediately. You can not read it back as (+1) (you can do this in JCL, where the GDS generations are rolled in at the end of the job).

GDSs can be removed and renamed by the relative GDS name. On a rename operation, the new name must not be a relative GDS name.

Access by Absolute Data Set Name

With absolute GDS names you can do all the things possible with other data sets.

Writing a data set with a last qualifier with the `GnnnnVnn` format requires that there exists a suitable GDG base. If the generation exists it is overwritten. If it does not, the new file is inserted in its place in the GDG and older GDGs are rolled off, if necessary.

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6.3.4 Accessing Migrated Data Sets

Tectia Server for IBM z/OS can transfer files to and from cataloged, online DASD (direct access storage device) data sets. The following data set types are supported:

- uncataloged DASD data sets
- migrated DASD data sets
- offline DASD data sets
- cataloged tape data sets
- uncataloged tape data sets
- offline tape data sets

Tape Security

Tectia relies on the system security product for controlling access to data sets. Sites should ensure that the appropriate restrictions are in place for `NL` (No Label) or `BLP` (Bypass Label Processing). Refer to the *RACF Security Administrator's Guide* or appropriate documentation for your SAF for information on restricting access to resource ICHBLP in the FACILITY class, or equivalent functionality. Tectia does not read labels and does not have any label exits.

Operational Security and Tectia Controls

Using an offline tape data set requires that a tape drive is available and that the tape cassette is mounted on the drive. The operator must mount the drive or cancel the mount request. Outstanding mount requests can cause shortages, locking and deadlocks in resource handling in the system.

Using data sets on offline DASD volumes requires that the operator varies the volume device online. This requires the operator to decide whether the device can be varied online (it is probably offline for a good reason) and to enter the vary command or cancel the request.

Using a migrated data set requires the system to recall the data set to a user-accessible (level 0) volume before it can be read or overwritten. If the data set is on a migration level 1 (DASD) or migration level 2 (tape) volume, it is first copied to level 0.

The z/OS system operators must monitor mount requests to make sure they do not go unanswered or cause problems. They must also monitor the system for Tectia SFT Server processes and Tectia file transfer clients that are hanging on allocation requests for offline data sets.

In Tectia Server for IBM z/OS, mounting an offline data set is by default not allowed and recalling a migrated data set is by default allowed.

The Tectia end user controls mounting and recalling with the extended file attributes `automount` and `autorecall`. The user must set `automount` to *`yes`* or *`immed`* for Tectia to attempt to mount offline data sets. The user can set `autorecall` to *`no`* to avoid recalling a data set by mistake.

In addition, the administrator must set up access rights to the RACF facility `SSZ.MOUNT` for the users who will be mounting offline data sets with Tectia client tools for z/OS. For more information, see *Tectia Server for IBM z/OS Administrator Manual*.

Using Uncataloged Data Sets

Existing data sets that do not have entries in the catalog can be accessed by specifying a volume serial number and unit.

Example 1. Read a tape data set that has the data set name `SRVACC1.SPECS.PDF` and is the third data set on volume `456123`.

Specify the file transfer attributes (`UNIT`, `VOLUMES`, `DATASET_SEQUENCE_NUMBER`) using a file transfer advice string:

```
sftp> sget /ftadv:un=TAPE,vol=456123,seqnum=3///'SRVACC1.SPECS.PDF' \
          /home/clusr1/tmp/specs.pdf
```

Alternatively, you can use the **sftpg3 site** command:

```
sftp> site unit=TAPE,volumes=456123,dataset_sequence_number=3
sftp> sget //'SRVACC1.SPECS.PDF' /home/clusr1/tmp/specs.pdf
```

Example 2. Create a data set without cataloging it using the `NORMDISP` attribute.

Specify the file transfer attributes (`UNIT`, `NORMDISP`) using a file transfer advice string:

```
sftp> sput /home/clusr1/tmp/specs-v2.pdf \
        /ftadv:unit=TAPE,normdisp=KEEP///'SRVACC1.SPECS.V2.PDF'
```

Alternatively, you can use the **sftpg3 site** command:

```
sftp> site unit=TAPE,normdisp=KEEP
sftp> sput /home/clusr1/tmp/specs-v2.pdf //'SRVACC1.SPECS.V2.PDF'
```

The `DATACLAS`, `STORCLAS`, and `MGMTCLAS` attributes are also available.

Requesting the System to Mount a Volume

For Tectia to request the system to mount an offline volume, you must use the `AUTOMOUNT` attribute. You must also have `READ` access to `SSZ.MOUNT`. For example, to read a data set on a tape volume, assuming that the data set has a catalog entry, use the following commands.

Specify the attribute with a file transfer advice string:

```
sftp> sget /ftadv:automount=yes///'SRVACC1.SPECS.PDF' \
        /home/clusr1/tmp/specs.pdf
```

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Alternatively, you can use the **sftpg3 site** command:

```
sftp> site automount=yes
sftp> sget //'SRVACC1.SPECS.PDF' /home/clusr1/tmp/specs.pdf
```

When `automount=yes`, Tectia first attempts to allocate the data set without allowing the system to mount the data set if it is offline. If this allocation fails, Tectia retries the allocation with the mount request. You can make Tectia omit the first attempt by specifying `automount=immed`.

Low-Level Access

Tectia has a facility for low-level access to dynamic file allocation because of the large number of attributes that can be specified when allocating tape data sets.

Tectia allocates data sets by calling the SVC 99 interface. This interface has a table of text units. Each text unit consists of key, parameter count, and parameters. The parameters have a length field and data. The interface is documented in the *Authorized Assembler Services Guide*.

Tectia allocates files at the start of a file transfer (except if the file is already allocated and is represented by a DD name). Tectia sets text units based on the extended attributes. The FTADV/**site** parameter `SVC99_TEXT_UNITS` allows the user to add and change text units in the table. The value of `svc99_text_units` is a sequence of text units delimited by underscores ('_'). Each text unit has the format *`xxxx`*`F`*`values`*, where *`xxxx`* is the key in hexadecimal, `F` is a format character and *`values`* is a character string. The *`values`* part is empty or consists of one string or of several strings delimited by plus signs ('+'). No value may contain spaces, tabs, newlines or any of the characters '`_+,/\`'. The *`values`* part must not exceed 80 characters in length.

The format character indicates how the value(s) are encoded. The possible values are:

- `S`: character string
- `X`: hexadecimal
- `F`: decimal number with length 4 in the text unit
- `H`: decimal number with length 2 in the text unit
- `C`: decimal number with length 1 in the text unit
- `-`: no text unit

When the format character is '`-`', Tectia removes the text unit with the given key if it is in the table. For the other characters, Tectia replaces the value in the text unit with the given key or adds a new text unit.

The following attributes show how to encode some of the examples in the *Authorized Assembler Services Guide*. The attributes are not intended to be practical cases.

To specify an accessibility code of Z for an ANSI tape data set:

- Using a file transfer advice string:

```
sftp> cd /ftadv:svc99_text_units=8001XE9/
```

- Using the **site** command:

```
sftp> site svc99_text_units=8001XE9
```

To specify a RACF profile that was defined generically and request unallocation when a DCB is closed:

- Using a file transfer advice string:

```
sftp> cd /ftadv:svc99_text_units=800EXD9D7D9D6C6+80_001CX/
```

- Using the **site** command:

```
sftp> site svc99_text_units=800EXD9D7D9D6C6+80_001CX
```

To enter a Key Encode Specification and a Key Label:

- Using a file transfer advice string:

```
sftp> cd /ftadv:svc99_text_units=8026SH_8024SLABELQ1.LABELQ2.LABELQ3/
```

- Using the **site** command:

```
sftp> site svc99_text_units=8026SH_8024SLABELQ1.LABELQ2.LABELQ3
```

6.3.5 SFTP and Tape Data Sets

When working with tape data sets, there are two alternative ways to specify the device unit on which the tape is to be mounted. Normally this can be done through the use of the FTADV/**site** parameter `UNIT`, but in some situations it is not practical to do so. The environment variable `SSH_SFTP_VOL_UNIT_MAP` can be defined to provide a mapping between a volume serial number pattern and a device unit, allowing the unit to be deduced from the volume.

`SSH_SFTP_VOL_UNIT_MAP` may be set to a picture-clause type pattern matching a six character volume serial number, and followed by the unit to be used, in the form `SSH_SFTP_VOL_UNIT_MAP=`*`volume_pattern:unit_specification`*.

For example, `SSH_SFTP_VOL_UNIT_MAP=`*`AA9999:CART`*, where *`A`* is an alphabetic character and *`9`* is a decimal digit, means that volumes with a serial number consisting of two letters followed by four digits are to be allocated with `UNIT=CART`.

More specifically, `SSH_SFTP_VOL_UNIT_MAP=TP00001:CART` generates an allocation request for a tape with volume serial number *`TP0001`* with unit *`CART`*.

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6.4 Controlling File Transfer

The current Secure File Transfer Protocol (SFTP) does not transfer any information about the files to be transferred, only the file contents as a byte stream. This is sufficient for Unix-type files if the sender and receiver use the same CCS. However, it is possible to set specific file permissions for transferred files by using the **chmod** command.

With MVS data sets, Tectia needs more information: which transfer format to use, what coded character sets are involved, and what the file characteristics are. The information can be encoded in the file name with a file transfer advice string, or it can be read from a file transfer profile. When both the client and server are Tectia, alternatively the **site** commands of **scpg3** and **sftpg3** can be used.

File transfer advice string and **site** command are described in the following section. For more information on file transfer profiles, see Section 10.4.2.

6.4.1 File Transfer Advice String / Site Command

File transfer advice strings (FTADV) can be used to relay the information needed in the file transfer by encoding it in the file name. Any file name that starts with `/ftadv:` has the format

```
/ftadv:advstr/realfilename
```

where `advstr` is the advice string and `realfilename` is the data set name or a file name to be further processed by the server.

The advice string is either a sequence of `name=value` pairs delimited by commas, or a one-word shortcut. For ease of use, some advice string names also have abbreviations. For example: `/ftadv:automount=yes/`, `/ftadv:automount/` and `/ftadv:autom/` all enable automount.

When using Tectia file transfer clients, **site** commands can be used as an alternative for file transfer advice string. For **site** command descriptions, see the **site** and **lsite** command in sftpg3(1) and the `--dst-site` and `--src-site` options in scpg3(1).

Similarly to file transfer advice string, when giving the **site** command, either the full parameter name or its abbreviation can be used. For example, the following two commands accomplish the same thing:

```
sftp> site x=bin
sftp> site transfer_mode=bin
```

Note

A workaround for third-party clients has been provided for the case where a previous 'cd' command is ignored when a subsequent 'get' or 'put' operand begins with a file transfer advice string '/ftadv:.../'. These clients do not prefix their 'cwd' onto the operand because the initial '/' causes it to be interpreted as an absolute path. The 'ftadv' string may now begin with a leading dot './ftadv:.../', allowing the operand to be interpreted as a relative path.

The available FTADV/**site** parameters are listed and described in the following.

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Table 6.2. FTADV names / site parameters

Parameter	Abbreviations	Possible values
AUTOMOUNT	-	YES|NO|IMMED
[NO]AUTOMOUNT	[NO]AUTOM	-
AUTORECALL	-	YES|NO
[NO]AUTORECALL	[NO]AUTOR	-
BLKSIZE	B, BLOCKSI	*size*
BLOCKS	BL	-
CONDDISP	CO	CATLG|UNCATLG|KEEP|DELETE
CYLINDERS	CY	-
DATACLAS	DA	*class*
DATASET_SEQUENCE_NUMBER	SEQNUM	*number*
DEFER	DE	YES|NO
[NO]DEFER	-	-
DIRECTORY_SIZE	M, DI, DIRSZ	*size*
EXPIRY_DATE	EXPDT	*yyddd|yyyyddd*
FILE_STATUS	STATUS	NEW|MOD|SHR|OLD
FILETYPE	FILET, FT	SEQ|JES|IDCAMS|IDC|PDS|IEB-COPY|IBC|ADRDSSU|DSS|SORT
FIXRECFM	FI	*length*
JOB_ID	JESID	*ID*
JOB_OWNER	JESO	*name*
JOBNAME	JESJOB	*name*
KEYLEN	KEYL	*length*
KEYOFF	KEYO	*offset*
LABEL_TYPE	LABEL	NL|SL|NSL|SUL|BLP|LTM|AL|AUL
LIKE	-	*like*
LRECL	R, LR	*length*
MGMTCLAS	MG	*class*
NORMDISP	NOR	CATLG|UNCATLG|KEEP|DELETE
PDSEXTENS	PDEX	extension
PDSGENS	PDGS	YES|NO
PDSMASK	PDMA	mask
PDSNOTE	PDNT	YES|NO
PDSRDW	PDDW	YES|NO
PDSUDATA	PDUD	YES|NO
PRIMARY_SPACE	PRI	*space*
PROFILE	P, PROF	*profile*
RECFM	O, REC	*recfm*

Parameter	Abbreviations	Possible values
RECORD_TRUNCATE	U, TRUN	YES|NO
[NO]TRUNCATE	[NO]TRU, [NO]TRUN	-
RETENTION_PERIOD	RET	*days*
SECONDARY_SPACE	SE, SEC	*space*
SIZE	L	*size*
SPACE_RELEASE	RLSE	YES|NO
SPACE_UNIT	SU	BLKS|TRKS|CYLS|AVGRECLEN
SPACE_UNIT_LENGTH	SUL	*length*
STAGING	S, STAGE	YES|NO
STORCLAS	ST	*class*
SUBSYS	-	*name*
SVC99_TEXT_UNITS	SVC99	*string*
TRACKS	TR	-
TRAILING_BLANKS	TRAIL	YES|NO
[NO]TRAILINGBLANKS	[NO]TRAI, [NO]TRAIL	-
TRANSFER_CODESET	C, CODESET	*codeset*
TRANSFER_FILE_CODESET	D, FCODESET	*codeset*
TRANSFER_FILE_LINE_DELIMITER	J, FLDELIM	UNIX|MVS|MVS-FTP|DOS|MAC|NEL
TRANSFER_FORMAT	F, FORMAT	LINE|STREAM|RECORD
TRANSFER_LINE_DELIMITER	I, LDELIM	UNIX|MVS|MVS-FTP|DOS|MAC|NEL
TRANSFER_MODE	X, MODE	BIN|TEXT
TRANSFER_TRANSLATE_DSN_TEMPLATES	A, XDSNT	*templates*
TRANSFER_TRANSLATE_TABLE	E, XTBL	*table*
TYPE	T	PS|PO|PDS|POE|PDSE|GDG| HFS|VSAM|ESDS|KSDS|RRN|PIPE
UNIT	UN	*unit*
UNIT_COUNT	UC, UNC	*number*
UNIT_PARALLEL	UNP	YES|NO
VOLUME_COUNT	VC, VOLCNT	*number*
VOLUMES	VO, VOL	*vol1+vol2+...*

`AUTOMOUNT=YES|NO|IMMED`

If set to `YES` and a normal allocation fails because a data set is not online, Tectia will allocate it and request the system to mount it. This requires that the user has read permission to the `SSZ.MOUNT` facility.

If set to `NO`, offline data sets are not mounted automatically.

If set to `IMMED`, Tectia will not attempt the normal allocation, it will request the system to mount the data set immediately.

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Default: `NO`

`[NO]AUTOMOUNT|[NO]AUTOM`

`AUTOMOUNT|AUTOM` is equal to `AUTOMOUNT=YES`.

`NOAUTOMOUNT|NOAUTOM` is equal to `AUTOMOUNT=NO`.

`AUTORECALL=YES|NO`

Defines whether data sets migrated by a storage manager are recalled automatically.

Default: `YES`

`[NO]AUTORECALL|[NO]AUTOR`

`AUTORECALL|AUTOR` is equal to `AUTORECALL=YES`.

`NOAUTORECALL|NOAUTOR` is equal to `AUTORECALL=NO`.

`BLKSIZE|B|BLOCKSI=`*`size`*

Specifies the maximum block size.

Default: none

`BLOCKS|BL`

Specifies that the space allocation unit is blocks. Equal to `SPACE_UNIT=BLKS`.

`CONDDISP|CO=CATLG|UNCATLG|KEEP|DELETE`

Specifies the disposition of the output file when a file transfer ends prematurely (the client or server are alive but disconnected from the other end; for example, when pressing **CTRL+C** in the client).

Note

If the client (when transferring to local or client side) or the server (when transferring to remote or server side) dies, they will have no control over the disposition.

The options have the following effects, depending on the file type (MVS or HFS):

- `CATLG`: an MVS data set is retained and its name is cataloged. An HFS file is retained.
- `UNCATLG`: the name of an MVS data set is removed from the catalog but the data set is retained. An HFS file is retained.
- `KEEP`: an MVS data set is retained (if cataloged it will be still cataloged, if uncataloged it will be still uncataloged). An HFS file is retained.
- `DELETE`: the name of an MVS data set is removed from the catalog and the space allocated for the data set is released.

Default: `CATLG`

`CYLINDERS|CY`

Specifies that the space allocation unit is cylinders. Equal to `SPACE_UNIT=CYLS`.

`DATACLAS|DA=`*`class`*

Specifies the data class of a data set.

Default: none

`DATASET_SEQUENCE_NUMBER|SEQNUM=`*`number`*

Identifies the relative position of a data set on a tape volume.

Default: System default

`DEFER|DE=YES|NO`

Specifies whether data set allocation is postponed from allocation phase to when the data set is opened.

If set to `YES` data set allocation is postponed until data set is opened.

If set to `NO` data set is allocated in allocation phase.

Default: `NO`

`[NO]DEFER|DE`

`DEFER|DE` is equal to `DEFER=YES`.
`NODEFER` is equal to `DEFER=NO`.

`DIRECTORY_SIZE|M|DI|DIRSZ=`*`size`*

Specifies the number of 256-byte records in the directory.

Default: `10`

`EXPIRY_DATE|EXPDT=`*`yyddd`*`|`*`yyyyddd`*

Specifies the expiration date for a new data set. On and after this date, the operating system can delete or write over the data set.

Default: System default

`FILE_STATUS|STATUS=NEW|MOD|SHR|OLD`

Defines the status of a data set. If entered, the value will be used when allocating the data set. This attribute corresponds to the first value in the `DISP` parameter of the JCL DD statement. Possible values are:

- `NEW`: Create a data set.
- `MOD`: Append to an existing data set. If the data set does not exist, a new data set is created.
- `SHR`: Create a read-only data set.
- `OLD`: Designate an existing data set.

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`FILETYPE|FILET|FT=SEQ|JES|IDCAMS|IDC|PDS|IEBCOPY|IBC|ADRDSSU|DSS|SORT`

Allow using file-system commands.

- SEQ: Sequential. Default.
- JES: Enables the commands **put** and **sput** to submit transferred files to the internal reader job queue for execution, **get** and **sget** commands to retrieve spool data sets, and for file transfer advice strings, also **rm** to delete jobs, and **ls** to list jobs.

  To terminate interfacing with JES and return to normal file access, set the file type back to sequential (SEQ), or to an empty string (that is, `FILETYPE=`). Entering an empty string as file type sets the file type to default.
- IDCAMS|IDC: Allows invoking IDCAMS commands from sftp and scp when addressing a Tectia z/OS server. A file of IDCAMS commands can be passed to the IDCAMS command processor and a file containing the IDCAMS response can then be fetched. IDCAMS allows the use of any non-authorized IDCAMS commands, controlled by SAF permissions.

  IDCAMS is primarily used to define and manage VSAM data sets and integrated catalog facility catalogs.
- PDS: Enable transfers between PDS/PDSE datasets and directories. Supports record format fixed-block, variable-block and undefined PDS(e) datasets, as well as USS directories, which may be used to receive from or send to PDS/PDSE datasets.

  For transfers between PDS/PDSE and Unix, also see the additional attributes PDSEXTENS, PDSGENS, PDSMASK, PDSNOTE, PDSRDW, PDSUDATA.

  Note that if you copy PDSE program objects with FILETYPE=PDS, copied members will not be executable. To copy PDSE program objects properly, use FILETYPE=IEBCOPY instead.
- IEBCOPY|IBC: Allow copying PDSE programs. Members of the copy will be correctly executable.
- ADRDSSU|DSS: Provides DUMP and RESTORE commands, which can be used to dump one or more datasets to a flat dump file, and to restore them from that dump, possibly on a different z/OS system.
- SORT: Transfer selected records or parts of records instead of an entire dataset.

`FIXRECFM|FI=`*`length`*

The data set organization is set to `FB` and the fixed record length is set to *`length`*.

Default: none

`JOB_ID|JESID=`*`ID`*

When in `FILETYPE=JES` mode, `JOB_ID` specifies that commands accessing the JES spool, such as **get**, apply only to jobs with a job ID that matches the supplied *`ID`*.

When interfacing with JES using a file transfer advice string, using **ls -l** in conjunction with a job ID permits listing the spool files for that job.

Commands **get**, **sget**, and so on, with a job ID can be used to retrieve the spool files for a given job.

`JOB_OWNER|JESO=`*`name`*

When in `FILETYPE=JES` mode, `JOB_OWNER` specifies that commands accessing the JES spool, such as **ls**, and **get**, and so on, apply only to jobs with owner matching the supplied *`name`*.

Default: Current user

`JOBNAME|JESJOB=`*`name`*

When in `FILETYPE=JES` mode, `JOBNAME` specifies that commands accessing the JES spool, such as **ls**, **get**, and so on, apply only to jobs with job name matching the supplied *`name`*.

`KEYLEN|KEYL=`*`length`*

Specifies the length in bytes of the keys used in the data set.

Default: none

`KEYOFF|KEYO=`*`offset`*

Specifies the key offset; the position of the first byte of the key in records of the specified VSAM data set.

Default: none

`LABEL_TYPE|LABEL=NL|SL|NSL|SUL|BLP|LTM|AL|AUL`

The type of the label for the data set. This attribute corresponds to the first value in the `LABEL` parameter of the JCL DD statement.

Note

It is recommended for sites to control the use of `BLP` and `NL` tape processing by restricting access to the appropriate resource, using RACF or an equivalent security product.

`LIKE=`*`like`*

Specifies the name of a model data set from which the `RECFM`, `BLKSIZE`, and `LRECL` attributes are to be copied. The name must be the full DSN of a cataloged data set and must be preceded with three underscores.

You must include the `TYPE` attribute when using `LIKE` unless you are creating a PS data set and the model is a PS data set.

Default: none

`LRECL|R|LR=`*`length`*

Maximum record length or fixed record length.

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Default: `4096` for VSAM, `80` if data set organization is `F` or `FB`, otherwise `1024`

`MGMTCLAS|MG=`*`class`*

Specifies the management class of a data set.

Default: none

`NORMDISP|NOR=CATLG|UNCATLG|KEEP|DELETE`

Specifies the data set disposition to be used after a file transfer that ends normally. This attribute corresponds to the second value in the `DISP` parameter of the JCL DD statement.

Default: `CATLG`

`PRIMARY_SPACE|PRI=`*`space`*

Primary space allocation for a data set.

Default: none

`PDSEXTENS|PDEX=`*`extensions`*

Save members with the specified extension.

Default: none

`PDSGENS|PDGS=`*`YES`*`|`*`NO`*

Generate ISPF stats.

Default: YES

`PDSMASK|PDMA=`*`mask`*

PDS/PDSE member-selection prefix mask.

Default: none

`PDSNOTE|PDNT=`*`YES`*`|`*`NO`*

Save/restore NOTEs for load modules.

Default: YES when copying PDS to PDS, NO otherwise.

`PDSRDW|PDDW=`*`YES`*`|`*`NO`*

Save/restore member content in RDW-format USS file. Required for restoring PDS from unloaded data in a Unix directory.

Default: NO

`PDSUDATA|PDUD=`*`YES`*`|`*`NO`*

Save/restore userdata in .udata files. Required for restoring PDS from unloaded data in a Unix directory.

Default: NO

`PROFILE|P|PROF=`*`profile`*

The file transfer profile specifies the named profile used for the file transfer. The profile name is case-sensitive. With special profile name `P=%` no profiles are used. This also prevents profile matching based on file name.

Default: none

`RECFM|O|REC=`*`recfm`*

`RECFM` specifies the data set organization. The possible values are all valid combinations of the following letters:

```
F       Fixed
V       Variable
U       Undefined
B       Blocked
S       Spanned or standard
M       Machine line printer codes
A       ASA line printer codes
```

Default: `VB`

If binary mode transfer is requested for reading `recfm=V(B)(S)` dataset with `recfm=U` specified in the `sget` request, the block meta information (BDW + RDW) will be transferred to the destination. After the read operation completes, the catalog and dcb information for the dataset will be maintained.

`RECORD_TRUNCATE|U|TRUN=YES|NO`

When a record truncation occurs while writing an MVS data set, the system will continue writing the data set if `RECORD_TRUNCATE` is set to `YES`; and the system will abort the transfer if `RECORD_TRUNCATE` is set to `NO` or omitted.

Record truncation will occur if the length of a transferred record (after code set and line delimiter conversion) is larger than the maximum record length of the data set. Truncation can occur only when `TRANSFER_FORMAT` is set to `LINE` or `RECORD`. Note that the `STREAM` format does not have any concept of records in transferred data and it will fill out all records to their maximum length.

In the `LINE` transfer format, the length of a transferred record is the number of characters up to a newline character.

In the `RECORD` format, the length of a transferred record is given by the 4 byte binary length field which precedes the record.

The maximum length of a data set record depends on the data set organization:

```
F and FB - LRECL
V and VB - LRECL-4
U        - BLKSIZE
VSAM     - MAXRECLEN
```

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When Tectia client tools for z/OS aborts writing a data set because of record truncation, it will complete the write operation during which the system observed the truncation. It will write to disk one or more records, at least one of which is truncated. The data set is left on the system.

Tectia client tools for z/OS may write a large amount of data in one write operation, typically 32kB. Several records may be written in the last operation, some of them truncated. Small files may be written to the end of the file, and thus the resulting data set will be equivalent to one written with setting `RECORD_TRUNCATE=YES`.

Note that some file transfer client programs do not always show the error or warning messages from the server. Using the verbose mode (`--verbose`, `-v`) may show more messages from the server.

Note

When Tectia client tools for z/OS writes a data set with `RECORD_TRUNCATE=YES`, data loss may occur.

`[NO]TRUNCATE|[NO]TRU|[NO]TRUN`

`TRUNCATE|TRU|TRUN` is equal to `RECORD_TRUNCATE=YES`.

`[NO]TRUNCATE|[NO]TRU|[NO]TRUN` is equal to `RECORD_TRUNCATE=NO`.

`RETENTION_PERIOD|RET=`*`days`*

The retention period in days. After the retention period, the data set expires and the operating system can delete or overwrite the data set.

Default: System default

`SECONDARY_SPACE|SE|SEC=`*`space`*

Secondary space allocation for a data set.

Default: none

`SIZE|L=`*`size`*

Size estimate (in bytes) for data set allocation.

Default: `1000000`

`SPACE_RELEASE|RLSE=YES|NO`

When a new data set it allocated, `SPACE_RELEASE` specifies whether unused disk space will be released. If set to `YES`, unused disk space of a new data set is released. If set to `NO`, allocated disk space of a new data set is retained.

Default: `YES`

`SPACE_UNIT|SU=BLKS|TRKS|CYLS|AVGRECLEN`

Unit of space allocation for a data set.

Possible values for the space allocation unit are:

- `BLKS`: Blocks
- `CYLS`: Cylinders
- `TRKS`: Tracks
- `AVGRECLEN`: Average record length

Default: none

`SPACE_UNIT_LENGTH|SUL=length`

When `SPACE_UNIT=BLKS` or `SPACE_UNIT=AVGRECLEN`, specifies the size of the space allocation unit.

Default: 100 with `SPACE_UNIT=AVGRECLEN`, none with `SPACE_UNIT=BLKS`

`STAGING|S|STAGE=YES|NO`

Specifies whether staging is to be used in the SFTP server when accessing a file or data set.

If set to `NO`, staging is not used.

If set to `YES`, staging is used, when needed.

Default: `NO`

Note

When staging is used, do not set the `_CEE_RUNOPTS` environment variable's `TRAP` option to `OFF`. If you do, **sftpg3** fails to start. The `TRAP` option is `ON` by default.

`STORCLAS|ST=class`

Specifies the storage class of system managed storage.

Default: none

`SUBSYS=name`

Specifies the name of the target subsystem.

Default: none

`SVC99_TEXT_UNITS|SVC99=string`

Dynamic allocation arguments that override or are added to arguments from other file transfer attributes. For detailed information on this attribute, see the section called “Low-Level Access”.

Default: none

`TRACKS|TR`

Specifies that the space allocation unit is tracks. Equal to `SPACE_UNIT=TRKS`.

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`TRAILING_BLANKS|TRAIL=YES|NO`

This option specifies whether to preserve trailing blanks in a transferred fixed record (`RECFM=F|FB`) data set. This option only applies to line-delimited target files (`TRANSFER_FORMAT=LINE`), not to target unit-record data sets.

Note

In variable format datasets (`RECFM=V|VB`) trailing blanks are always preserved, independent of the value of this option.

If set to `YES`, trailing blanks will be transferred. This can be used, for example, to preserve the structure of fixed format data sets when transferring to a Unix-type file system.

If set to `NO`, trailing blanks will be stripped.

Default: `NO`

`[NO]TRAILINGBLANKS|[NO]TRAI|[NO]TRAIL`

`TRAILINGBLANKS|TRAI|TRAIL` is equal to `TRAILING_BLANKS=YES`.

`NOTRAILINGBLANKS|NOTRAI|NOTRAIL` is equal to `TRAILING_BLANKS=NO`.

`TRANSFER_CODESET|C|CODESET=`*`codeset`*

During the transfer the data has the specified code set. *`codeset`* is the code set name that is known to the **iconv** function of the system performing the conversion. The available code sets can be listed by invoking the **iconv** command at a USS prompt with the `-l` option:

```
> iconv -l
```

Default: none

Example 1: A Windows SFTP client puts a file to a z/OS data set and gets a data set from z/OS

Using file transfer advice strings:

```
sftp> sput file.txt /ftadv:C=ISO8859-1,D=IBM-1047/__DATASET.TXT ❶
sftp> sget /ftadv:D=IBM-1047,C=ISO8859-1/__DATASET.TXT file.txt ❷
```

❶ The Windows client tells the z/OS server that the code set during the transfer is ISO8859-1 and that the server should store the data set with the IBM-1047 code set.

❷ The Windows client tells the z/OS server that the code set in the data set is IBM-1047 and it should be converted to ISO8859-1 before transferring the data to the Windows client.

Using the **site** command:

```
sftp> site C=ISO8859-1 D=IBM-1047
sftp> sput file.txt //DATASET.TXT
sftp> sget //DATASET.TXT file.txt
```

Example 2: A z/OS SFTP client puts a data set to a Windows file and gets a file from Windows

Using file transfer advice strings:

```
sftp> sput /ftadv:C=ISO8859-1,D=IBM-1047/__DATASET.TXT file.txt  ❶
sftp> sget file.txt /ftadv:C=ISO8859-1,D=IBM-1047/__DATASET.TXT  ❷
```

❶ The z/OS client is told that code set in the data set is IBM-1047 and it should be converted to ISO8859-1 before transferring the data to the Windows server.

❷ The z/OS client is told that the file has the ISO8859-1 code set during the transfer and the data set should be stored with the IBM-1047 code set.

Using the **lsite** command:

```
sftp> lsite C=ISO8859-1 D=IBM-1047
sftp> sput //DATASET.TXT file.txt
sftp> sget file.txt //DATASET.TXT
```

Note

The line delimiter information is always given to the host that is capable of performing the conversion, in these cases the z/OS host.

`TRANSFER_FILE_CODESET|D|FCODESET=`*`codeset`*

The data in the data set has the specified code set. *`codeset`* is the code set name that is known to the **iconv** function of the system performing the conversion. The available code sets can be listed by invoking the **iconv** command at a USS prompt with the `-l` option:

```
> iconv -l
```

Default: none

`TRANSFER_FILE_LINE_DELIMITER|J|FLDELIM=UNIX|MVS|MVS-FTP|DOS|MAC|NEL`

The transfer file line delimiter specifies the newline convention used in the (source or destination) file. Possible values are:

- `UNIX`: The line delimiter used in the file is LF (`\n`, `0x0A`).
- `MVS`: The line delimiter used in the file is NL (`\n`, `0x15`). When writing to a data set, also the CR (`\r`, `0x0D`) code is considered as the End of Line.
- `MVS-FTP`: When reading MVS data sets, each record in the data set is treated as a line. The transfer line delimiter is appended to the record. Any control characters in the record data are preserved.

  When reading data sets with printer control characters, the control characters are preserved in the output.

  ### Note

  If you use `J=MVS-FTP` when writing data sets, you must set `--streaming=no`.

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If the code set conversion is specified either by `TRANSFER_TRANSLATE_TABLE|E`, or by `TRANSFER_CODESET|C` and `TRANSFER_FILE_CODESET|D`, the appended delimiter is the delimiter specified by `TRANSFER_LINE_DELIMITER|I`, `TRANSFER_CODESET|C`, or `TRANSFER_TRANSLATE_TABLE|E`. If no code set conversion is requested, the delimiter is defined by the code set of the data set. By default it is EBCDIC.

You can specify code sets by defining `TRANSFER_FILE_CODESET` without `TRANSFER_CODESET`. For example, to have a DOS delimiter in Unicode (`x'000D000A'`) appended to the records, set `"I=DOS,J=MVS-FTP,C=UCS-2"`, and to have a Unix delimiter in ISO Latin 1 (`x'0A'`), set `"I=UNIX,J=MVS-FTP,D=ISO8859-1"`.

- `DOS`: The line delimiter used in the file is CRLF (`\r\n`, `0x0D 0x0A`).
- `MAC`: The line delimiter used in the file is CR (`\r`, `0x0D`).
- `NEL`: The line delimiter used in the file is Unicode New Line (`0x85`).

Default: none

Note

The line delimiter information should be given to the host that is capable of performing the conversion, such as a host with a Tectia.

Note

For the line delimiter conversion to happen, both `TRANSFER_LINE_DELIMITER|I` and `TRANSFER_FILE_LINE_DELIMITER|J` must be specified.

Note

Line delimiter conversion is implemented for single byte code sets only.

Example: a z/OS Tectia SFTP client sends a data set to a Windows host and copies the file back from Windows

In this example, the code set is also converted.

Using file transfer advice strings:

```
sftp> sput /ftadv:I=DOS,J=MVS,C=ISO8859-1,D=IBM-1047/__DATASET.TXT file.txt ❶
sftp> sget file.txt /ftadv:I=DOS,J=MVS,C=ISO8859-1,D=IBM-1047/__DATASET.TXT \
        file.txt ❷
```

❶ The file line delimiter conversion (`J=MVS`) makes the z/OS client insert an NL (`0x15`) character after each record. The line delimiter conversion (`I=DOS`) converts all NL:s to CRLF (`0x0D 0x0A`) characters, which remain unchanged in the code set conversion. The z/OS client is told that the code set

in the data set is IBM-1047 and it should be converted to ISO8859-1 before transferring the data to the Windows server.

❷ The CRLF line delimiters (set by `I=DOS`) are converted to LF characters (`J=MVS`), which are converted to NL characters in the code set conversion. The conversion from line-delimited stream format to record-oriented format occurs automatically. In the code set conversion, the z/OS client is told that the file has the ISO8859-1 code set during the transfer and the data set should be stored with the IBM-1047 code set.

Using **lsite** commands:

```
sftp> lsite I=dos J=mvs
sftp> lsite C=IBM-437 D=IBM-1047
sftp> sput //DATASET.TXT file.txt
sftp> sget file.txt //DATASET.COPY.TXT
```

`TRANSFER_FORMAT|F|FORMAT=LINE|STREAM|RECORD`

The byte stream consists of the bytes that are transferred as payload in the SFTP protocol packets. The byte stream has one of the following formats: `LINE`, `STREAM` or `RECORD`. All three formats may have data consisting of text, non-text data, or a mixture of these.

When writing an MVS data set, a record that is longer than the maximum or fixed record length will cause an error unless `RECORD_TRUNCATE` is set to `YES`, in which case the record will be truncated. When writing to data sets with fixed record lengths, short records will be filled with binary zeroes if you use the record transfer format and with blanks if you use the line transfer format.

- `LINE`: The line transfer format is record-based. It uses delimiter characters to mark the end of a record. The delimiter character may be a Carriage Return (CR) or a Newline (NL). When writing to or reading from data sets with ASA control characters, a Form Feed (FF) is also treated as a delimiter. The table below shows the values of these characters in EBCDIC and ASCII. Data sent to Tectia client tools for z/OS in the line transfer format must be in EBCDIC or must be converted to EBCDIC during the transfer.

Delimiter	EBCDIC				ASCII			
	Name	Dec	Oct	Hex	Name	Dec	Oct	Hex
\r Carriage Return	CR	13	015	0x0D	CR	13	015	0x0D
\n Newline	NL	21	025	0x15	LF	10	012	0x0A
\f Form Feed	FF	12	014	0x0C	FF	12	014	0x0C

Note that ASCII does not have a NL character, instead Line Feed (LF) is used to delimit lines.

Avoid conversions that transform an ASCII Line Feed (`LF/10/012/0x0A`) into an EBCDIC Line Feed (`LF/37/045/0x25`) or an EBCDIC Newline (`NL/21/025/0x15`) into an ASCII Next Line (`NEL/133/0205/0x85`).

Be aware that sending a double delimiter, e.g. `\r\n` or `\n\r`, to Tectia client tools for z/OS will result in two records. The `TRANSFER_LINE_DELIMITER` and `TRANSFER_FILE_LINE_DELIMITER` attributes

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can be used to cause the Tectia client tools for z/OS server or client program to convert between the line delimiter conventions.

Tectia client tools for z/OS sends `\n` as the Server Newline Convention in the server initialization SFTP protocol message.

When transferring line format data to and from MVS files with ASA line printer control characters, Tectia client tools for z/OS will convert between the control characters and line delimiter characters, as described in the IBM z/OS *XL C/C++ Programming Guide*, Chapter *"Using ASA Text Files"*.

To transfer records without changing the ASA code, use the `STREAM` or `RECORD` transfer format, or define the data set using a DD card and specify `RECFM=FB` or `RECFM=VB`.

Data sets transferred in the line transfer format and recreated on a mainframe will not necessarily be identical.

- `STREAM`: The stream transfer format contains the data bytes of the data set but no structural information. If a data set with a fixed record length is transferred with the stream format and recreated with the same record length, the record structure will be preserved. Variable length records will not be recreated properly if transferred with the stream format.

- `RECORD`: The record transfer format is record-based. Each record is preceded by a length field consisting of a 4 bytes, which indicates the number of data bytes in the record.

  When `TRANSFER_FILE_LINE_DELIMITER|J=MVS` is specified, the length field consists of a 4-byte big-endian binary integer, which indicates the number of data bytes in the record.

  When `TRANSFER_FILE_LINE_DELIMITER|J=MVS-FTP` is specified, the length field consists of a 2-byte big-endian binary integer followed by 2-byte zeros. The 2-byte big-endian binary integer indicates the number of data bytes in the record plus the four bytes length field.

  A data set that is transferred with the record transfer format can be recreated as any data set type.

Default: `LINE`.

`TRANSFER_LINE_DELIMITER|I|LDELIM=UNIX|MVS|MVS-FTP|DOS|MAC|NEL`

The transfer line delimiter specifies the newline convention used in the data that is transferred over the connection. Possible values are:

- `UNIX`: The line delimiter on the connection is LF (`\n`, `0x0A`).

- `MVS`: The line delimiter on the connection is NL (`\n`, `0x15`). If the data is converted from EBCDIC to ASCII, the NL becomes a LF (`\n`, `0x0A`).

- `MVS-FTP`: When writing to a data set, only the LF (`\n`, `0x0A`) control codes are considered as an End Of Line. Any CR (`\r`, `0x0D`) codes are preserved as data in the record.

When writing data sets with ASA printer control characters, the first character on each line is used as the ASA character.

Note

If you use `I=MVS-FTP` when reading data sets, you must set `--streaming=no`.

- `DOS`: The line delimiter on the connection is CRLF (`\r\n`, `0x0D 0x0A`).
- `MAC`: The line delimiter on the connection is CR (`\r`, `0x0D`).
- `NEL`: The line delimiter used in the file is Unicode New Line (`0x85`).

Default: none

Note

The line delimiter information should be given to the host that is capable of performing the conversion, such as a host with a Tectia.

`TRANSFER_MODE|X|MODE=BIN|TEXT`

The transfer mode specifies whether code set and line delimiter conversions are performed. The available values are:

- `BIN`: Code set and line delimiter conversions are not performed.
- `TEXT`: Code set and line delimiter conversions are performed.

Default: none

Note

If `TRANSFER_MODE` is not given but both `TRANSFER_CODESET` and `TRANSFER_FILE_CODESET` or `TRANSFER_TRANSLATE_TABLE` are present conversions are performed.

`TRANSFER_TRANSLATE_DSN_TEMPLATES|A|XDSNT=`*`templates`*

`templates` specifies the search templates for the translate table. Write `'%T'` to show the point where the translate table name (see above) is to be inserted. Delimit the templates with a plus character. The data set name templates must not contain slashes, instead they must be preceded by two or three underscores. For more information, see Section 10.3.1.

The first translate table data set that is found is used to perform the code conversion.

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Note

The translate table must translate line delimiters into EBCDIC NL characters. See `TRANSFER_FORMAT`.

Default: none

`TRANSFER_TRANSLATE_TABLE|E|XTBL=`*`table`*

`TABLE` is the name of the table that specifies the code set conversion. If set, this attribute overrides the transfer code set and file code set attributes. The table is always applied in the normal direction, that is, the first character array is used for incoming (from the line to the data set) data and the second array for outgoing data. If the opposite translation is needed, e.g. the data set contains ASCII and should be transferred as EBCDIC, you (or your system programmer) can prepare a table data set with the character arrays in reversed order (e.g. with the system utility CONVXLAT or by editing an existing translate data set).

`TYPE|T=PS|PO|PDS|POE|PDSE|GDG|HFS|VSAM|ESDS|KSDS|RRN|PIPE`

Specifies the type of a data set when the data set is created. The available values are:

- `PS`: The type of the created data set is PS.
- `PO|PDS`: The type of the created data set should be PDS. Note that in order to create a PDS, you need to specify the `DIRECTORY_SIZE` parameter. If you do not specify the directory size, a sequential data set - not a partitioned data set - is created.
- `POE|PDSE`: The type of the created data set is PDSE.
- `GDG`: The type of the created data set is GDG.
- `HFS`: The type of the created data set is HFS.
- `VSAM`: The type of the created data set is VSAM.
- `ESDS`: The type of the created data set is VSAM ESDS.
- `KSDS`: The type of the created data set is VSAM KSDS.
- `RRN`: The type of the created data set is VSAM RRN.
- PIPE: The type of the created data set is PIPE.

Default: `PO`, if data set name includes member, otherwise `PS`

`UNIT|UN=`*`unit`*

The name of the device or group of devices that the data set will reside on (or does reside on, if it already exists). The maximum length of *`unit`* is 8 characters. If the value exceeds the maximum length, it is truncated to 8 characters.

It is also possible to specify a device address. Precede a four digit address with an underscore.

Default: none

`UNIT_COUNT|UC|UNC=number`
Specifies the number of devices for the data set. This attribute corresponds to the second value in the `UNIT` parameter of the JCL DD statement.

Default: System default

`UNIT_PARALLEL|UNP=YES|NO`
Asks the system to mount all the volumes for the data set in parallel. This attribute corresponds to the character 'P' in the second value in the `UNIT` parameter of the JCL DD statement.

Default: System default

`VOLUME_COUNT|VC|VOLCNT=number`
Specifies the maximum number of volumes that an output data set requires. This attribute corresponds to the volume count value in the `VOLUME` parameter of the JCL DD statement.

Default: System default

`VOLUMES|VO|VOL=vol1+vol2+...`
A plus sign (+) separated list of volumes a data set will reside on (or does reside on, if it already exists).

Default: none

File Transfers between z/OS Machines

When data sets are transferred between z/OS machines, the destination data set is by default allocated with the same attributes as the source data set. The attributes for the destination data set can be overridden with the **site** commands.

Note

If you change the data set record format from `VB` to `FB` during transfer, you have to specify both `BLKSIZE` and `LRECL` for the destination data set. Otherwise, an error may occur if the block size does not match the record length.

Note

Tectia Server for IBM z/OS does not support data set allocation of `LARGE`, `EXTENDED`, or `COMPRESSED` formats. However, transfer is possible to pre-allocated data sets of these types.

6.4.2 File Transfer Environment Variables for the Clients

The file transfer clients **scpg3** and **sftpg3** use the following environment variables:

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```
SSH_DEBUG_FMT                 (default: "%Dd/%Dt/%Dy %Dh:%Dm:%Ds:%Df %m/%s:%n:%f %M")
SSH_SFTP_SMF_TYPE             (default: NULL)
SSH_SFT_PSEUDOVOLUME_VOLSERS  (default: MIGRAT)
SSH_SFTP_HOME_MVS             (default: "no")
SSH_SFTP_SHOW_BYTE_COUNT      (default: "no")
SSH_SFTP_STATISTICS           (default: "yes")
```

The `SSH_DEBUG_FMT` variable can be used to specify the format of the debug messages. For more information, see **SSH_DEBUG_FMT** .

If `SSH_SFTP_SMF_TYPE` is set to `TYPE119` file transfers create SMF records of type 119.

`SSH_SFT_PSEUDOVOLUME_VOLSERS` can be used to define a list of pseudo-volume serial numbers for data sets that are migrated or archived, see Section 6.4.3.

The default file transfer home location is the user's Unix System Services (USS) home directory. If `SSH_SFTP_HOME_MVS` is set to `yes`, the local directory is set to USER prefix in the MVS side. See the section called "Setting the File Transfer Home Location" for examples of using this variable.

If `SSH_SFTP_SHOW_BYTE_COUNT` is set to `yes`, the number of transferred bytes is shown after successful file transfer. Also the names of source and destination files are shown.

By default, a normal progress bar is shown while transferring a file. If `SSH_SFTP_STATISTICS` is set to `no`, the progress bar is not shown. If it is set to `simple`, file transfer statistics are shown after the file has been transferred.

Furthermore, **sftpg3** uses the following environment variable for defining the path to the batch file to be run when **sftpg3** is started:

```
SSH_SFTP_BATCH_FILE   (default: NULL)
```

Setting the File Transfer Home Location

For SFTP connections, the file transfer home location is the directory on the client where the SFTP session starts. By default, Tectia Server for IBM z/OS uses the user's Unix System Services (USS) home directory as the file transfer home location. The environment variable `SSH_SFTP_HOME_MVS` in the user's `$HOME/.profile` file on the client machine can be used to control the file transfer home location.

If the environment variable `SSH_SFTP_HOME_MVS` in the user's `$HOME/.profile` file on the client end is omitted or its value is `no`, the user's USS home directory is used as the file transfer home, for example `/u/userid/`, and the MVS user prefix must be accessed using "`//`". If variable `SSH_SFTP_HOME_MVS` in the user's `$HOME/.ssh2/environment` file on the remote side is omitted or it's value is no, the user's USS home directory is used as the file transfer home on the remote end.

If the value of `SSH_SFTP_HOME_MVS` is `yes`, the user's MVS USERID prefix is used as the file transfer home location, for example `//'USERID.`, and the USS home directory must be accessed using `/u/userid/` or `~`. Setting the `SSH_SFTP_HOME_MVS` variable to `yes` on the user's `$HOME/.profile` file on the client end will set

the user's file transfer home to MVS USERID prefix locally, if set on the remote `$HOME/.ssh2/environment` file, the MVS USERID prefix will be used on the remote end.

Examples when `SSH_SFTP_HOME_MVS=no`

When `SSH_SFTP_HOME_MVS` is set to `no` (or omitted), the following `get` command run in the SFTP client results to a file `/home/user1/dataset.txt` in Tectia Server for IBM z/OS:

```
sftp> open user1@server
sftp> get dataset.txt
```

The following **sget** command run in the SFTP client results to a MVS sequential data set `//'USERID.MF.FILE'` in Tectia Server for IBM z/OS:

```
sftp> open user1@server
sftp> sget remote_file //MF.FILE
```

Examples when `SSH_SFTP_HOME_MVS=yes`

When `SSH_SFTP_HOME_MVS` is set to `yes`, the following `get` command in the SFTP client results to a data set `//'USER1.DATASET.TXT'` in Tectia Server for IBM z/OS:

```
sftp> open user1@server
sftp> get dataset.txt
```

The following **sget** command run in the SFTP client results to a USS file `/u/user1/mf.file` in Tectia Server for IBM z/OS:

```
sftp> open user1@server
sftp> sget remote_file ~/mf.file
```

Or:

```
sftp> open user1@server
sftp> sget remote_file /u/user1/mf.file
```

6.4.3 Restoring Archived Data Sets

A data set may have been migrated or archived by storing it out of the normal data file system to a tape or some other storage medium. Such data sets will have a volume serial number set to a pseudo-value that indicates that they are not available on an online volume. Data facility hierarchical storage manager (DFHSM) uses the special volume serial number `MIGRAT` for this purpose. The SFTP subsystem recognizes this by default and issues the appropriate allocation request to cause such data sets to be recalled when asked to do so.

Various other storage management systems use different values as the pseudo volume serial number for data sets they have migrated. You can give any such special volume serial number via the environment variable `SSH_SFT_PSEUDOVOLUME_VOLSERS`, which accepts a comma-separated list of one or more volume serial numbers, matching those in use by the local site storage manager to denote migrated data sets. In the case where migrated data sets at your installation have volume serial numbers other than `MIGRAT`, you can specify

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this environment variable in your shell profile or `STDENV DD`. See *Tectia Server for IBM z/OS Administrator Manual* for further details.

Extended file attributes `automount` and `autorecall` are used to control the behavior of SFTP when working with migrated data sets. See Section 6.4 for further details. Note that the requisite security manager permissions may be required to recall data sets.

6.5 Listing Data Sets with Tectia client tools for z/OS

Tectia client tools for z/OS can be used to list data sets.

6.5.1 Data Set Lists

To display data set lists, use the **ls** and **ls -l** commands. The **ls** command shows the list with relative data set names. The **ls -l** command shows additional information formatted by the server.

When listing a PDS or PDSE, the member names are listed.

When listing a GDG, the GDG name is treated as a prefix. The listing may contain data sets that are not in the GDG index but do have data set names that have the GDG name as a prefix.

Using the **ls** command without any parameters displays the content of the current working directory.

```
sftp> ls
BINARY.FILE
CONT2.TEST2
DEMO.ZIP
FILE.Z
FILE1.PS
FILE1.VSAM
FILE2.PS
ISPF.ISPPROF
PDS
SAMPLIB
TEST.FILE
WINFILE.PS
WINPDS
```

Users can also define the DSN qualifier or HFS path they want to list. To use an absolute DSN, start the prefix with "`//'`". To use a relative DSN, which will be completed with the user name, start the prefix with "`//`".

Note

When listing data sets in the main catalog, the listing shows only catalog entries. The catalog does not have entries for users. The user's name will be in the listing only if there is a user catalog connector entry with that name.

To list data sets with the DSNs `USER1.TEST.PS.*`, use the following command:

```
sftp> ls //'USER1.TEST.PS.'
//'USER1.TEST.PS.':
FILE1
FILE2
FILE3
```

If the user is connected as `USER1`, use the following command for an extended list:

```
sftp> ls -l //TEST.PS.
//TEST.PS.:
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
Z6SYS1 Jul 25 2006 VB     1024 27998 PS       50001  FILE1
Z6SYS1 Jul 25 2006 VB     1024 27998 PS       50001  FILE2
Z6SYS1 Jul 25 2006 VB     1024 27998 PS       50001  FILE3
```

The fields in the extended list are:

Volume
: The volume or volumes the data set resides on. If the volume cannot be accessed, the text "`:offline`" is appended to the volume name.

Date (Referred)
: The day on which the data set was last referred to, or the creation date

Record format (Recfm)
: The `RECFM` or "VSAM"

Record size (Lrecl)
: The `LRECL`

Block size (BlkSz)
: The `BLKSIZE`

File type (Dsorg)
: The file type: PS, PO, POE, ESDS, KSDS, RRN, or PS/PO. PS/PO is used for non-VSAM data sets on off-line volumes.

Size Estimate (Space)
: An estimate of the count of data bytes in the data set which is based on the number of used tracks; or for VSAM files, the High RBA; and for PDSEs, the number of allocated tracks. A 3390 track is estimated to hold 50001 bytes (the track count can be seen in the least significant digits). The size may be smaller than the number of data bytes in the data set, if it has an efficient block size. The size of the data set when transferred may differ greatly from the size estimate, depending on such factors as character encoding, line delimiters, and trailing blanks.

Name (Dsname)
: The relative data set name

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6.5.2 Data Set Hierarchy

Tectia client tools for z/OS present z/OS data sets as if they formed a hierarchy of directories where the data set name (DSN) qualifiers are the directory names.

The **cd** command can be used to change the DSN prefix. To use an absolute DSN start the prefix with "`//'`". To use a relative DSN, which will be completed with the user name, start the prefix with "`//`".

For example, to change the working "directory" to `//'USER1`, use the command:

```
sftp> cd //'USER1.'
MVS prefix `'USER1.'' is the current directory.
'USER1.'
sftp>
```

If the user is connected as `USER1`, use the command:

```
sftp> cd //
MVS prefix `'USER1.'' is the current directory.
'USER1.'
sftp>
```

Once working in a "directory" (`//'USER1.'`, for example) you can go into a "subdirectory" by doing a **cd** to a qualifier:

```
sftp> cd TEST.
MVS prefix `'USER1.TEST.'' is the current directory.
'USER1.TEST.'
sftp> ls -l
'USER1.TEST.':
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
Z6SYS1 Jul 17 2006 VB    1024  27998 PS       50001  FILE
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  PS.FILE1
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  PS.FILE2
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  PS.FILE3

sftp> cd PS.
MVS prefix `'USER1.TEST.PS.'' is the current directory.
'USER1.TEST.PS.'
sftp> ls -l
'USER1.TEST.PS.':
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  FILE1
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  FILE2
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  FILE3

sftp>
```

You can go "up" in the hierarchy with the "`cd ..`" command:

```
sftp> cd ..
MVS prefix `'USER1.TEST.'' is the current directory.
'USER1.TEST.'
sftp> ls
'USER1.TEST.':
FILE
PS.FILE1
PS.FILE2
PS.FILE3

sftp> cd ..
MVS prefix `'USER1.'' is the current directory.
'USER1.'
sftp>
```

The **cd** command can also be used for going into a PDS or PDSE file, for example:

```
sftp> cd PDS
MVS prefix `'USER1.PDS'' is the current directory.
The working directory `'USER1.PDS'' is a partitioned data set.
'USER1.PDS'
sftp> ls
'USER1.PDS':
MEM1
MEM2
```

Instead of using the **cd** command to change the directory one qualifier at a time, the whole data set name can be used, for example:

```
sftp> cd //'USER1.TEST.PS.'
MVS prefix `'USER1.TEST.PS.'' is the current directory.
'USER1.TEST.PS.'
```

6.6 Secure File Transfer Examples Using the z/OS Client

The client component of Tectia Server for IBM z/OS contains two file transfer applications, **scpg3** and **sftpg3**.

- **scpg3** is a secure replacement for remote copy (**rcp**) and provides easy secure non-interactive file transfers.
- **sftpg3** is a secure replacement for FTP and provides a user interface for interactive file transfers and a batch mode for unattended file transfers.

The following examples (summarized in Table 6.3) can be used for interactive and unattended file transfers to and from a mainframe running Tectia Server for IBM z/OS 6.8. The same examples apply to file transfers against Windows and Unix servers. In these examples, the `ssh_ftadv_config.example` file transfer profiles are used. See Section 10.4.2 for more information.

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Table 6.3. Examples of interactive and unattended secure file transfers using the scpg3 and sftpg3 clients.

	Interactive file transfers	Unattended file transfers
scpg3	1. Remote Unix file into MVS data set 2. MVS data set to remote Unix file 3. Remote Windows text file into PDS member 4. Remote Windows text file into fixed block PDS member 5. z/OS binary file to another z/OS system	1. Remote file into MVS data set 2. MVS data set to remote Windows file 3. MVS data set to remote Unix file using translate table 4. Remote file into pre-allocated MVS data set 5. Remote Unix ASCII file into PDS member 6. Remote Windows ASCII file into PDS member
sftpg3	1. Unix file to z/OS VSAM ESDS data set using filename-matched profiles 2. File listing and several interactive file transfers between z/OS and Unix 3. File transfers via BatchPipes	1. Remote ASCII file into data set member 2. Run sftpg3 using a batch command file

6.6.1 Interactive File Transfers

Interactive file transfers can be used from Unix System Services shells, for example, OMVS, Telnet, or Secure Shell sessions can be used.

Note

In these examples, the `ssh_ftadv_config.example` file transfer profiles are used. See Section 10.4.2 for more information.

File Transfers Using the scpg3 z/OS Client

The **scpg3** syntax is the following:

```
$ scpg3 user@source:source_file user@destination:destination_file
```

Local paths can be specified without the *`user@system:`* prefix.

Note

In the following examples, data set names that contain single quotes and/or parentheses are placed in regular quotation marks (`" "`). This must be done to prevent the shell from trying to interpret the single quotes and parentheses. Alternatively, you can use backslashes (\) to escape the single quotes and parentheses, for example `//\'USER1.WINPDS\(MEM1\)\'`.

Example 1: Fetch a Unix file into an MVS data set

A file transfer profile is not defined in the file transfer command, so the filename-matched profile is used if matched. In this case, the file name does not match any of the defined profiles, so the default profile is used (text format with code set conversion).

```
> scpg3 user1@10.1.70.193:source_file //FILE1.PS
```

or

```
$ scpg3 user1@10.1.70.193:source_file "//'USER1.FILE2.PS'"
```

Example 2: Put an MVS data set to a Unix file

A file transfer profile is not defined in the file transfer command, so the filename-matched profile is used if matched. The data set name has the `".Z"` extension, so the correct profile is selected automatically (binary file transfer).

```
$ scpg3 "//'USER1.PDS.Z'" user1@10.1.70.193:/tmp/binaries/file.Z
```

Example 3: Fetch a Windows text file into a partitioned data set member

In this case, a Windows profile is used in order to do the Windows line delimiter conversion correctly. The profile also defines code set conversion.

Using a file transfer advice string:

```
$ scpg3 user1@10.1.70.100:textfile /ftadv:P=WIN///'USER1.WINPDS(MEM1)'
```

Or, alternatively, using a **site** parameter:

```
$ scpg3 --dst-site="P=WIN" user1@10.1.70.100:textfile "//'USER1.WINPDS(MEM1)'"
```

Example 4: Fetch a Windows text file into a fixed block partitioned data set member

A windows profile is used for code set and line delimiter conversions, but additional parameters are required for defining the Fixed Block file format.

Using a file transfer advice string:

```
$ scpg3 user1@10.1.70.100:jcl-file /ftadv:P=WIN,O=FB,R=80///'USER1.WINPDS(JCL)'
```

Or, alternatively, using **site** parameters:

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```
$ scpg3 --dst-site="P=WIN,O=FB,R=80" user1@10.1.70.100:jcl-file "//'USER1.WINPDS(JCL)'"
```

Example 5: Copy a z/OS binary file to another z/OS system

To ensure that both parties handle the data set as binary, set the binary profile (`P=BIN`) or binary settings (`X=BIN,F=STREAM`) to both local and remote data sets. If you are not sure whether the profiles are enabled, use the binary settings (`X=BIN,F=STREAM`).

Using a file transfer advice string:

```
$ scpg3 /ftadv:P=BIN///LOCAL.BINARY \
  user@lpar2.example.com:/ftadv:X=BIN,F=STREAM///REMOTE.BINARY
```

Or, alternatively, using **site** parameters:

```
$ scpg3 --src-site="P=BIN" --dst-site="X=BIN,F=STREAM" //LOCAL.BINARY \
  user@lpar2.example.com://REMOTE.BINARY
```

File Transfers Using the sftpg3 z/OS Client

sftpg3 has the **sput** and **sget** commands that can be used for mainframe file transfers.

Example 1: Fetch a Unix file to a z/OS VSAM ESDS data set using filename-matched profiles

An **sftpg3** connection is opened and a file is transferred from Unix to z/OS with the **sget** command.

The example assumes that you have set a filename-matched profile that matches `textfile.txt`.

```
$ sftpg3 user1@10.1.70.193
user1@10.1.70.193's password:
sftp> sget textfile.txt /ftadv:T=ESDS///FILE1.VSAM
textfile.txt                  |   49B |   49B/s | TOC: 00:00:01 | 100%
sftp> quit
```

Example 2: File listing and several interactive file transfers between z/OS and Unix

```
$ sftpg3 user1@10.1.70.193
user1@10.1.70.193's password:
sftp> ls ❶
mainframe_files/
source_file
textfile.txt

sftp> cd mainframe_files ❷
/home/user1/mainframe_files
sftp> ls ❸
/home/user1/mainframe_files:
binary.dat
jcl
sftp> sget binary.dat //'USER1.BINARY.FILE' ❹
binary.dat                    | 4.6kB | 4.6kB/s | TOC: 00:00:01 | 100%
```

```
sftp> ascii ❺
sftp> sget jcl /ftadv:O=FB R=80///'USER1.PDS(MEM1)' ❻
jcl                           |   98B |   98B/s | TOC: 00:00:01 | 100%
sftp> sput //FILE1.PS /tmp/result.txt ❼
FILE1.PS                      |   49B |   49B/s | TOC: 00:00:01 | 100%
sftp> binary ❽
sftp> sput //BINARY.FILE binary_file.dat ❾
BINARY.FILE                   | 4.6kB | 4.6kB/s | TOC: 00:00:01 | 100%
```

❶ List files in current working directory.

❷ Change current working directory to `mainframe_files`.

❸ List files in current working directory.

❹ Get a file to an MVS data set.

❺ Set transfer mode to ASCII.

❻ Get an ASCII file into an MVS data set member, using a file transfer advice string to set `recfm FB` and `lrecl 80`.

❼ Put an MVS data set to an ASCII file.

❽ Set transfer mode to binary.

❾ Put an MVS data set to a binary file.

Example 3: File transfers via BatchPipes

Tectia SFTP allows file transfers via the BatchPipes subsystem, which can speed up batch-process file transfers.

To use BatchPipes for file transfer, you will need to specify the BatchPipes-subsystem name in FTADV attributes. This can be done, for example, with the following commands on the local and remote machine respectively.

On the local machine:

```
$ sftpg3
  open remote
  sput //DATASET1 /ftadv:subsys=BP01,...///BATPIPE
  quit
```

And on the remote machine:

```
$ scpg3 /ftadv:subsys=BP01,...///BATPIPE //DATASET2
```

You can open the pipe ends in either order.

Once both ends of the batch pipe are open, processing via the pipe can start. The transferred records from DATASET1 are written to BATPIPE, and as each is written, the reader process gets a record from BATPIPE and copies it to DATASET2.

As another example, here is a batch job that writes to pipe. In this example the batch job is running on host1. The BatchPipes subsystem must be running on host1:

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```
//USER1BPW JOB ,,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//             NOTIFY=&SYSUID
//*
//* write to batchpipe; other end: sftp get
//*
//WRT     EXEC PGM=IEBGENER
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  DUMMY
//SYSUT1   DD  DSN=USER1.DATASET1,DISP=SHR
//SYSUT2   DD  DSN=USER1.BATPIPE,SUBSYS=BP01,
//             RECFM=FB,LRECL=80,BLKSIZE=27920
//*
```

A remote sftp process then opens the batch pipe and starts reading records from it:

```
open host1
sget /ftadv:subsys=BP01,fi=80,B=27920//__USER1.BATPIPE \
     //DATASET2
quit
```

As records are fed into the batch pipe by the writer job, they are fetched by sftpg3, communicating securely over the network with host1, and written to local dataset DATASET2. Writing and reading happen in parallel, without waiting for the writer process to complete before the transfer can start.

Note

Both ends of a batch pipe must have the same RECFM, LRECL and BLKSIZE attributes. We recommend specfiying these explicitly.

6.6.2 Unattended File Transfers

Unattended file transfers of MVS data sets can be executed in JCL by `BPXBATCH`, `BPXBATSL`, or `oshell`. **scpg3** uses the same syntax for interactive and unattended file transfers. **sftpg3** has a batch mode for non-interactive file transfers.

Note

User interaction is not possible when using unattended file transfers.

Users must be set up to use a non-interactive authentication method for unattended use, such as public key without a passphrase.

Because user interaction is not possible, the server host key must be stored on disk on the client before unattended file transfers will succeed. More information and examples on storing remote server keys can be found in Section 4.2 and Section 4.9.1.

The sample scripts shown in this section can also be found in `<HLQ>.V681.SAMPLIB`.

File Transfers Using the scpg3 z/OS Client

Example 1: Fetch a remote file into an MVS data set

This example (`SCPGET` from `SAMPLIB`) executes **scpg3** and copies a remote file (*`file.bin`*) into a data set (*`//'USER.TEST.BINFILE'`*). If the data set does not exist, it is created with default values `recfm VB` and `lrecl 1024`.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SCPGET  EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/scpg3
  user@remote:file.bin
  //'USER.TEST.BINFILE'
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//
```

Example 2: Put an MVS data set to a remote Windows file

In this example (`SCPPUT1` from `SAMPLIB`), **scpg3** is executed to copy a data set to a remote file (*`test.list`*), converting the code set from IBM-1047 to ISO8859-1 and records to CR-LF delimited lines.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SCPPUT1 EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM  DD  *
PGM /opt/tectia/bin/scpg3
  /ftadv:C=ISO8859-1,D=IBM-1047,I=DOS,J=MVS//__HLQ.TEST.LIST
  user@remote:test.list
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//
```

Example 3: Put an MVS data set to a remote Unix file using translate table

In this example (`SCPPUT` from `SAMPLIB`), **scpg3** is executed to copy a data set assigned to `DD LIST` to a remote file (*`test.list`*), performing code set translation via the `'TCPIP.STANDARD.TCPXLBIN'` translate table.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SCPPUT  EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM  DD  *
```

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```
PGM /opt/tectia/bin/scpg3
  /ftadv:E=STANDARD,A=___TCPIP.%T.TCPXLBIN,F=LINE///DD:LIST
  user@remote:test.list
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//LIST     DD  DSN=&SYSUID..TEST.LIST,DISP=SHR
//
```

Example 4: Fetch a remote file into a pre-allocated MVS data set

In this example (`SCPGET2` from `SAMPLIB`), a remote file (*`testfile`*) is copied into a pre-allocated data set, assigned to `DD TEST`.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SCPGET2 EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/scpg3
  user@remote:testfile
  //DD:TEST
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//TEST     DD  DSN=&SYSUID..TEST,DISP=(NEW,CATLG),
//             VOL=SER=ZZSYS1,SPACE=(TRK,(2,2)),
//             DCB=(RECFM=VB,LRECL=1024,BLKSIZE=27998)
//
```

Example 5: Fetch a remote Unix ASCII file into a data set member

In this example (`SCPGET3` from `SAMPLIB`), a remote Unix ASCII file (*`jcl.txt`*) is copied to mainframe into a PDS member using `lrecl 80` and `recfm FB`, creating the PDS if it does not exist.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SCPGET3 EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/scpg3
  user@remote:jcl.txt
  /ftadv:C=ISO8859-1,D=IBM-1047,FI=80,DIRSZ=10///'USER.JCL(JCL1)'
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//
```

Example 6: Fetch a remote Windows ASCII file into a data set member

In this example (`SCPGET3W` from `SAMPLIB`), a remote ASCII CRLF (Windows/DOS) file (*`jcl.txt`*) is copied to mainframe into a PDS member using `lrecl 80` and `recfm FB`, creating the PDS if it does not exist.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SCPGT3W EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/scpg3
 user@remote:jcl.txt
 /ftadv:C=ISO8859-1,D=IBM-1047,I=DOS,J=MVS,FI=80,M=10///'USER.JCL(JCL1)'
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//
```

File Transfers Using the sftpg3 z/OS Client

The **sftpg3** file transfer application can be run in batch mode for non-interactive file transfers.

Example 1: Fetch a remote ASCII file into a data set member

In this example (`SFTPBAT` from `SAMPLIB`), **sftpg3** is run in batch mode to copy a remote ASCII file (*`jcl.txt`*) into a PDS member using `lrecl 80` and `recfm FB`. If the PDS does not exist, it will be created.

The stdout and stderr message files are printed to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SFTP    EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/sftpg3 -B //DD:STDIN
  user@remote
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  *
sget jcl.txt \
  /ftadv:C=ISO8859-1,D=IBM-1047,FI=80,DIRSZ=10///'USER.JCL(JCL1)'
ls //'USER.JCL'
//
```

Example 2: Run sftpg3 using a batch command file

In this example (`SFTP` from `SAMPLIB`), **sftpg3** is run in batch mode (with the `-B` option). Since it is not possible to enter a password, we use public-key authentication with no passphrase for the private key.

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sftpg3 returns the highest error code as the return code from the run. BPXBATSL multiplies this by 256 and returns the product as the step's condition code.

Using the **ls** command may cause non-zero error codes, for example if a referenced data set is in use in another address space. Run listings in separate steps if it is important to get the proper condition codes from file transfers.

The stdout and stderr message files are printed combined to `SYSOUT`. Required environment variables are supplied in `SSHENV` via `STDENV DD`. Modify the DD statement according to your requirements.

```
//SFTP2   EXEC PGM=BPXBATSL,REGION=0M
//STDPARM  DD  *
PGM /opt/tectia/bin/sftpg3 -B //DD:STDIN
    user@remote
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDIN    DD  *
cd //'USER.TEST.REPORTS' ❶
sget RPT1 /ftadv:RECFM=FB,LRECL=80///TEST.RPT1 ❷
ls -l //TEST.RPT1 ❸
/*
//
```

❶ Change current working directory to `//'USER.TEST.REPORTS'`.

❷ Fetch `RPT1` to `//TEST.RPT1`.

❸ List the contents of `//TEST.RPT1` in long format.

Chapter 7 Extended File Transfer Features for z/OS

The following chapter will describe and provide examples of Tectia's extended file transfer features.

7.1 Tectia SFTP Filetype IDCAMS support

IDCAMS is the command processor for Access Method Services (AMS), the System Managed Storage (SMS) utility which handles the definition and management of datasets, both VSAM and non-VSAM, and dataset catalogs. It can be invoked from JCL, TSO, Unix Systems Services or via an API. Command text is received and executed, and output is produced, as specified by the language defined in the (z/OS) DFSMS Access Method Services Commands manual.

The objective of this feature is to support the execution of IDCAMS commands in SFTP. This permits the definition of several kinds of datasets not otherwise possible, with a full range of options not previously handled, as well as other dataset manipulations.

For example, it is now possible to define a Generation Datagroup (GDG) base directly in the SFTP stream and then proceed to add members to it, without the need to have a separate process external to SFTP to create the base.

There is some overlap between Tectia FTADV site options and IDCAMS commands. The difference is that IDCAMS is a superset, covering many more operations and options. The FTADV syntax is terse, constrained and not easy to remember, although well suited to typing in at the SFTP command line, whereas IDCAMS commands are expressive and free format, as well as being well known to z/OS professionals. IDCAMS also supports IF-THEN-ELSE tests, allowing basic conditional processing.

Here is an example of defining a GDG base:

```
DELETE TEST.WORK.GDG -
  GENERATIONDATAGROUP -
  FORCE -
  PURGE
SET MAXCC = 0
DEFINE GENERATIONDATAGROUP -
  ( -
```

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```
    NAME(TEST.WORK.GDG) -
    NOEMPTY -
    SCRATCH -
    LIMIT(15) -
  )
IF  MAXCC = 0 THEN -
    LISTCAT ENTRIES(TEST.WORK.GDG) ALL
```

The base will be deleted if it exists, ignoring the return code if it does not exist, and its catalog description is listed if it has been created successfully.

To execute this via sftpg3, the commands previously saved in a file, say "input", are passed to IDCAMS as follows:

```
sput ./input /ftadv:filetype=IDCAMS/
```

IDCAMS sysprint output is placed in a temporary file on the host where the commands are run, as notified by the response:

```
IDCPR=/tmp/sshidcPrxxxxxx
```

and automatically echoed in the client. If an error occurs, the temporary file is retained for diagnosis, otherwise it is removed.

The same could be run from a non-z/OS platform using a client such as OpenSSH sftp by including the appropriate character set conversion options:

```
put ./input /ftadv:filetype=idcams,c=iso8859-1,d=ibm-1047/

get /ftadv:c=iso8859-1,d=ibm-1047//tmp/sshidcPrxxxxxx
```

This phase handles entry of commands and retrieval of results in a way similar to submitting a batch job to JES. A possible future enhancement would be to make use of the IDCAMS interface from other SFTP commands such as **mkdir**.

7.2 PDS and PDSE Filetype

For PDS and PDSE dataset transfers, Tectia is required both on the client and the server side.

Note

PDSE load-libraries containing V3 program objects require special handling and are not supported by this feature; instead, use the Filetype IEBCOPY.

Supported are:

- Record format fixed-block

- Variable-block
- Undefined PDS and PDSE datasets
- USS directories, which may be used to receive from or send to PDS(E) datasets.

Note

In order to not interfere with existing, limited Tectia support for PDS and PDSE datasets this facility is activated only when the `site` or `ftadv` option is specified. Without one of those options execution will proceed along the old path resulting in ISPF statistics and metadata being ignored.

Do note the PDS-options have to go on the dataset, even when it would seem logical to put them on the Unix file specifier. This is because they are dataset options and therefore can only be used on a dataset. The `--target|-t` syntax allows the specification of the name of the target directory or PDS in a convenient way.

Example commands for **sftpg3**:

```
# PDS to USS dir, text, defaults
get --target ./tstasm1 /ftadv:FT=PDS///'USER.TST.ASM'

# PDS to dir, save userdata in .udata files, with extension .asm
get --target ./tstasm2
 /ftadv:FT=PDS,PDUD=YES,PDEX=asm///'USER.TST.ASM'

# PDS to dir, load modules, save .udata, save in RDW format,
#  save files with extension .bin, track NOTES
get --target ./tstasml \
 /ftadv:FT=PDS,PDUD=YES,PDEX=bin,PDDW=YES,PDNT=YES///'USER.TST.LOAD'

# dir to PDS, text, ISPF stats generated automatically
get --target /ftadv:FT=PDS///'USER.TST.ASMN' /u/user/work/tstasm1

# dir to PDS, text, restore stats from saved .udata files
get --target /ftadv:FT=PDS,PDUD=YES///'USER.TST.ASMN' \
 /u/user/work/tstasm2

# dir to PDS, binary, has saved .udata, origin file in RDW format,
# pass any NOTE metadata along
get --target /ftadv:FT=PDS,PDUD=YES,PDDW=YES,PDNT=YES///'USER.TST.LOADM' \
 /u/user/work/tstasml

# PDS to PDS, text, with member selection mask ASM
get --target /ftadv:ft=PDS///'USER.TST.ASMN' \
 /ftadv:FT=PDS,PDMA=asm///'USER.TST.ASM'

# PDS to PDS, load modules, all metadata transferred automatically
get --target /ftadv:FT=PDS///'USER.TST.LOADM' \
 /ftadv:FT=PDS///'USER.TST.LOAD'
```

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Examples for **scpg3**:

```
RECFM=FB

# copy PDS 'USER.TST.ASM' to tstasmscp/ adding extension .asm to filenames
scpg3 host:/ftadv:FT=PDS,PDEX=asm/___USER.TST.ASM tstasmscp

# copy directory tstasmscp/ to PDS 'USER.TST.ASMN', creating it
scpg3 tstasmscp \
 host:/ftadv:FT=PDS,LIKE=___USER.TST.ASM,SPACE_UNIT=CYLS,PRI=1,SEC=1/___USER.TST.ASMN

# copy PDS 'USER.TST.ASM' to new PDS 'USER.TST.ASMP', creating it
scpg3 /ftadv:FT=PDS/___USER.TST.ASM \
 host:/ftadv:FT=PDS,LIKE=___USER.TST.ASM,SPACE_UNIT=CYLS,PRI=1,SEC=1/___USER.TST.ASMP

RECFM=VB

# copy PDS 'USER.TST.C' to tstcscp/ adding extension .c to filenames
scpg3 host:/ftadv:FT=PDS,PDEX=c/___USER.TST.C tstcscp

# copy directory tstcscp/ to PDS 'USER.TST.C2', creating it
scpg3 tstcscp
 host:/ftadv:FT=PDS,LIKE=___USER.TST.C,SPACE_UNIT=CYLS,PRI=1,SEC=1/___USER.TST.C2

# copy PDS 'USER.TST.C' to new PDS 'USER.TST.C2', creating it
scpg3 /ftadv:FT=PDS/___USER.TST.C \
 host:/ftadv:FT=PDS,LIKE=___USER.TST.C,SPACE_UNIT=CYLS,PRI=1,SEC=1/___USER.TST.C2

RECFM=U

# copy PDS 'USER.TST.LOAD' to tstbinscp/ saving member metadata to .udata
# files, adding extension .bin to filenames, saving member data in RDW files,
# saving member NOTE data, selecting members that begin with ASM
scpg3 \
 host:/ftadv:FT=PDS,PDUD=YES,PDEX=bin,PDDW=YES,PDNT=YES,PDMA=asm/___USER.TST.LOAD \
 tstbinscp
# copy files from directory tstbinscp/ to new PDS 'USER.TST.LOADN', files are
# in RDW format, member metadata in .udata files, restore NOTE data
scpg3 tstbinscp \
 host:/ftadv:FT=PDS,PDUD=YES,PDDW=YES,PDNT=YES,\
 LIKE=___USER.TST.LOAD,SPACE_UNIT=CYLS,PRI=1,SEC=1/___USER.TST.LOADN

# copy PDS 'USER.TST.LOADN' to 'USER.TST.LOADP', with member metadata, etc.
scpg3 \
 /ftadv:FT=PDS/___USER.TST.LOADN \
 host:/ftadv:FT=PDS,LIKE=___USER.TST.LOADN,SPACE_UNIT=CYLS,PRI=1,SEC=1/___USER.TST.LOADP
```

7.3 IEBCOPY Filetype

Filetype IEBCOPY is commonly used when transferring PDSE libraries to ensure that transferred program objects remain properly executable.

In the example below, the source PDSE 'SFT.LOADE' will be unloaded using IEBCOPY to a sequential data set which will be tersed and copied to the local machine, where it will be untersed and then loaded to the new PDSE 'SFT.LOADEX' using IEBCOPY.

Note

The terse and unterse steps are required to preserve the binary record structure of the IEBCOPY unload dataset.

```
sftpg3 remote-host
get -t /ftadv:FT=IBC,O=U,R=0,B=32760,T=POE,SPACE_UNIT=CYLS,PRI=1,SEC=1/___SFT.LOADEX \
       /ftadv:FT=IBC/___SFT.LOADE
```

It is possible to pass a file of IEBCOPY commands to be run locally or remotely via sftpg3 or scpg3, as follows:

```
cat ibcinput
 COPYGROUP INDD=((SYSUTX,R)),OUTDD=SYSUTY
 SELECT MEMBER=ASM1*

scpg3 ~/ibcinput \
  /ftadv:ft=IBC,ibcindd=SYSUTX,ibcoutdd=SYSUTY,ibcindsn=TST.ASM,ibcoutdsn=NEW.ASM/
```

The allocations for IEBCOPY are set up using the ibc{in,out}{dd,dsn} ftadv options or site commands, along with any other allocation options required, such as space requirements, e.g. SPACE_UNIT=CYLS,PRI=1,SEC=1, etc.

Note

IEBCOPY has several functions available through its command language, see the DFSMSdfp utilities manual for these.

7.4 ADRDSSU Filetype

ADRDSSU is useful for working with groups of datasets and files. It can be used to dump one or more datasets to a flat dump file and to restore them from that dump, possibly on a different z/OS system.

Support for ADRDSSU in Tectia for z/OS File Transfer is activated by the Filetype=ADRDSSU site command or FTADV option.

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Note

sftpg3, scpg3 and sftp-server-g3 must be authorized to run most of these examples, otherwise abend S047 will result.

Examples for **sftpg3**:

```
# Issuing WTO on remote.

$ cat sftpindss0
open vmhost#2222
put -t /ftadv:ft=DSS/ dsswto.in
quit

$ cat dsswto.in
WTO 'HELLO FROM ADRDSSU'

$ sftpg3 -B sftpindss0
```

```
# Datasets dump and restore under different names (local to local).
# Note that the ADRDSSU DUMP and RESTORE commands do require authorization.

$ cat sftpindss1
open 127.0.0.1#2222
put -t /ftadv:ft=DSS,dssin=___WORK.DSS2.DUMP/work/target.in \
  /ftadv:ft=DSS,dssout=___WORK.DSS2.DUMP,SPACE_UNIT=CYLS,PRI=12,SEC=6/source.in
quit

$ cat source.in
 DUMP -
   DATASET( -
     INCLUDE( -
       USER.TST.*   , -
     ) -
   ) -
   OUTDDNAME(SYSUT2) -
   CANCELERROR -
   COMPRESS -
   OPTIMIZE(4) -
   WAIT(0,0)

$ cat target.in
 RESTORE -
   INDD(SYSUT1) -
   DATASET(INCLUDE(**)) -
   RENAMEU((**,*.TSTX.**)) -
   CATALOG -
   REPLACEU
```

```
$ sftpg3 -B sftpindss1
```

```
# Datasets dump and restore under different names (local to remote).

$ cat sftpindss2
open vmhost#2222
put -t \
  /ftadv:ft=DSS,dssin=___WORK.DSS2.DUMP,SPACE_UNIT=CYLS,PRI=12,SEC=6/~/work/target.in \
  /ftadv:ft=DSS,dssout=___WORK.DSS2.DUMP,SPACE_UNIT=CYLS,PRI=12,SEC=6/~/work/source.in
quit

$ sftpg3 -B sftpindss2
```

Examples for **scpg3**:

```
# Issuing WTO on remote.

$ scpg3 dsswto.in vmhost#2222:/ftadv:ft=DSS/
```

```
# Datasets DUMP and RESTORE (local to local).

$ cat scpindss1l
scpg3 \
  /ftadv:ft=DSS,dssout=___WORK.DSS2.DUMP,SPACE_UNIT=CYLS,PRI=12,SEC=6/source.in \
  /ftadv:ft=DSS,dssin=___WORK.DSS2.DUMP/work/target.in

scpg3 -B scpindss1l
```

7.5 SORT Filetype

SORT is a Filetype that provides the ability to transfer selected records or parts of records instead of having to transfer an entire dataset. Records can be selected, reformatted or converted based on use case.

This filetype can also be useful when wanting to reduce network usage if only specific parts of a dataset are needed.

In the following example there is a dataset called `SORTDATA` which contains a few lines of text while `sortcmds` contains the following:

```
RECORD TYPE=F
SORT FIELDS=(5,4,CH,A),
  DYNALLOC=SYSDA,FILSZ=E16
OUTFIL FNAMES=SORTOUT,OUTREC=(1,16,80:X)
OPTION EQUALS,MSGPRT=ALL
```

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Example for **scpg3**:

```
scpg3 \
  "/ftadv:ft=sort,sortin=___USER1.DEV.DATA(SORTDATA)/sortcmds" \
   vmhost#2222:/ftadv:SPACE_UNIT=CYLS,PRI=1,SEC=1,T=PS,FI=80/___USER1.TST.SORTED
```

Example for **sftpg3**:

```
open vmhost#2222
set exit-value=0
sput /ftadv:ft=sort,sortin=___USER1.DEV.DATA(SORTDATA)/sortcmds \
     /ftadv:SPACE_UNIT=CYLS,PRI=1,SEC=1,T=PS,FI=80/___USER1.TST.SORTED
```

7.6 DSNType PIPE

Allows Tectia SFTP to interact with Unix pipelines on mainframes. This means the Unix shell, utilities and programs are available to perform transformations on the data stream dynamically.

In combination with normal one-way pipes (|), filters and **sftpg3**/**scpg3**, it is possible to create file transfers and text processing pipelines to script a series of otherwise manual steps.

Example for **scpg3**:

The writer copies a PDS member `ASM0` to the Unix named pipe `/tmp/tube` local-to-local:

```
  scpg3 "//DEV.ASM(ASM0)" /ftadv:type=pipe//tmp/tube
```

The reader copies the contents of the pipe to a different PDS member:

```
  scpg3 /ftadv:type=pipe//tmp/tube "//TST.ASMO(ASM0)"
```

Note

It is mandatory to start the writer process before the reader.

Building on the previous command, the reader command can incorporate a Unix filter utility to manipulate the text stream. The content of the pipe will be translated to upper case before being piped into the standard input of the **scpg3** command, which transfers it to the target:

```
  tr '[:lower:]' '[:upper:]' < /tmp/tube |
    scpg3 /dev/fd0 "host://tst.asmo(asm0)"
```

Note

The system devices `/dev/fd[012]` can be used to refer to the standard input, output and error streams in **scp** and **sftp** commands.

7.7 Batchpipes Subsystem

Batchpipes is a z/OS subsystem which allows pipe-like access to a special kind of in-memory datasets it manages. It is used to improve parallelism in batch processes by eliminating temporary datasets.

Many batch workloads run more slowly than necessary because of the synchronous bottleneck caused by the common reliance on temporary datasets. One job in the batch process writes out a temporary dataset, which is then used as input by a subsequent job. This means that the reader job cannot start before the writer job has completed.

Batchpipes allows jobs to exploit the parallelism of writing to and reading from the same "pipe" dataset simultaneously, overlapping their processing and shortening the elapsed time of the job stream.

Tectia SFTP supports file transfer to and from the Batchpipes subsystem. This permits integration of secure file transfers into Batchpipes job streams. File transfer data may be introduced or extracted, without relying on temporary datasets or files, improving the throughput of batch processes involving file transfers.

Access to Batchpipes is mediated through the SUBSYS dynamic allocation keyword, which can be specfied as a site command or file-transfer advisory string (ftadv). The Batchpipes subsystem must be running for the allocation to succeed. From there, normal sftp get and put commands can be used to transfer records to and from the batch pipe.

For example, here are two processes which perform a transfer via Batchpipes:

```
local:
$ sftpg3
  open remote
  sput //DATASET1 /ftadv:subsys=BP01,...///BATPIPE
  quit
```

```
remote:
$ scpg3 /ftadv:subsys=BP01,...///BATPIPE //DATASET2
```

On "local", a connection is established to "remote", where a batch pipe dataset is opened as the target (for writing). The process waits until the other end of the batch pipe is opened for reading.

On "remote", a local connection is made to the batch pipe for reading.

Once both ends of the batch pipe are open (the order of opening does not matter), processing via the pipe can start. The transferred records from DATASET1 are written to BATPIPE, and as each is written, the reader process gets a record from BATPIPE and copies it to DATASET2.

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This is a contrived, purely illustrative example, to make it clear how Tectia file transfer works with Batchpipes. Obviously, it would be pointless to perform a dataset transfer in such a round-about way.

Here is a somewhat more realistic example, involving a batch job (on host1) which writes to the pipe:

```
//USER1BPW JOB ,,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//             NOTIFY=&SYSUID
//*
//* write to batchpipe; other end: sftp get
//*
//WRT     EXEC PGM=IEBGENER
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  DUMMY
//SYSUT1   DD  DSN=USER1.DATASET1,DISP=SHR
//SYSUT2   DD  DSN=USER1.BATPIPE,SUBSYS=BP01,
//             RECFM=FB,LRECL=80,BLKSIZE=27920
//*
```

A remote sftp process then opens the batch pipe and starts reading records from it:

```
open host1
sget /ftadv:subsys=BP01,fi=80,B=27920//__USER1.BATPIPE \
     //DATASET2
quit
```

As records are fed into the batch pipe by the writer job, they are fetched by sftpg3 from it, communicating securely over the network with host1, and written to local dataset DATASET2. Writing and reading happen in parallel, without waiting for the writer process to complete before the transfer can start.

As mentioned, the order of opening the ends of the batch pipe does not matter, so the reader sftp process could be waiting for the batch job to start. Obviously, the Batchpipes subsystem needs to be running on host1. The other end needs only to be able to pass the required site/ftadv options to the Tectia server on host1.

Both ends of a batch pipe must have the same recfm, lrecl and blksize attributes, so it is generally a good idea to specfiy them explicitly.

7.8 File-transfer Retry

The Tectia for z/OS retry facility is used to retry a failed file transfer where part of the source file/dataset has been transferred to the target, and it is required to complete the transfer.

It tries to establish the end record position in the target and resumes copying from the source at the same record position, appending to the target. z/OS is record-oriented, even for line-delimited HFS files, so an interrupted transfer ends on a record boundary.

Note

This is retry: the target contains some initial part ofthe source (may be a zero-sized part) and retry appends the missingsource records to the target. Operation is based on record position inthe target and source. This is different from the way append works,which simply appends the whole source onto the end of the target.

The retry facility is intended to work with fixed and variable length record-based datasets and with line-delimited HFS files. It is not intended to support all sorts of character set and line-ending conversions, except to the extent that retry can be made to work with these.

The initial transfer command can be done with or without the retry option. After a failure of the transfer, it can be retried by supplying the retry option. It is recommended to run the initial transfer command in the normal way without the retry option (this is faster since the data can be transferred without positioning), and then to fall back to using the retry option if it is required to resume a partial transfer.

Retry example commands:

```
# scpg3 and sftpg3 on Unix files

scpg3 sort.out sort.out2

sftpg3
  open vmhost#2222
  sput sort.out ~/work/rtry/sort.out2

#  Run the command        # initially sort.out2 does not exist or is empty
  diff sort.out sort.out2   # no difference

  vi sort.out2              # delete some lines at the end
                                  # (simulating interrupted transfer)

#  run the command again     # transfer missing lines
    (e.g. scpg3 --retry sort.out sort.out2)
  diff sort.out sort.out2   # no difference

#  run the command again     # transfers zero lines
    (e.g. sput --retry sort.out ~/work/rtry/sort.out2)
  diff sort.out sort.out2   # no difference

# scpg3 and sftpg3 from Unix file to MVS dataset

scpg3 --retry sort.out //SORT.OUT2

sftpg3
  open vmhost#2222
  sput --retry sort.out //SORT.OUT2

# scpg3 and sftpg3 from MVS dataset to MVS dataset
```

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```
scpg3 --retry //SORT.OUT //SORT.OUT2

sftpg3
  open vmhost#2222
  sput --retry //SORT.OUT //SORT.OUT2

# scpg3 and sftpg3 from MVS dataset to Unix file

scpg3 --retry //SORT.OUT2 sort.out2

sftpg3
  open vmhost#2222
  sput --retry //SORT.OUT2 ~/work/rtry/sort.out2
```

sort.out content:

```
14 Si Silicon
16 S  Sulphur
21 Sc Scandium
34 Se Selenium
38 Sr Strontium
50 Sn Tin
51 Sb Antimony
62 Sm Samarium
```

Example retry with ASCII HFS output:

```
# Using scpg3

$ scpg3 --retry //SORT.OUT2 /ftadv:x=text/sort.out3

$ ll -T sort.out3
t ISO8859-1   T=on  rw-rr-   1 GAVIN    SYS1    114 May 27 16:22 sort.out3

$ file sort.out3
sort.out3:  text

$ env _BPXK_AUTOCVT=OFF file sort.out3
sort.out3:  binary data

$ od -x sort.out3
0000000000      3134    2053    6920    5369    6C69    636F    6E0A    3136
0000000020      2053    2020    5375    6C70    6875    720A    3231    2053
0000000040      6320    5363    616E    6469    756D    0A33    3420    5365
0000000060      2053    656C    656E    6975    6D0A    3338    2053    7220
0000000100      5374    726F    6E74    6975    6D0A    3530    2053    6E20
0000000120      5469    6E0A    3531    2053    6220    416E    7469    6D6F
0000000140      6E79    0A36    3220    536D    2053    616D    6172    6975
0000000160      6D0A
```

For testing purposes, one can repeat similar steps as described above to simulate interrupted transfer and retrying. Note that if the target dataset is edited for this sort of test, it is necessary to operate in blocks not records. Editing a VB dataset with any zero-length records in ISPF edit will corrupt those records by adding a space.

In a real-world situation, the transfer may have failed for some reason such as a loss of the network connection, leaving the target dataset/file incomplete. This can be simulated for testing purposes by varying the connection off, etc.

Note

On z/OS, x=text is currently the only conversion option supported with retry, and only on output HFS. It allows the creation of a simple tagged ASCII file.

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Chapter 8 Secure Shell Tunneling

Tunneling is a way to forward otherwise unsecured application traffic through Secure Shell. Tunneling can provide secure application connectivity, for example, to POP3, SMTP, and HTTP-based applications that would otherwise be unsecured.

The Secure Shell v2 connection protocol provides channels that can be used for a wide range of purposes. All of these channels are multiplexed into a single encrypted tunnel and can be used for tunneling (forwarding) arbitrary TCP/IP ports and X11 connections.

The client-server applications using the tunnel will carry out their own authentication procedures, if any, the same way they would without the encrypted tunnel.

The protocol/application might only be able to connect to a fixed port number (e.g. IMAP 143). Otherwise any available port can be chosen for tunneling. For remote tunnels, the ports under 1024 (the well-known service ports) are not allowed for ordinary users, but are available only for system administrators (root privileges).

There are two basic kinds of tunnels: local and remote. They are also called outgoing and incoming tunnels, respectively. X11 forwarding and agent forwarding are special cases of a remote tunnel. The different tunneling options are handled in the following sections.

8.1 Local Tunnels

A local (outgoing) tunnel forwards traffic coming to a local port to a specified remote port.

With `sshg3` on the command line, the syntax of the local tunneling command is as follows:

```
client$ sshg3 -L [protocol/][listen-address:]listen-port:dst-host:dst-port sshserver
```

where:

- `[protocol/]` specifies which protocol is to be used in the tunneled connection, it can be `ftp` or `tcp` (optional argument). The default is `tcp`.

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- `[listen-address:]` defines which interface on the local client will be listened to (optional argument). By default all interfaces are listened.
- `listen-port` is the number of the port on the local client, and connections coming to this port will be tunneled to the server.
- `dst-host:dst-port` define the destination host address and the port to which the connection is tunneled from the server.
- `sshserver` is the IP address or the host name of the Secure Shell server.

The host name or IP address of the destination host and sshserver can be defined as regular expressions that follow the egrep syntax, but no wildcards are supported.

Note

If `dst-host` is specified as a domain name rather than IP address, the name will be resolved according to the address family settings of `sshserver`. For example, if the domain name is resolved to an AAAA DNS record (IPv6) and the address family setting of the server is `inet` (IPV4), the tunnel will not work.

Setting up local tunneling allocates a listener port on the local client host. Whenever a connection is made to this listener, the connection is tunneled over Secure Shell to the remote server and another connection is made from the server to a specified destination host and port. The connection from the server onwards will not be secure, it is a normal TCP connection.

Note

Every user with access to the local client host will be able to use the local tunnels.

Figure 8.1 shows the different hosts and ports involved in local tunneling (port forwarding).

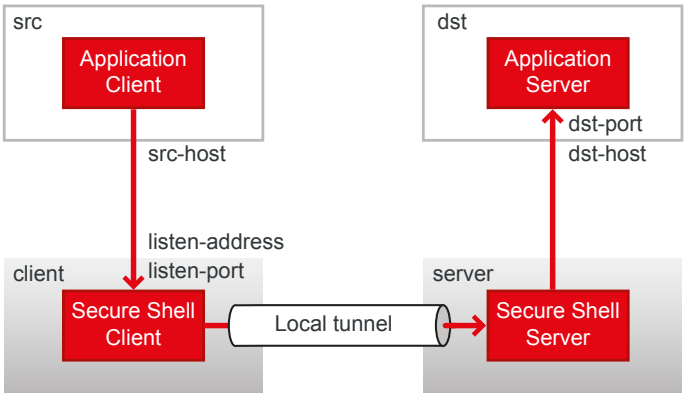

Figure 8.1. Local tunneling terminology

For example, when you issue the following `sshg3` command on the command line, all traffic coming to port 1234 on the client host will be forwarded to port 23 on the server.

```
client$ sshg3 -L 1234:localhost:23 --abort-on-failing-tunnel username@sshserver
```

The forwarding address in the command is resolved at the (remote) end point of the tunnel. In this case `localhost` refers to the server host (`sshserver`).

In this example, also the `--abort-on-failing-tunnel` option is specified. It causes the command to abort if creating the tunnel listener fails (for example, if the port is already reserved). Normally if the connection to the server succeeds, but creating the listener fails, no error message is given.

8.1.1 Non-Transparent TCP Tunneling

When non-transparent TCP tunneling is used, the application to be tunneled is set to connect to the local listener port instead of connecting to the server directly. Tectia client tools for z/OS forwards the connection securely to the remote server.

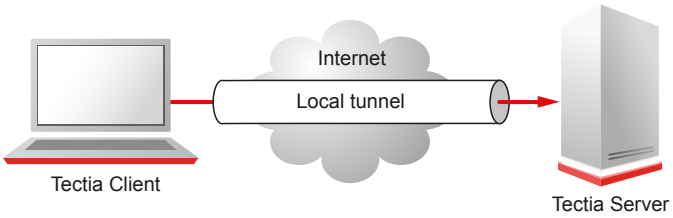

Figure 8.2. Simple local tunnel

If you have three hosts, for example, `sshclient`, `sshserver`, and `imapserver`, and you forward the traffic coming to the `sshclient`'s port `143` to the `imapserver`'s port `143`, only the connection between the `sshclient` and `sshserver` will be secured. The command you use would be similar to the following one:

```
sshclient$ sshg3 -L 143:imapserver:143 username@sshserver
```

Figure 8.3 shows an example where the Secure Shell server resides in the DMZ network. Connection is encrypted from the Secure Shell client to the Secure Shell server and continues unencrypted in the corporate network to the IMAP server.

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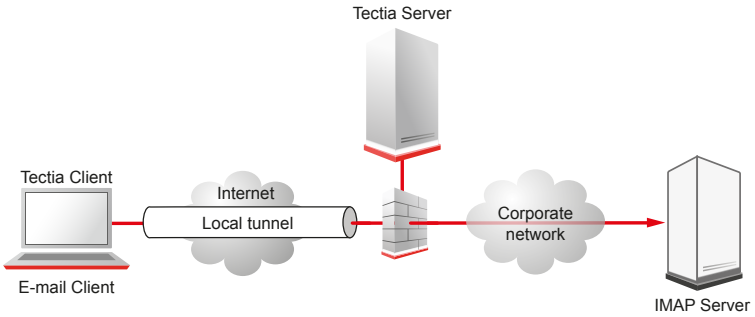

Figure 8.3. Local tunnel to an IMAP server

Tunnels can also be defined for connection profiles in the Connection Broker configuration file. The defined tunnels are opened automatically when a connection with the profile is made. The following is an example from a `ssh-broker-config.xml` file:

```
<profile id="id1" host="sshserver.example.com">
...
  <tunnels>
    <local-tunnel type="tcp"
                  listen-port="143"
                  dst-host="imap.example.com"
                  dst-port="143"
                  allow-relay="no" />
  ...
  </tunnels>
</profile>
```

By default, local tunnels originating only from the client host itself are allowed. To allow also other machines to connect to the tunnel listener port, set the `allow-relay` to `yes`.

Automatic Tunnels

Automatic tunnels are one way of creating non-transparent local tunnels for application connections.

Automatic tunnels always use a connection profile in the tunnel establishing. You can create listeners for local tunnels that will be activated automatically when the Connection Broker starts up. The actual tunnel will be formed the first time a connection is made to the listener port. If the connection to the server is not open at that time, it will be opened automatically as well.

In the Connection Broker configuration file, make the following kind of settings:

```
<static-tunnels>
  <tunnel type="tcp"
          listen-port="9874"
          dst-host="st.example.com"
          dst-port="9111"
          allow-relay = "no"
```

```
          profile="id1" />
</static-tunnels>
```

Examples of Local Tunneling

When **sshg3** is used to create secure tunnels using local port forwarding, the TCP applications to be tunneled are configured to connect to a localhost port instead of the application server port.

Example application, `clientapp1`, by default connects to a Unix server `unix.example.com` using TCP port 2345.

```
$ clientapp1 --username user1 --server unix.example.com --port 2345
```

For securing this TCP application using Secure Shell, use the following commands:

```
$ sshg3 -L 2345:localhost:2345 user1@unix.example.com -S -f &
$ clientapp1 --username user1 --server localhost --port 2345
```

The above **sshg3** command connects to remote Secure Shell server `unix.example.com`, creates a local listener on port 2345, instructs the remote Secure Shell server to forward the incoming traffic to `localhost:2345`, and goes to background in single-shot-mode.

8.1.2 Non-Transparent FTP Tunneling

Non-transparent FTP tunneling is an extension to the generic tunneling mechanism. Unlike generic tunneling (port forwarding) mechanism, non-transparent FTP tunneling secures the transferred files, in addition to the FTP control channel. The FTP tunneling code monitors the tunneled FTP control channels and dynamically creates new tunnels for the data channels as they are requested.

When non-transparent FTP tunneling is used, tunnels are created from local client ports to remote servers. The FTP client is configured to connect to Tectia client tools for z/OS which will forward the connection to the endpoint where a Secure Shell server is running.

The typical use case is that Tectia client tools for z/OS is located on the same host as the FTP client; and the FTP server is on the same host as the Secure Shell server. However, other configurations are also supported, but it is worth noticing that the connection is encrypted only between Tectia client tools for z/OS and the Secure Shell server.

Non-transparent FTP tunneling can be requested on the command line, or enabled and defined in the Connection Broker configuration. The configured non-transparent FTP tunneling uses connection profiles, that are defined on Tectia client tools for z/OS.

On command-line, FTP tunneling can be used for both local and remote tunnels. Non-transparent FTP-tunneling is started by entering a `sshg3` command with the following syntax:

```
sshclient$ sshg3 -L ftp/1234:localhost:21 username@sshserver
```

For information on the `sshg3` command, see the sshg3(1) man page.

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FTP tunnels can also be defined for connection profiles in the Connection Broker configuration file. The following is an example from the Connection Broker configuration file `ssh-broker-config.xml`:

```
<profiles>
  <profile id="id1" host="sshserver.example.com"
  ...
    <tunnels>
      <local-tunnel type="FTP"
                    listen-port="1234"
                    dst-host="127.0.0.1"
                    dst-port="21"
                    allow-relay="NO" />
      ...
    </tunnels>
  </profile>
</profiles>
```

An FTP connection can then be made with the following (example) commands:

```
sshclient$ ftp
ftp$ open localhost 1234
```

The FTP connection to port 1234 on client is now tunneled to port 21 on the Secure Shell server.

As an alternative to FTP tunneling, you can use the **sftpg3** or **scpg3** clients for secure file transfers. These clients can be used on command line or in scripts and they require less configuration than FTP tunneling, since Tectia Server already has **sft-server-g3** as a subsystem, and **sftpg3** and **scpg3** clients are included with Tectia client tools for z/OS. Managing remote user restrictions on the server machine will be easier, since you do not have to do it also for FTP.

To understand exactly how FTP tunneling is done, two different cases need to be examined: the active mode and the passive mode of the FTP protocol.

Tunneling FTP in Passive Mode

In passive mode, the FTP client sends the command `PASV` to the server, which reacts by opening a listener port for the data channel and sending the IP address and port number of the listener as a reply to the client. The reply is of the form

```
227 Entering Passive Mode (a1,a2,a3,a4,p1,p2)
```

where `a1.a2.a3.a4` is the IP address and `p1*256+p2` is the port number. For example, the reply for IP address 10.1.60.99 and port 1548 is: `227 Entering Passive Mode (10,1,60,99,6,12)`.

When the Connection Broker notices the reply to the `PASV` command, it will create a local port forwarding to the destination mentioned in the reply. After this the Connection Broker will rewrite the IP address and port in the reply to point to the listener of the newly created local port forwarding (which exists always in a localhost address, 127.0.0.1) and pass the reply to the FTP client. The FTP client will open a data channel based on the reply, effectively tunneling the data through the Secure Shell connection, to the listener the FTP server has

opened. The net effect is that the data channel is secured all the way except from the Secure Shell server to the FTP server if they are on different machines. This sequence of events takes place automatically for every data channel.

Since the tunnel is opened to a localhost address, the FTP client must run on the same machine as Tectia client tools for z/OS if passive mode is used.

Tunneling FTP in Active Mode

In active mode, the FTP client creates a listener on a local port, for a data channel from the FTP server to the FTP client, and requests the channel by sending the IP address and the port number to the FTP server in a command of the following form:

```
PORT a1,a2,a3,a4,p1,p2
```

where `a1.a2.a3.a4` is the IP address and `p1*256+p2` is the port number. The Connection Broker intercepts this command and creates a remote port forwarding from the localhost address of the Secure Shell server to the address and port specified in the `PORT` command.

After creating the tunnel, the Connection Broker rewrites the address and port in the `PORT` command to point to the newly opened remote forwarding on the Secure Shell server and sends it to the FTP server. Now the FTP server will open a data channel to the address and port in the `PORT` command, effectively forwarding the data through the Secure Shell connection. The Connection Broker passes the incoming data to the original listener created by the FTP client. The net effect is that the data channel is secure the whole way except from Tectia client tools for z/OS to the FTP client. This sequence of events takes place automatically for every data channel.

For FTP tunneling in active mode to work, the FTP server must be run on the same host as the Secure Shell server, and the FTP client and Tectia Client must reside on the same host.

Note

Tunneling FTP in active mode is not guaranteed to work in all setups. If possible, use the passive mode when tunneling FTP connections.

8.1.3 SOCKS Tunneling

SOCKS tunneling is a mechanism available for tunneling applications that support the SOCKS4 or SOCKS5 client protocol.

Instead of configuring tunneling (a.k.a port forwarding) from specific ports on the local host to specific ports on the remote server, you can specify a SOCKS server which can be used by the user's applications. Each application is configured in the regular way except that it is configured to use a SOCKS server on a localhost port. The Secure Shell client application, Tectia client tools for z/OS, opens a port in the localhost and mimics a SOCKS4 and SOCKS5 server for any SOCKS client applications.

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When the applications connect to services such as IMAP4, POP3, SMTP, and HTTP, they provide the necessary information to the SOCKS server, which is actually Tectia client tools for z/OS mimicking a SOCKS server. Tectia client tools for z/OS will use this information in creating a tunnel to the Secure Shell server and relaying the traffic back and forth securely.

With `sshg3` on the command line, the syntax of the SOCKS tunneling command is as follows:

```
client$ sshg3 -L socks/[listen-address:]listen-port username@sshserver
```

where:

- `[listen-address:]` defines which interface on the client will be listened to (optional argument)
- `listen-port` is the number of the port on the client
- `sshserver` is the IP address or the host name of the Secure Shell server.

For example, the following command will set up a local tunnel from port `1234` on the client to `sshserver`. The applications are set to use a SOCKS server at port `1234` on the client. From the server, the connections are forwarded unsecured to the destination hosts requested by the applications.

```
sshclient$ sshg3 -L socks/1234 username@sshserver
```

SOCKS tunnels can also be defined for connection profiles in the Connection Broker configuration file. The following is an example from a `ssh-broker-config.xml` file:

```
<profile id="id1" host="sshserver.example.com">
...
  <tunnels>
    <local-tunnel type="socks"
                  listen-port="1234"
                  allow-relay="no" />
  ...
  </tunnels>
</profile>
```

8.2 Remote Tunnels

A remote (incoming) tunnel forwards traffic coming to a remote port to a specified local port.

With `sshg3` on the command line, the syntax of the remote tunneling command is as follows:

```
client$ sshg3 -R [protocol/][listen-address:]listen-port:dst-host:dst-port \
username@sshserver
```

where:

- `[protocol/]` specifies which protocol is to be used in the tunneled connection, it can be `ftp` or `tcp` (optional argument). The default is `tcp`.

- `[listen-address:]` defines which interface on the remote server will be listened to (optional argument). By default all interfaces are listened.
- `listen-port` is the number of the port on the remote server, and connections coming to this port will be tunneled to the client.
- `dst-host:dst-port` define the destination host address and the port to which the connection is tunneled from the client.
- `sshserver` is the IP address or the host name of the Secure Shell server.

The IP addresses and host names of the destination host and the sshserver can be defined using regular expressions that follow the egrep syntax. No wildcards are supported.

Note

If `dst-host` is specified as a domain name rather than IP address, the name will be resolved according to the address family settings of `client`. For example, if the domain name is resolved to an AAAA DNS record (IPv6) and the address family setting of the client is `inet` (IPV4), the tunnel will not work.

Setting up remote tunneling allocates a listener port on the remote server. Whenever a connection is made to this listener, the connection is tunneled over Secure Shell to the local client and another connection is made from the client to a specified destination host and port. The connection from the client onwards will not be secure, it is a normal TCP connection.

Note

Every user with access to the remote server host will be able to use remote tunnel.

Figure 8.4 shows the different hosts and ports involved in remote port forwarding.

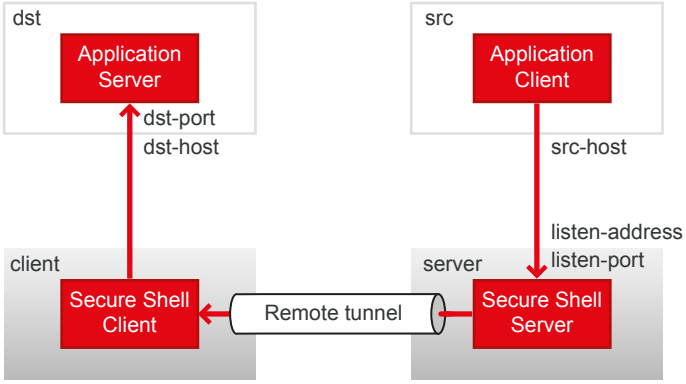

Figure 8.4. Remote tunneling terminology

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For example, if you issue the following command, all traffic which comes to port 1234 on the server will be tunneled to port 23 on the client. See Figure 8.5.

```
sshclient$ sshg3 -R 1234:localhost:23 username@sshserver
```

The forwarding address in the command is resolved at the (local) end point of the tunnel. In this case `localhost` refers to the client host.

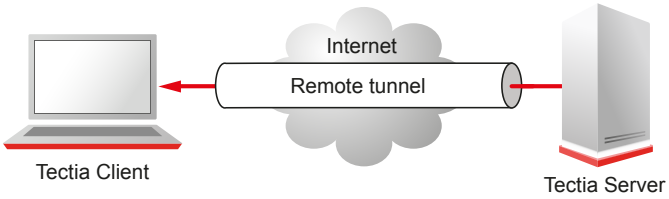

Figure 8.5. Remote tunnel

Tunnels can also be defined for connection profiles in the Connection Broker configuration file. The defined tunnels are opened automatically when a connection with the profile is made.

The following is an example from a `ssh-broker-config.xml` file:

```
<profile id="id1" host="sshserver.example.com">
 ...
   <tunnels>
      <remote-tunnel type="tcp"
                     listen-port="1234"
                     dst-host="localhost"
                     dst-port="23" />
   ...
   </tunnels>
</profile>
```

8.3 Agent Forwarding

Agent forwarding is a special case of remote tunneling. In agent forwarding, Secure Shell connections and public-key authentication data are forwarded from one server to another without the user having to authenticate separately for each server. Authentication data does not have to be stored on any other machine than the local machine, and authentication passphrases or private keys never go over the network.

Tectia client tools for z/OS provides authentication agent functionality and the Connection Broker can also serve OpenSSH clients as an authentication agent. Tectia Server supports agent forwarding on Unix platforms. Thus, the start and end points of the agent forwarding chain can be Windows or Unix hosts, but all hosts in the middle of the forwarding chain must be Unix hosts and must have both the Secure Shell client and server components installed.

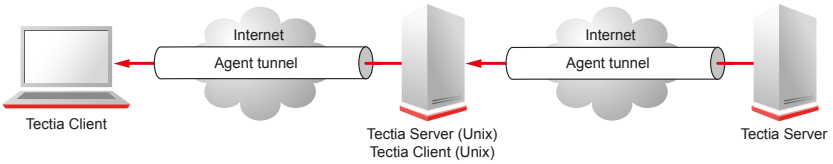

Figure 8.6. Agent forwarding

In the factory settings, agent forwarding is enabled (on).

Agent forwarding can be enabled or disabled on the client side both in the default configuration settings and separately for each connection profile.

In the `ssh-broker-config.xml` file, agent forwarding can be disabled by setting the following line either under `default-settings` or under a connection `profile`:

```
<forwards>
  <forward type="agent" state="off" />
</forwards>
```

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Chapter 9 Troubleshooting Tectia

You can run Tectia Client in debug mode to gather information that is useful when troubleshooting any connection or authentication problems.

Do not leave the client running in debug mode unnecessarily. Debugging slows down the performance of the client.

See Section 1.2 for information on accessing the Tectia online support resources and contacting Tectia Technical Support.

9.1 Starting Connection Broker in Debug Mode

The Connection Broker is an internal component included in Tectia Client. The Connection Broker handles all cryptographic operations and authentication-related tasks for Tectia Client and the command-line tools **sshg3, scpg3, sftpg3**.

To start the Connection Broker in debug mode, follow these instructions:

1. Open a shell (on Unix) or command prompt window (on Windows).

2. Stop the Connection Broker, if it is currently running. Enter the following command to exit the Connection Broker. This will close all currently open connections of the current user:

   ```
   $ ssh-broker-g3 --exit
   ```

3. Start the Connection Broker in debug mode by running the following command:

   ```
   $ ssh-broker-g3 -D<filter> -l <logfile>
   ```

   In the command:

   - `logfile` specifies the file to which the debug output will be directed

   - `filter` is an expression that takes the following syntax: `"module=level,module=level,..."`

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- `module` is an optional expression that can be used to restrict the debug output to only a particular module or to allow the use of varying debug levels for different modules.
- `level` is an integer from 0 (no debug info) to 99 that specifies the desired amount of debug information.

  Note that levels 1-9 are the recommended ones. The higher the number, the more detailed the troubleshooting output will be, and the more the debugging will affect performance.

The following example command starts the Connection Broker with global debug level 4 and outputs the debug information to a log file named `broker.log`:

```
$ ssh-broker-g3 -D4 -l broker.log
```

The following example command starts the Connection Broker with debug level 5 for modules starting with "`SecShAuth`" and level 2 for everything else:

```
$ ssh-broker-g3 -D"SecShAuth*=5,2" -l broker.log
```

4. Connect to a server using one of the clients:

```
$ sshg3 user@host
```

5. View the debug information for the connection in the `broker.log` file.

On Unix, you can display the debug output also by using the command line tools with argument `-D`. For example, the following command will display the debug output with a debug level 5 for modules starting with `SecShAuth` and level 2 for modules starting with `Sft`:

```
$ sftpg3 -D"SecShAuth*=5,Sft*=2" user@host
```

9.2 Debugging File Transfer

The return codes and error messages should be sufficient to explain most errors. Check that the code and message are correct by looking at the results:

- Was the file transferred OK but the error code wrong?
- Was the error code 0 but the file corrupted?

To diagnose file transfer problems, take a trace. If possible, also take a trace of a similar but successful run and compare the two traces. To get traces that can be compared with a **diff** command, use a trace format without "`%Dx`" or "`%p`" specifiers:

```
SSH_DEBUG_FMT=" %m/%s:%n:%f %M"
```

To trace the generic file transfer level, use the debug string '`sftp*=14`'.

To trace the z/OS low level, use the debug string '`*mvs*=7`'.

To trace both, use '`sftp*=14,*mvs*=7`'.

To get the trace for the client end, put the debug string on the command line, for example:

```
$ sftpg3 -D "sftp*=14" user1@www.example.com
```

To get the trace for the client end when using **sftpg3**, use the **debug** command:

```
sftp> pwd
sftp> lpwd
sftp> debug sftp*=14,*mvs*=7
sftp> sput tmp.txt //TMP.TXT
sftp> debug 1
```

To get the trace for the server end when using **sftp/scp**, create, on the remote machine, the file `$HOME/.ssh2/environment`, and put in a line like this:

```
SSH_SFTP_DEBUG=sftp*=14
```

To make the debug at the server end go into a HFS file at the server, add this line in the `$HOME/.ssh2/environment` file:

```
SSH_SFTP_DEBUG_FILE=/tmp/my-debug.txt
```

9.3 Solving Problem Situations

This section gives workaround instructions on common error situations that may occur when using Tectia client tools for z/OS or when using other Secure Shell clients to connect to Tectia Server for IBM z/OS.

Interactive Login from Unix to z/OS

When interactively logging in from a Unix (usually HP-UX) client host to an Tectia Server for IBM z/OS host, the terminal is garbled and the shell does not accept input properly.

This happens because user terminals on Unix (especially HP-UX) often have the `istrip` (strip-8th-bit) flag on. This setting gets inherited by the pseudo terminal on z/OS which causes an interactive `/bin/sh` session malfunction.

To avoid the anomaly, do one of the following steps:

- Give the command "`stty -istrip`" on the Unix host before connecting the z/OS host with Secure Shell.

  OR

- Call "`stty -istrip`" on the z/OS host in the shell init file (`$HOME/.profile` or equivalent).

  To avoid surprises, check that the shell has a tty before calling stty:

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```
if [ tty >/dev/null 2>&1 ]; then
  stty -istrip
fi
```

Chapter 10 Using Off-Platform Clients to Access z/OS Hosts Running Tectia Server for IBM z/OS

This chapter contains information on using Secure Shell clients other than Tectia client tools for z/OS to connect to Tectia Server for IBM z/OS:

- Public-key authentication from other hosts to Tectia Server for IBM z/OS
- Handling MVS data sets and HFS file system access from other hosts to Tectia Server for IBM z/OS
- File transfer staging from other hosts to Tectia Server for IBM z/OS
- Listing data sets with other SFTP clients
- File transfer advice strings and file transfer profiles
- Examples on file transfer using Windows and Unix clients

Note

When accessing a z/OS host that runs Tectia Server using legacy OpenSSH **scp**, the OpenSSH **scp** binary must exist in `/bin/scp` on the z/OS host. Further, legacy OpenSSH **scp** cannot be used to transfer MVS datasets, as it does not support dataset access.

Non-legacy OpenSSH **scp** does not use the SCP protocol anymore but rather uses the SFTP protocol instead, allowing one to transfer MVS datasets and USS files. One can force the legacy option by using the **scp -O** flag.

Note

The default OpenSSH configuration on z/OS does not produce SMF records. SMF recording must be configured separately for OpenSSH if the OpenSSH SCP events are intended to be captured.

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10.1 Using Public-Key Authentication from Other Hosts to z/OS

In the following instructions:

- `Server_zos` is the remote host running Tectia Server for IBM z/OS that you are trying to connect to.
- `ServerUser` is the user name on `Server_zos` that you are logging in as.
- `Client` is the host running the Secure Shell client.
- `ClientUser` is the user name on `Client` that should be allowed to log in to `Server_zos` as `ServerUser`.

The instructions assume that `ClientUser` is allowed to log in to `Server_zos` as `ServerUser` using some other authentication method (usually password).

10.1.1 From Tectia Client on Windows to Tectia Server on z/OS

These instructions apply to Tectia Client on Windows. For more information, see *Tectia Client User Manual*.

Using Graphical User Interface

On Windows and Linux, you can use the Tectia Public-Key Authentication Wizard to generate a key pair.

1. New keys are generated in the **Tectia Connections Configuration GUI**. Select the **Keys and Certificates** page under **User authentication** and click **New Key** to start the **Public-Key Authentication Wizard**.

   The wizard will generate two key files, your private key and your public key. The private key file has no file extension, and the public key has the same base file name as the private key, but with `.pub` as the file extension. The key files will be stored on your local computer, in the user profile directory.

2. Public keys can be uploaded automatically to servers that have the SFTP subsystem enabled. The automatic upload can be done on the **Keys and Certificates** page of the **Tectia Connections Configuration GUI**.

   Select your key pair from the list and click **Upload**. The **Upload Public Key** dialog box opens.

3. Define the remote host where you want to upload the key.

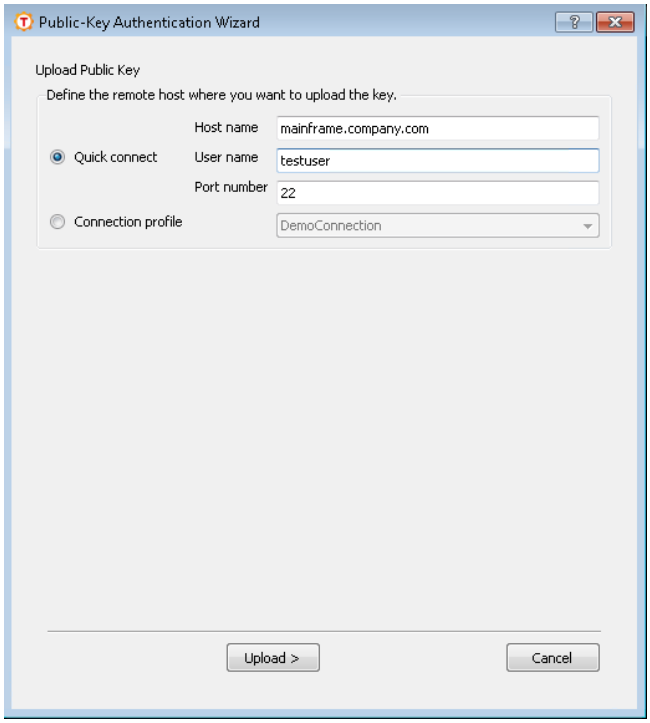

Figure 10.1. Uploading the public key

Click **Upload** to start the upload.

4. If you are already connected to the remote server host, the key upload starts immediately. If you are not connected, you will be prompted to authenticate to the server (by default with password).

5. Make sure that public-key authentication is allowed in the Connection Broker configuration on `Client`, in the default settings and in the relevant connection profile (it is allowed by default).

Using Command-Line Tools

The key pair can also be generated and transferred to the z/OS server by using command-line tools.

1. Create a key pair using **ssh-keygen-g3**. For non-interactive use, the key can be generated without a passphrase with the `-P` option. The `-t` option can be used to specify the key type (the default is RSA).

```
C:\>ssh-keygen-g3 -P win_key
Generating 2048-bit rsa key pair
9 oOo.oOo.oOo
Key generated.
2048-bit rsa, ClientUser@TECTIA_WIN, Wed Feb 2 2016 12:09:46 +0200
Private key saved to C:\Users\ClientUser\AppData\Roaming\SSH\UserKeys\win_key
Public key saved to C:\Users\ClientUser\AppData\Roaming\SSH\UserKeys\win_key.pub
```

2. Create a remote `.ssh2` directory on `Server_zos` (if it does not exist already):

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```
C:\>sshg3 ServerUser@Server_zos mkdir .ssh2
```

3. Transfer the public key to `Server_zos` with conversion options:

```
C:\>scpg3 -a "C:\Users\ClientUser\AppData\Roaming\SSH\UserKeys\win_key.pub"
  ServerUser@Server_zos:~/.ssh2/
```

4. Create the remote authorization file on `Server_zos`:

```
C:\>sshg3 ServerUser@Server_zos "echo Key win_key.pub >> .ssh2/authorization"
```

5. Make sure that public-key authentication is allowed in the Connection Broker configuration on `Client`, in the default settings and in the relevant connection profile (it is allowed by default).

10.1.2 From Tectia Client on Unix to Tectia Server on z/OS

These instructions apply to Tectia Client on Unix. For more information, see *Tectia Client User Manual*.

To enable public-key authentication from Tectia Client on Unix to Tectia Server on z/OS:

1. Create a key pair using **ssh-keygen-g3**. For non-interactive use, the key can be generated without a passphrase with the `-P` option. The `-t` option can be used to specify the key type (the default is RSA).

```
$ ssh-keygen-g3 -t rsa -P $HOME/.ssh2/unix_key
Generating 2048-bit rsa key pair
   9 .oOo.oOo.oOo
Key generated.
2048-bit rsa, ClientUser@tectia_unix, Tue Nov 11 2014 10:43:23 +0200
Private key saved to /home/ClientUser/.ssh2/unix_key
Public key saved to /home/ClientUser/.ssh2/unix_key.pub
```

2. Create a remote `.ssh2` directory on `Server_zos` (if it does not exist already):

```
$ sshg3 ServerUser@Server_zos mkdir .ssh2
```

3. Copy your public key to the remote `Server_zos`:

```
$ scpg3 -a unix_key.pub \
ServerUser@Server_zos:~/.ssh2/unix_key.pub
```

4. Create an `authorization` file on the remote `Server_zos`.

```
$ sshg3 ServerUser@Server_zos "echo Key unix_key.pub >> .ssh2/authorization"
```

5. Make sure that public-key authentication is allowed in the Connection Broker configuration on `Client`, in the default settings and in the relevant connection profile (it is allowed by default).

10.1.3 From OpenSSH Client on Unix to Tectia Server on z/OS

In addition to the standard IETF SecSh keys used by Tectia, Tectia Server for IBM z/OS accepts OpenSSH public keys for user authentication. For more information on OpenSSH configuration, see OpenSSH documentation.

To enable public-key authentication from OpenSSH client on Unix to Tectia Server on z/OS:

1. Create a key pair using **ssh-keygen**, for example:

```
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ClientUser/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ClientUser/.ssh/id_rsa.
Your public key has been saved in /home/ClientUser/.ssh/id_rsa.pub.
The key fingerprint is:
72:e7:68:3b:b6:cb:95:33:46:e8:46:e0:aa:4e:94:cd ClientUser@openssh.example.com
The key's randomart image is:
+--[ RSA 2048]----+
|                 |
|                 |
|      .          |
|   + . . .       |
|  o E o S o      |
| .   . = = .     |
|  . .   = B      |
| . .   +o+ o     |
| .o    .=+       |
+-----------------+
```

   To create the key without a passphrase, hit enter when prompted to enter the passphrase.

   When the key is created with default file name (`id_rsa`), it is automatically used in public-key authentication attempts.

2. Create a `.ssh2` directory on `Server_zos` (if it does not exist already):

```
$ ssh ServerUser@Server_zos mkdir .ssh2
```

3. Copy your public key to the remote `Server_zos` using **sftp**:

```
$ sftp ServerUser@Server_zos
sftp> put id_rsa.pub /ftadv:C=ISO8859-1,D=IBM-1047,X=TEXT/.ssh2/id_rsa.pub
```

4. Create an `authorization` file on the remote `Server_zos`.

```
$ ssh ServerUser@Server_zos "echo Key id_rsa.pub >> .ssh2/authorization"
```

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5. Make sure that public-key authentication is allowed in the OpenSSH client configuration on `Client` (it is allowed by default).

10.2 Setting up Terminal Data Conversion

A remote account on a z/OS machine can have a locale and a code page that differs from the default 'C' locale and IBM-1047 code page. Tectia Server for IBM z/OS can convert the terminal data stream to match the locale.

The code page can be specified in the server configuration or with the **chcp** command (see the *z/OS UNIX System Services Command Reference*). The **chcp** command is typically used in a `.profile` or `.tshrc` script, see the IBM book *z/OS USS User's Guide*), but it can also be used during an interactive session.

For remote command sessions, the code page can be specified in the configuration of Tectia Server for IBM z/OS. It is possible to define user-id-specific and client-host-specific subconfigurations, see the *Tectia Server for IBM z/OS Administrator Manual*.

Most SSH clients allow the user to specify how line delimiters are to be handled. Tectia Server for IBM z/OS can also be configured for EOL conventions.

The code page of the data on the line is specified as an argument in the **chcp** command and in the server configuration. The default is Latin 1, (ISO8859-1). If the SSH client uses some other code page, the code page should be specified in the **chcp** command or in the configuration.

10.3 Handling MVS Data Sets and HFS File System Access

This section describes how access to MVS data sets and HFS files are handled when other clients than Tectia client tools for z/OS are used to connect to Tectia Server for IBM z/OS.

10.3.1 Data Set and HFS File System Access

Old SFTP clients regard `/` (slash) as a directory separator, which requires the SFTP server to use some "tricks" to fool the clients. The SFTP client generally does not have any inherent knowledge of MVS data sets and accesses all files as if they were part of a hierarchical file system.

If an SFTP client tries to open the file `//FILE.NAME`, the MVS data set is actually opened. Some SFTP clients remove all consecutive slashes so that the file to be accessed becomes `/FILE.NAME`. The SFTP server will interpret this as the HFS file `FILE.NAME`, located at the HFS root. To avoid this client behavior, the SFTP server has other ways of naming MVS data sets. If a client tries to access the file `/_FILE.NAME`, `/FTADV:X=BIN/_/FILE.NAME` or `/FTADV:X=BIN/__FILE.NAME`, the SFTP server interprets these as the data set `//FILE.NAME`. All these combinations are needed as it may be necessary to make the SFTP clients pass the correct file or data set name to the server.

In z/OS, if a data set name is not enclosed in single quotes, the user prefix is added in front of the data set name. For example, if user `USER1` has a data set `DATASET.NAME1`, the user can access it using the data set name `//DATASET.NAME1`. It is also possible to use an absolute prefixed name `//'USER1.DATASET.NAME1'`.

Because single quotes are special characters in most environments, the SFTP server introduces a new convention to use triple slashes to access absolute prefixed data set names. The name becomes `///USER1.DATASET.NAME1`. All combinations of slashes and underscores can be used. For example, `USER1` can access his/her data set using one of the following names:

```
//DATASET.NAME1
/_DATASET.NAME1
/FTADV:X=BIN/_/DATASET.NAME1
/FTADV:X=BIN/__DATASET.NAME1
```

or

```
//'USER1.DATASET.NAME1'
/_'USER1.DATASET.NAME1'
/FTADV:X=BIN/_/'USER1.DATASET.NAME1'
/FTADV:X=BIN/__'USER1.DATASET.NAME1'
```

or

```
///USER1.DATASET.NAME1
//_USER1.DATASET.NAME1
/_/USER1.DATASET.NAME1
/__USER1.DATASET.NAME1
/FTADV:X=BIN/_/_USER1.DATASET.NAME1
/FTADV:X=BIN/_//USER1.DATASET.NAME1
/FTADV:X=BIN/__/USER1.DATASET.NAME1
/FTADV:X=BIN/___USER1.DATASET.NAME1
```

The choice of name type depends on the client. If consecutive slashes are not sent to the server, "`/_`" (or "`/__`" for a prefixed absolute data set) is probably the best choice. The SFTP client interprets the file path to be absolute and does not add any directories in front of the name. If a file transfer advice string (see Section 10.4.1) is added in front of the file name, "__" (or "___" for a prefixed absolute data set) is a safe choice. The data set name becomes `/FTADV:X=BIN/__DATASET.NAME1`. The client interprets it as an absolute path to the file and does not change it. The SFTP server on the other hand recognizes the advice string `/FTADV:X=BIN/` and interprets `__DATASET.NAME1` to be the real name of the data set `//DATASET.NAME1`.

z/OS has also library data sets, whose members are accessed using the data set name `//DATASET.NAME1(MEMBER1)`.

Again, parentheses may be special characters in some environments. The SFTP server introduces a new convention for accessing library members using a single slash as a member separator. The name becomes `//DATASET.NAME1/MEMBER1`.

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Accessing HFS Root

Because of the new conventions for data set names there are some exceptions in the HFS file names. HFS file or directory name cannot start with an underscore if the file or directory is located in the root directory. Also, if an advice string is used with absolute HFS names, the HFS root must be written either as `/` or _.

Case-Sensitivity of HFS and MVS Names

HFS file names are case-sensitive. For example, `/tmp/MYFILE` and `/tmp/myfile` result in two different files.

MVS data set names are case-insensitive. For example `//'USER1.DATASET.NAME1'` and `//'user1.dataset.name1'` are handled the same way.

10.3.2 Accessing Generation Data Groups (GDG)

Tectia Server for IBM z/OS supports generation data groups defined in ICF. Reading GDG ALLs is not supported. Tectia Server for IBM z/OS will not create GDG bases or model data sets.

Note

Tectia file transfers are atomic. Running "`sget gdg.base(0) file1`" two times in succession might retrieve different files. A loop of "`sput file1 gdg.base(+1)`" commands might fill the GDG with identical files and roll off all the previous generations.

In the examples below, **sshd2** means server functions on z/OS that can be used by any remote client.

Navigating

sshd2 allows you to navigate to a GDG base and to a prefix of a base. The name of the GDG base is returned to the client with a period at the end, the same way as for prefixes.

Listing

sshd2 shows GDG bases with the type `GDG`. Generation data sets (GDS) are shown with their absolute data set names.

GDSs are normal data sets. The long name format (`ls -l`) will show all details.

Listing a base with `-l` will show full details of the GDSs. The listing may contain data sets that are not in the GDG index but do have data set names that have the GDG name as a prefix.

It is possible but not recommended to use data set names which have the GDG base name as a prefix but are not GDS names. For example:

```
sftp> cd //'USER1.GENGRP'
MVS prefix `'USER1.GENGRP.'' is the current directory.
The working directory `'USER1.GENGRP.'' is a generation data group.
```

```
'USER1.GENGRP.'
sftp> ls -l
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
S6SYS1 Jan 03 2007 VB     1000 27998 PS       50001  G0006V00.IMPOSTOR
S6SYS1 Jan 02 2007 VB     1000 27998 PS       50001  G0007V00
S6SYS1 Jan 02 2007 VB     1024 27998 PS       50001  G0008V09
S6SYS1 Jan 02 2007 VB     1024 27998 PS       50001  G0077V99
S6SYS1 Jan 02 2007 VB     1024 27998 PS       50001  G0088V99
S6SYS1 Jan 04 2007 VB     1024 27998 PS       50001  G0100V00
S6SYS1 Jan 02 2007 FB       80 27920 PS       50001  GARBAGE
```

You cannot navigate to a prefix that ends in a `GnnnnVnn` qualifier. Thus you cannot do "`cd G0006V00`" or "`ls //'USER1.GENGRP.G0006V00'`" in the example above.

If the GDG has the `NOSCRATCH` option, GDSs are retained when they are rolled off.

sshd2 shows data sets based on the prefix – it does not show which data sets are in the GDG and which are not.

Access by Relative DSN

sshd2 gives full access with relative generation numbers for reading and writing.

The following formats can be used for the relative GDS name `abc.xyz(relno)` (`relno` must be 0, +1, or -nn):

```
abc.xyz(relno)
abc.xyz./relno
abc.xyz/relno
abc.xyz.relno
```

Access by Absolute DSN

With absolute GDS names you can do all the things possible with other data sets.

Writing a data set with a last qualifier with the `GnnnnVnn` format requires that there exists a suitable GDG base. If the generation exists it is overwritten. If if does not, the new file is inserted in its place in the GDG and older GDGs are rolled off, if necessary.

10.4 Alternate Methods for Controlling File Transfer

The current Secure Shell protocol and current clients do not transfer any information about the files to be transferred, only the file contents as a byte stream. This is sufficient for Unix-type files if the sender and receiver use the same CCS.

Tectia Server for IBM z/OS needs more information: which transfer format to use, what code sets are involved, and what the file characteristics are. When Tectia is used at both ends, the information can be relayed by using

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the **site** commands of **scpg3** and **sftpg3**, or read from environment variables. When a third-party Secure Shell client is used together with Tectia Server for IBM z/OS, the information can be either encoded in the file name (advice string), read from a file transfer profile, or read from environment variables.

Using the **site** command is described in Section 6.4.1. Using environment variables is described in Section 6.4.2 and Section 10.4.3. For information on using third-party clients, see Section 10.4.1 and Section 10.4.2.

10.4.1 File Transfer Advice String (FTADV)

When using a third-party Secure Shell client for transferring files to and from Tectia Server for IBM z/OS, it is necessary to relay information about the transfer format, code sets and file characteristics. Since the SFTP server decodes the name for the data set, the file name in the request can be used to convey this information.

Instructions for using file transfer advice string, as well as a complete description of the available advice string names, are provided in Section 6.4.1.

Example Advice Strings

The following examples demonstrate file transfer advice string usage in various situations.

Example 1

Below is an example of a file name that requests the transfer of a PDS member with the line transfer format and code set conversion from EBCDIC to an ASCII code set.

```
/ftadv:D=IBM-1047,C=ISO8859-1,F=line/__personal.cntl/idlist
```

Example 2

The following example requests the transfer of a data set with the line transfer format and code set conversion using the translate table `USR1.SFTP.TCPXLBIN`, if it exists, or `TCPIP.SFTP.TCPXLBIN`. Different combinations of underscore and slash ("__", "_/", "/_", or "//") in front of the file name indicate that the file is an MVS data set.

```
/ftadv:F=line,E=SFTP,A=___USR1.%T.TCPXLBIN+___TCPIP.%T.TCPXLBIN/__DATA1.FILE1
```

Example 3

The example below names an HFS file to be transferred without changes. Transfer mode is set to binary (`X=bin`) to avoid conversion and to override any defaults set in the matching file transfer profiles or environment files.

```
/ftadv:X=bin,T=HFS,F=stream/profcopy
```

Example 4

The next example uses the named file transfer profile `myprofile`. The advice string also sets the data set code set to `ISO8859-15`. This value overwrites the value specified in the profile.

```
/ftadv:P=myprofile,D=iso8859-15/testfile
```

Note

Advice strings can also be used with directory names in file transfer GUIs. With advice strings, file transfer can be controlled in the GUI. For example in the Windows GUI, if you use the directory `/ftadv:P=WIN/_path/to/current/directory/`, all file transfers to and from the directory `/path/to/current/directory` use the advice string `/ftadv:P=WIN/`. This means that all file transfers use the named profile `WIN` (see Section 10.4.2).

Note

Advice string parameters are case-insensitive, with the exception of file transfer profile names. For example, `P=win` and `P=WIN` point to different profiles.

Example 5

This example uses the `LIKE` attribute when creating an MVS PS data set with the name "`userid.TEST.CPY1`". The server copies `RECFM`, `LRECL`, and `BLKSIZE` from the PDS "`COMP.DATA.CNTL`".

```
/ftadv:like=___COMP.DATA.CNTL,T=PS/__TEST.CPY1
```

This example uses the `LIKE` attribute when creating a PDSE, "`COMP.CODE`". The record characteristics are copied from a PDS, "`COMP.SOURCE`". The PDSE is created when adding the first member, `PRG1`. The new PDS is estimated to need 15 MB space.

```
/ftadv:like=___COMP.SOURCE,T=POE,size=15000000/____COMP.CODE(PRG1)
```

10.4.2 File Transfer Profiles

A file transfer profile is a mechanism for pre-configuring different types of file transfers. Both the mainframe clients (**scpg3**, **sftpg3**) and the server (**sshd2**) use the same profile mechanism. There are two types of profiles: named profiles and filename-matched profiles.

Named profiles can be used with the file transfer advice string parameter `P`. A named profile provides the default values for different advice string parameters. Those default values can be overwritten with advice string parameters.

The filename-matched profiles can be used for configuring advice string default values when transferring files whose names match a certain regular expression. Again, those default values can be overwritten with advice string parameters.

File transfer profiles for Tectia server and client tools on z/OS can be set in the `/opt/tectia/etc/ssh_ftadv_config` file globally for all users and in the `$HOME/.ssh2/ssh_ftadv_config` file for each user separately.

The syntax of the profile is:

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```
%NAME|REGEXP ADVSTRING
```

Each profile starts with a profile name or an `egrep` style of regular expression followed by one or more white spaces and the advice string. The profile name must start with the percent (`%`) character. The regular expression must not start with the `%` character. If the `%` character needs to be the first character in the regular expression, it must be escaped with a backslash (`\`). Note that in order to get the regular expression escape character, backslash, into a regular expression, it must be escaped by using `\\`.

The profile name and regular expression must start from the beginning of the line. There must not be any white space in front of the name or regular expression.

An advice string is a comma-separated list of name-value pairs of type `name=value`. There may be white spaces in the advice string. It can span over multiple lines. There must be at least one white space character in the beginning of a spanned advice string line. An advice string must not contain the file transfer advisor marker `/ftadv:/` or a file name.

Profiles with `%NAME` can be used with the advice string `P=NAME`. Profiles with `REGEXP` are used only for matching file names. The first `REGEXP` that matches a file name is used.

Comments can be added to the file with a hash (`#`) character. Everything on the line after `#` is ignored.

See the following sections for examples of Named File Transfer Profiles and Filename-Matched File Transfer Profiles in various situations.

Examples of Named File Transfer Profiles

Example 1

The following profile converts text files from Unix to MVS. ASCII is converted to EBCDIC. This profile is only used if the advice string contains the parameter `P=UNIX`.

```
%UNIX
    X=text,
    F=line,
    C=iso8859-1,
    D=ibm-1047
```

Example 2

The next profile converts text files from Windows to MVS. ASCII is converted to EBCDIC. The line delimiter is converted from the Windows style to the MVS style. This profile is only used if the advice string contains the parameter `P=WIN`.

```
%WIN
    X=text,
    F=line,
    C=iso8859-1,
    D=ibm-1047,
```

```
    I=dos,
    J=mvs
```

Example 3

The following profile can be used when transferring text files from MVS to another MVS. This profile is only used if the advice string contains the parameter `P=ZOS`.

```
%ZOS
    X=text,
    F=line
```

Example 4

This profile can be used when transferring text files between the Unix and MVS environments. All data sets created on the MVS side have fixed blocked lines of 80 characters per line. Again, to use this profile, `P=FB80` needs to be added to the advice string.

```
%FB80
    X=text,
    F=line,
    C=iso8859-1,
    D=ibm-1047,
    O=fb,
    R=80
```

Example 5

The following profile creates record format data sets with maximum record length of 1024 bytes. The advice string `P=REC` is needed.

```
%REC
    F=record,
    R=1024
```

Example 6

The following profile can be used when transferring binary files.

```
%BIN
    X=bin,
    F=stream
```

Examples of Filename-Matched File Transfer Profiles

Example 1

This next profile is used whenever a data set name contains the string `TXT`, `txt`, `TEXT` or `text` in it.

```
//.*(TXT|txt|TEXT|text).*$
    X=text,
    F=line,
```

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```
    C=iso8859-1,
    D=ibm-1047
```

Example 2

The following profile matches files that have the extension `.txt`, `.TXT`, `.c`, `.C`, `.h`, `.H`, `.log`, `.LOG`, `.conf` or `.CONF`. Code set conversion from ASCII to EBCDIC is performed.

```
.*\\.(txt|TXT|c|C|h|H|log|LOG|conf|CONF)$
    X=text,
    F=line,
    C=iso8859-1,
    D=ibm-1047
```

Example 3

The following profile matches binary files with extensions `.gz`, `.Z`, `.tar` and `.bin`.

```
.*\\.(gz|Z|tar|bin)$
    X=bin,
    F=stream
```

Example 4

This profile matches all files and data set names. Data is transferred in text format and code set conversion from ASCII to EBCDIC is performed.

```
.*$
    X=text,
    F=line,
    C=iso8859-1,
    D=ibm-1047
```

Example 5

This profile specifies that record truncation is allowed. Data is transferred in text format and code set conversion from ASCII to EBCDIC is performed.

```
.*$
    X=text,
    F=line,
    U=yes,
    C=iso8859-1,
    D=ibm-1047
```

Note

With truncation, data loss may occur.

Enabling Example File Transfer Profiles

File transfer profiles are not enabled by default. File transfer profiles can be enabled by copying the example profile file `/opt/tectia/etc/ssh_ftadv_config.example` to `/opt/tectia/etc/ssh_ftadv_config` (globally for all users) or `$HOME/.ssh2/ssh_ftadv_config` (for a specific user).

```
> cp /opt/tectia/etc/ssh_ftadv_config.example <$HOME>/.ssh2/ssh_ftadv_config
```

10.4.3 File Transfer Environment Variables for the Server

The environment variables for file transfer on Tectia Server for IBM z/OS can be set in the `/etc/environment` file globally for all users and in the `$HOME/.ssh2/environment` file for each user separately.

File transfer server uses the following environment variables:

```
SSH_SFTP_HOME_MVS                       (default: "no")
SSH_SFTP_RECORD_TRUNCATE                (default: "no")
SSH_SFTP_STAGEFS_CACHE_SIZE_LIMIT       (default: "524288000")
SSH_SFTP_STAGEFS_CACHE_ENTRY_LIFETIME   (default: "10")
SSH_SFTP_STAGEFS_CACHE_REFRESH_INTERVAL (default: "5")
SSH_SFTP_DEBUG                          (default: NULL)
SSH_SFTP_DEBUG_FILE                     (default: NULL)
SSH_SFT_PSEUDOVOLUME_VOLSERS            (default: MIGRAT)
SSH_SFTP_VOL_UNIT_MAP                   (default: NULL)
```

If `SSH_SFTP_HOME_MVS` is set to `yes`, the file transfer server starts in the MVS side. The file transfer client sees USER prefix as its starting directory. Default is `no`, the file transfer server starts in the USS side. See the section called “Setting the File Transfer Home Location” for examples of using this variable.

The `SSH_SFTP_RECORD_TRUNCATE` environment variable can be used to set the default value for the `record_truncate` file transfer attribute. The valid values are `yes` and `no`. The environment variable will be overridden by a matched transfer profile or the advice string if they contain the `record_truncate` (or `U`) attribute. If none of these sources is available, `no` will be used.

The `SSH_SFTP_STAGEFS_CACHE_SIZE_LIMIT` variable specifies staging cache size in bytes. It limits the use of system resources. The default is 524288000 bytes (500 MB).

The `SSH_SFTP_STAGEFS_CACHE_ENTRY_LIFETIME` variable specifies how many seconds one cache entry is stored in the cache. After the lifetime has expired the entry is removed from the cache and system resources are released. The default is 10 seconds.

The `SSH_SFTP_STAGEFS_CACHE_REFRESH_INTERVAL` variable specifies how many seconds may pass until the cache is refreshed. The default is 5 seconds.

With `SSH_SFTP_DEBUG`, the debug level can be set for the file transfer server.

If `SSH_SFTP_DEBUG_FILE` is set, debug messages are stored in the file named in the variable.

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The `SSH_SFT_PSEUDOVOLUME_VOLSERS` can be used to define a list of pseudo-volume serial numbers for data sets that are migrated or archived, see Section 6.4.3.

The environment variable `SSH_SFTP_VOL_UNIT_MAP` can be defined to provide a mapping between a volume serial number pattern and a device unit, allowing the unit to be deduced from the volume. See Section 6.3.5 for more details.

Setting the File Transfer Home Location

For SFTP connections, the file transfer home location is the directory on the server where the SFTP session starts. For SCP operations, the home location is the default target of the operation on the server, and directory paths are relative to the home location.

By default, Tectia Server for IBM z/OS uses the user's Unix System Services (USS) home directory as the file transfer home location.

The environment variable `SSH_SFTP_HOME_MVS` in the user's `$HOME/.ssh2/environment` file on the server can be used to control the file transfer home location.

If the environment variable is omitted or its value is `no`, the user's USS home directory is used as the file transfer home, for example `/u/userid/`, and the MVS user prefix must be accessed using "`//`" or "`/_`".

If the value of the environment variable is `yes`, the user's MVS USERID prefix is used as the file transfer home location, for example `//'USERID.`, and the USS home directory must be accessed using `/u/userid/` or `~`.

Examples when `SSH_SFTP_HOME_MVS=no`

When `SSH_SFTP_HOME_MVS` is set to `no` (or omitted), the following `put` command run in the Windows SFTP client results to a file `/home/user1/dataset.txt` in Tectia Server for IBM z/OS:

```
sftp> open user1@zos
sftp> put dataset.txt
```

Also the following Windows SCP client command would result to the same data set:

```
$ scpg3 --dst-site="X=TEXT" file.txt user1@zos:dataset.txt
```

The following **sput** command run in the Windows SFTP client results to a MVS sequential data set `//'USERID.MF.FILE'` in Tectia Server for IBM z/OS:

```
sftp> open user1@zos
sftp> sput remote_file //MF.FILE
```

The same applies to the Windows SCP client command.

Examples when `SSH_SFTP_HOME_MVS=yes`

When `SSH_SFTP_HOME_MVS` is set to `yes`, the following `put` command in a Windows SFTP client results to a data set `//'USER1.DATASET.TXT'` in Tectia Server for IBM z/OS:

```
sftp> open user1@zos
sftp> put dataset.txt
```

Also the following Windows SCP client command would result to the same data set:

```
$ scpg3 --dst-site="X=TEXT" file.txt user1@zos:dataset.txt
```

The following **sput** command run in the Windows SFTP client results to a USS file `/u/user1/mf.file` in Tectia Server for IBM z/OS:

```
sftp> open user1@zos
sftp> sput remote_file ~/mf.file
```

Or:

```
sftp> open user1@zos
sftp> sput remote_file /u/user1/mf.file
```

The same applies to the Windows SCP client command.

10.5 Staging

The current Secure Shell protocol, as implemented in third-party products and current Tectia versions, is designed for Unix files which are byte streams. While MVS data sets are record-based, they must be staged before sending or destaged after they have been received. Staging copies a data set into byte stream format and may also convert the character set. Destaging transforms a byte stream into a file format and may also convert the character set. HFS files that do not need character set conversion, do not need to be staged.

There are two modes of staging:

- Offline staging stores the byte stream as an HFS file. Offline staging incurs the overhead of writing the byte stream to disk and reading it.

  Tectia client tools for z/OS support native MVS data set reading and writing and generally do not require staging.

  To use offline staging, you must run the **ssh-sft-stage** utility as a separate step. For more information, see ssh-sft-stage(1).

- Online staging places the byte stream in virtual storage when the file is transferred. The Tectia Server for IBM z/OS (server program) will use online staging automatically if a data set cannot be transferred directly.

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Online staging is more convenient and, for small files, more efficient. Online staging, for large files, will page out most of the byte stream and will page it in again. Online staging does not support files that are larger than 2 GB.

By default, staging is disabled. You can also control staging in the server configuration. When staging is disabled, all clients are required to send the data in the correct order (as consecutive blocks from beginning to end) or else the file transfer fails. In case Tectia Server for IBM z/OS detects changes in the order of the blocks, it stops the transfer and reports an error about non-serialized transfer.

To enable staging, use either one of the following methods:

- Add the staging setting for **sft-server-g3** into the `sshd2_config` configuration:

  ```
  subsystem-sftp /opt/tectia/libexec/sft-server-g3 --attribute=staging:YES
  ```

- Use the file transfer advice string in the **put** command:

  ```
  sftp> put over2gigfile.txt /ftadv:S=YES///'target'
  ```

Note

If the file transfer client uses the SFTP protocol for transferring the files, and does not access the files or data sets in the correct order, staging must be enabled. If the client accesses file data in random offsets, or uses checksums, staging is necessary.

Note

When staging is used, do not set the `_CEE_RUNOPTS` environment variable's `TRAP` option to `OFF`. If you do, **sftpg3** fails to start. The `TRAP` option is `ON` by default.

A summary of situations when staging is needed is shown in the following table. In the table, *Native* indicates that staging is not required, *Online* indicates that online staging is automatically used, and *Offline* indicates that the data set has to be staged offline.

Table 10.1. Staging summary

Client version	Server version	File size <2GB	File size >2GB
Tectia z/OS 5.2-	Any Unix/Windows	Native	Native
Tectia Unix/Win 5.2-	Tectia z/OS 5.2-	Native	Native
OpenSSH SFTP Client	Tectia z/OS 6.1-	Native	Native
Tectia z/OS 5.2-	Tectia z/OS 5.2-	Native	Native
Tectia (all) 4.x-5.1	Tectia z/OS 5.2-	Online	Offline
3rd-party Unix/Win	Tectia z/OS 5.2-6.0	Online	Offline

Tectia client tools for z/OS include a utility program, **ssh-sft-stage**, for offline staging and destaging. `STAGE` (located in `<HLQ>.V681.SAMPLIB`) is a sample of JCL for running the staging utility:

```
//STAGE   EXEC PGM=BPXBATSL,REGION=0M,TIME=NOLIMIT
//STDPARM  DD  *
PGM /opt/tectia/sbin/ssh-sft-stage -v
  -i /FTADV:F=LINE,D=IBM-1047,C=ISO8859-1///DD:PROGLI
  -s /tmp/stage.tmp
//STDENV   DD  DSN=<HLQ>.V681.PARMLIB(SSHENV),DISP=SHR
//STDOUT   DD  SYSOUT=*
//STDERR   DD  SYSOUT=*
//STDIN    DD  DUMMY
//PROGLI   DD  DSN=&SYSUID..TEST.C.LIST,DISP=SHR
//
```

10.6 Listing Data Sets with Other SFTP Clients

Most SFTP command-line and GUI clients can be used to list data sets when Tectia Server for IBM z/OS is installed. Tectia Client supports listing data sets with **sftpg3** (Tectia SFTP command-line client) on Unix and Windows.

The clients will typically contract two slashes into one. Use the alternative style of writing MVS data set names with underscores. In the examples below we show the alternative style in parentheses. See Section 10.3.1.

10.6.1 Data Set Lists

The form of data set lists depends on the file transfer client. To display data set lists, on most clients the users can use the **ls** and **ls -l** commands. Usually the **ls** command shows the list with relative data set names and possibly some additional information. The file size is one field in the additional information. Many SFTP clients show the file sizes of MVS data sets as "`0`" because Tectia Server for IBM z/OS does not determine the exact file size when listing files and does not set the size field in the protocol message. The **ls -l** command shows additional information formatted by the server.

When listing a PDS or PDSE, the member names are listed.

When listing a GDG, the GDG name is treated as a prefix. The listing may contain data sets that are not in the GDG index but do have data set names that have the GDG name as a prefix.

Using the **ls** command without any parameters displays the content of the current working directory.

```
sftp> ls
BINARY.FILE
CONT2.TEST2
DEMO.ZIP
FILE.Z
FILE1.PS
FILE1.VSAM
```

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```
FILE2.PS
ISPF.ISPPROF
PDS
SAMPLIB
TEST.FILE
WINFILE.PS
WINPDS
```

Users can also define the DSN qualifier or HFS path they want to list. To use an absolute DSN, start the prefix with "`//'`". To use a relative DSN, which will be completed with the user name, start the prefix with "`//`".

Some older Tectia and third-party command-line and GUI clients require that a dot sign is added after the data set prefix you want to display. This applies also to older Tectia Server for IBM z/OS file transfer clients.

For example, to list the data sets of a user's MVS home directory using absolute DSN, use the following command:

```
sftp> ls /__USERID.
```

Or using a relative DSN, use the following command:

```
sftp> ls /_.
```

10.6.2 Data Set Hierarchy

Tectia Server for IBM z/OS presents z/OS data sets as if they formed a hierarchy of directories where the data set name (DSN) qualifiers are the directory names.

The **cd** command can be used to change the DSN prefix. To use an absolute DSN start the prefix with "`//'`". To use a relative DSN, which will be completed with the user name, start the prefix with "`//`".

For example, to change the working "directory" to `//'USER1`, use the command:

```
sftp> cd //'USER1.'
MVS prefix `'USER1.'' is the current directory.
'USER1.'
sftp>
```

If the user is connected as `USER1`, use the command:

```
sftp> cd //
MVS prefix `'USER1.'' is the current directory.
'USER1.'
sftp>
```

Once working in a "directory" (`//'USER1.'`, for example) you can go into a "subdirectory" by doing a **cd** to a qualifier:

```
sftp> cd TEST.
MVS prefix `'USER1.TEST.'' is the current directory.
'USER1.TEST.'
```

```
sftp> ls -l
'USER1.TEST.':
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
Z6SYS1 Jul 17 2006 VB    1024  27998 PS       50001  FILE
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  PS.FILE1
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  PS.FILE2
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  PS.FILE3

sftp> cd PS.
MVS prefix `'USER1.TEST.PS.'' is the current directory.
'USER1.TEST.PS.'
sftp> ls -l
'USER1.TEST.PS.':
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  FILE1
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  FILE2
Z6SYS1 Jul 25 2006 VB    1024  27998 PS       50001  FILE3

sftp>
```

You can go "up" in the hierarchy with the "**cd ..**" command:

```
sftp> cd ..
MVS prefix `'USER1.TEST.'' is the current directory.
'USER1.TEST.'
sftp> ls
'USER1.TEST.':
FILE
PS.FILE1
PS.FILE2
PS.FILE3

sftp> cd ..
MVS prefix `'USER1.'' is the current directory.
'USER1.'
sftp>
```

The **cd** command can also be used for going into a PDS or PDSE file, for example:

```
sftp> cd PDS
MVS prefix `'USER1.PDS'' is the current directory.
The working directory `'USER1.PDS'' is a partitioned data set.
'USER1.PDS'
sftp> ls
'USER1.PDS':
MEM1
MEM2
```

Instead of using the **cd** command to change the directory one qualifier at a time, the whole data set name can be used, for example:

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```
sftp> cd //'USER1.TEST.PS.'
MVS prefix `'USER1.TEST.PS.'' is the current directory.
'USER1.TEST.PS.'
```

10.7 Secure File Transfer Examples Using Windows and Unix Clients

Tectia Client for Windows includes a GUI and command-line applications for secure system administration and secure file transfer. Tectia Client for Unix includes only the command-line applications.

Note

When Tectia Client 6.x on Unix or Windows is used to rename or transfer files or mainframe data sets to/from z/OS hosts, and direct MVS data set access on the server side is needed, you need to define the following environment variables on the client:

- `SSH_SFTP_STREAMING_MODE=ext` to activate extended streaming
- `SSH_SFTP_CHECKSUM_MODE=no` to deactivate the checksum mode

  The checksums cannot be used with streaming, because checksum calculation requires staging, but staging and streaming are mutually exclusive.

For more information, see *Tectia Client 6.x User Manual*.

10.7.1 File Transfers Using Windows GUI

In these examples, Tectia Client 6.2 is used. The same syntax applies to most of the Windows GUI SFTP applications.

Note that many SFTP clients show the file sizes of MVS data sets as "`0`". This is because Tectia Server for IBM z/OS does not determine the exact file size when listing files and does not set the size field in the protocol message.

MVS Data Set and HFS File System Hierarchies

GUI clients display MVS data sets as files and folders. Sequential and VSAM data sets are displayed as files and partitioned data sets as folders.

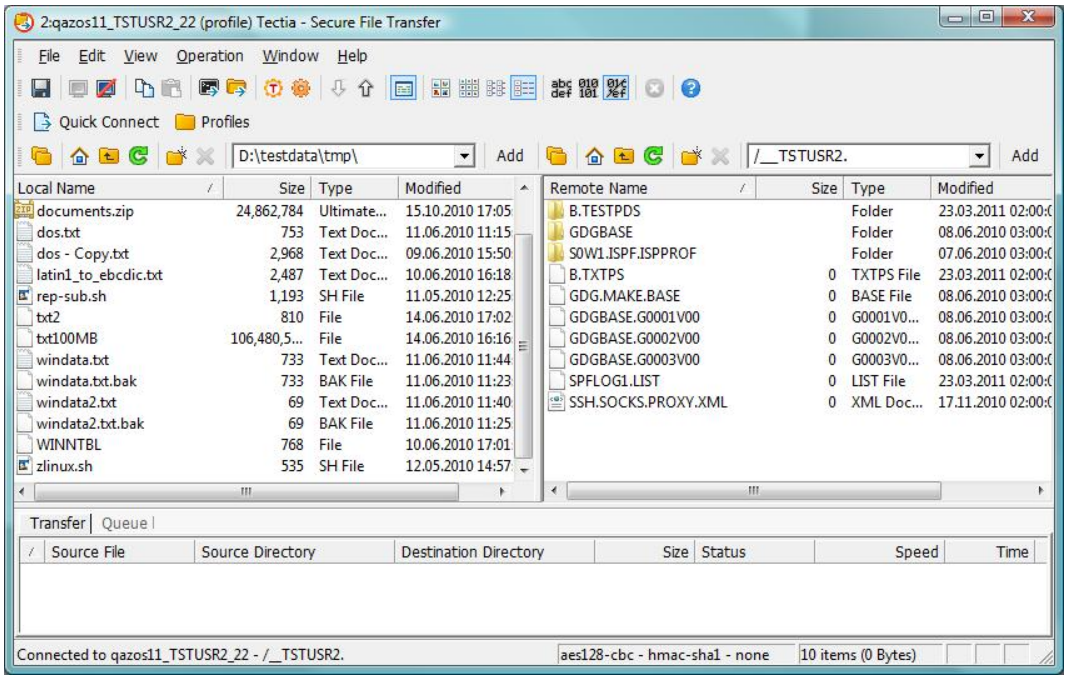

Figure 10.2. Viewing MVS data sets in the Tectia Secure File Transfer GUI on Windows

Partitioned data set members can be viewed by double-clicking the `PDS` "folder".

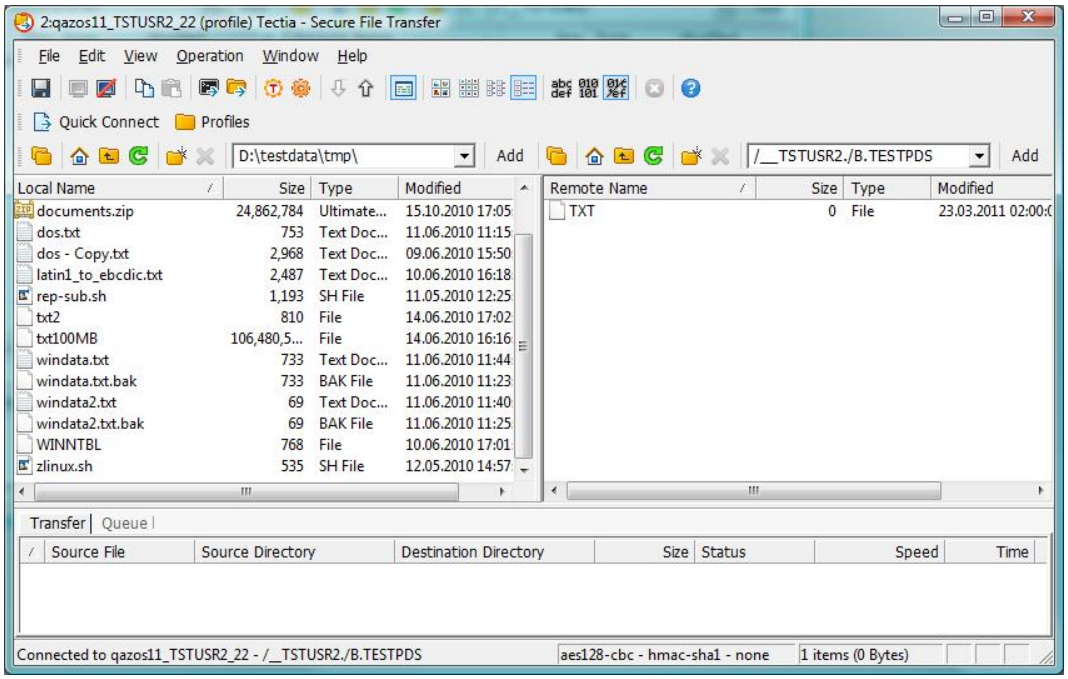

Figure 10.3. Viewing partitioned data sets

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If a default file transfer home directory is defined as MVS, Unix System Services can be accessed by typing `/` (or a Unix home directory like `/home/user1`) in the remote path.

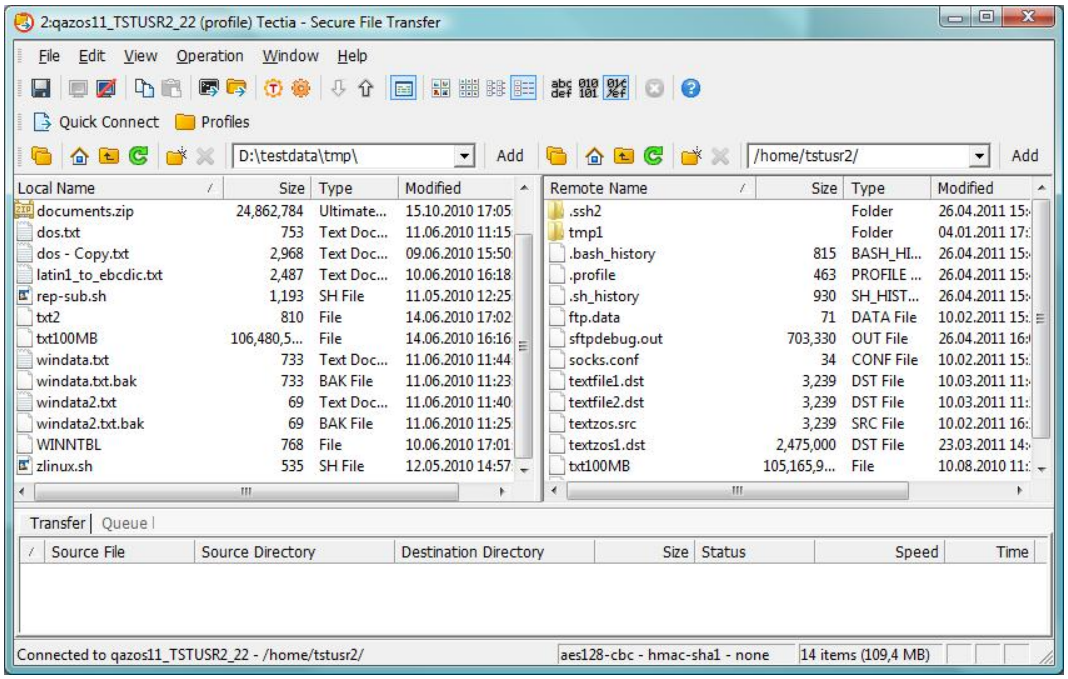

Figure 10.4. Viewing USS home directory

If a default file transfer home directory is defined as USS, MVS data sets can be accessed by typing `/__USERNAME.` (for example `/__USER1.`) in the remote path.

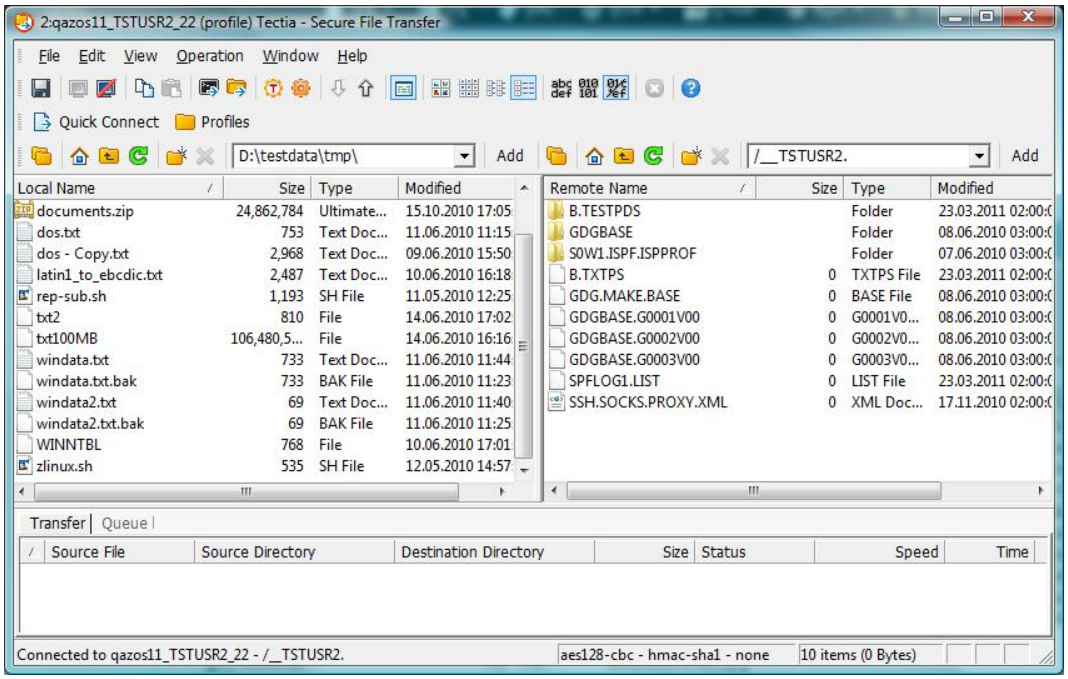

Figure 10.5. Viewing MVS "home"

Interactive File Transfers Using Windows GUI

Files and MVS data sets can be transferred with drag-and-drop either between local and remote views, or between Windows Explorer/Desktop and remote view.

These file transfers use the default file transfer profile if file transfer profiles are enabled.

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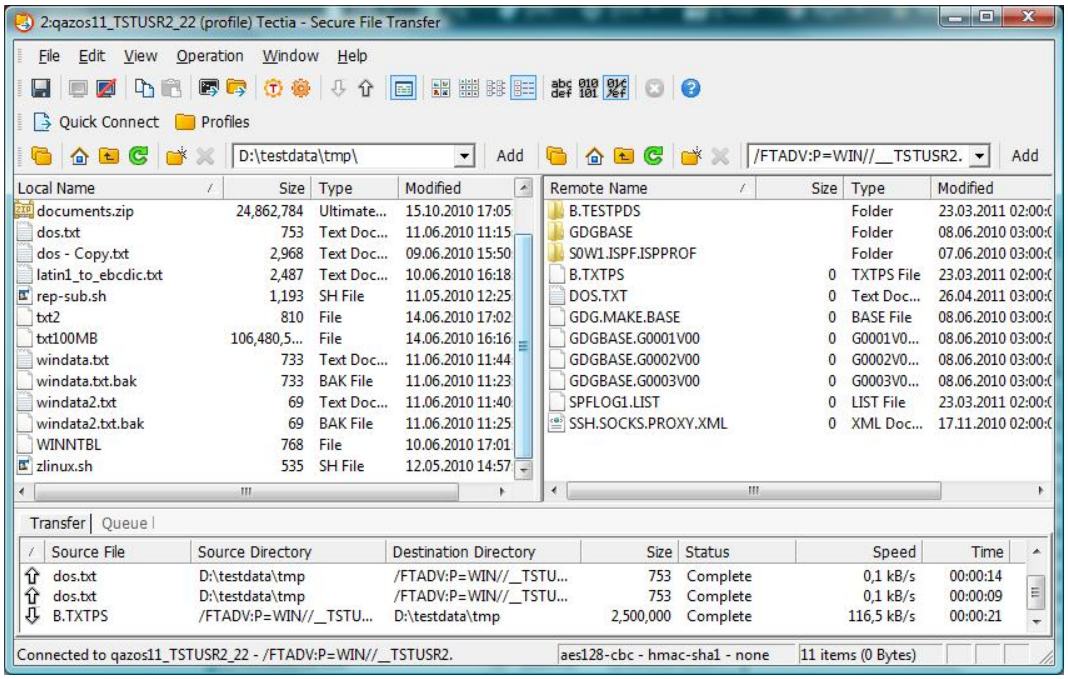

Figure 10.6. Transferring files between Windows and MVS

Whole partitioned data sets can be transferred by transferring the PDS folders.

Specific profiles or file transfer parameters can be defined to remote path with the same format as described earlier. In the figure below, the advice string `"/FTADV:P=WIN/___USER1."` is used to select a Windows file transfer profile.

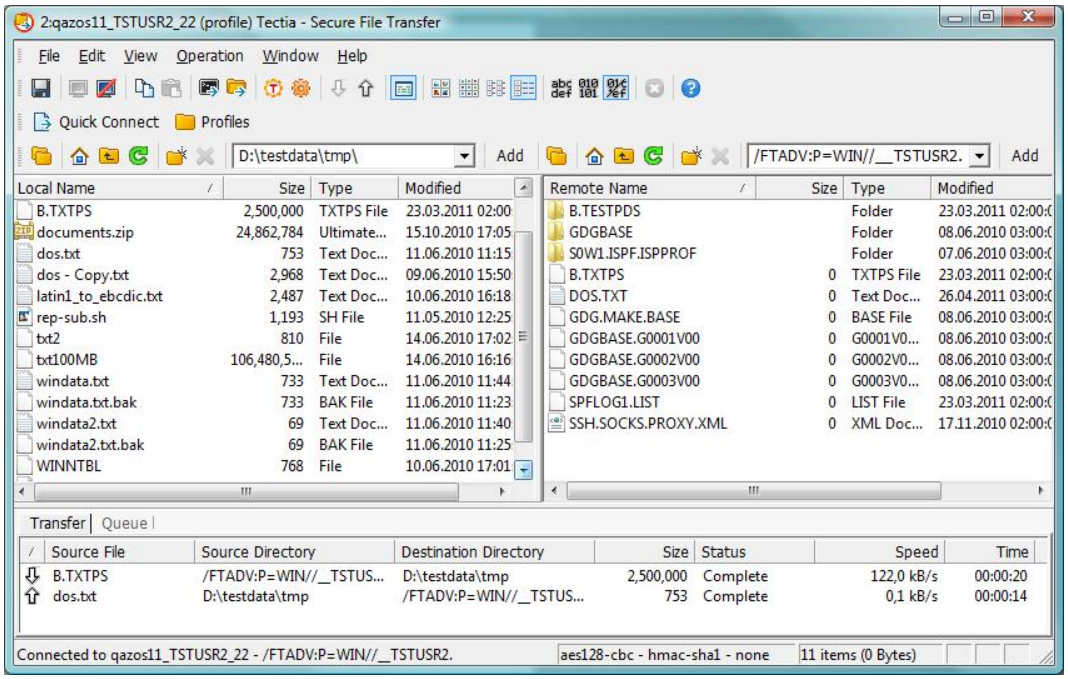

Figure 10.7. Using advice strings

Unattended File Transfers Using Windows GUI

The Tectia Client GUI does not yet provide scheduled non-interactive file transfer capabilities, but the file transfer queue can be used for semi-automatic file transfers. Files, folders, and data sets can be dragged to the file transfer queue where user can select "Transfer all" with a right mouse click to initiate a batch file transfer.

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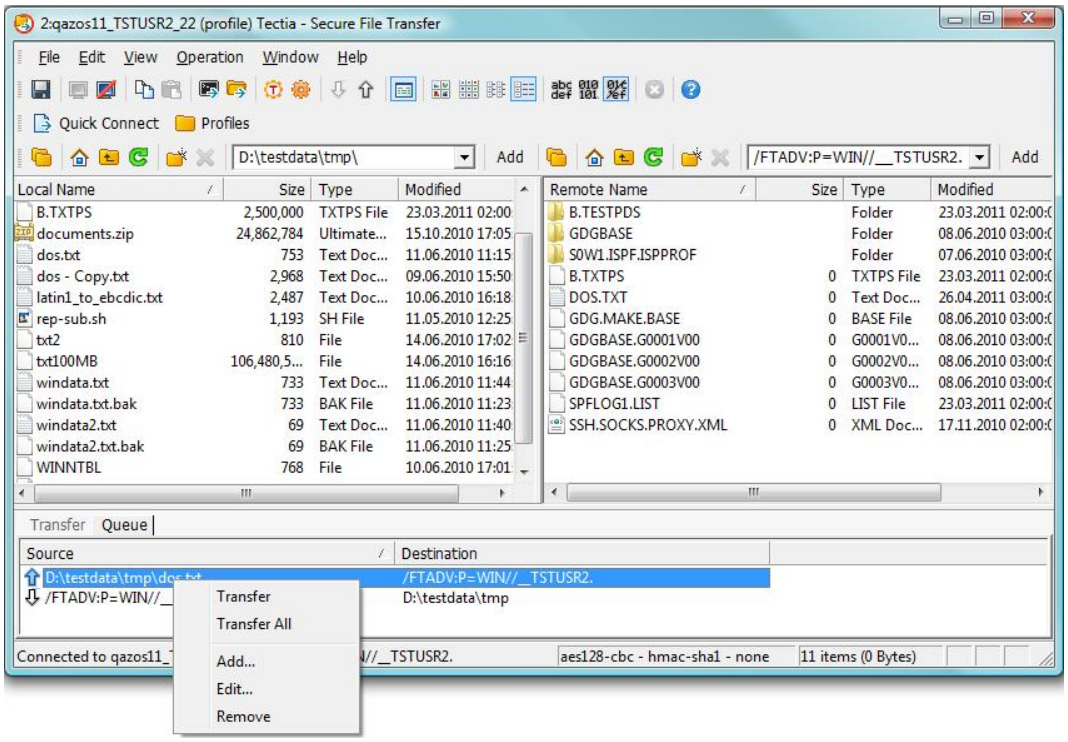

Figure 10.8. Batch file transfer

10.7.2 File Transfers Using Command-Line Applications

Most of the examples in this section use Tectia Client. If not mentioned otherwise, also other clients can be used. The examples apply to both Unix and Windows command-line clients.

Interactive File Transfers Using Command-Line Applications

Tectia Client on Windows and Unix contain two file transfer clients.

- **scpg3** is a secure replacement for remote copy and provides easy secure interactive and non-interactive file transfers.
- **sftpg3** is a secure replacement for FTP and provides a user interface for interactive file transfers and a batch mode for unattended file transfers.

The file transfer formats are the same as described earlier.

Example 1: Copy a Unix file to an MVS partitioned data set member using the default file transfer profile.

```
$ scpg3 textfile.txt user1@zos:/__USER1.TEST2.PDS/MEMBER1
```

Example 2: Copy an MVS sequential data set to a Windows file using a Windows file transfer profile.

```
C:\> scpg3 user1@zos:/ftadv:P=WIN/___USER1.TEST2.PS.FILE c:\temp\my_file.txt
```

Example 3: Copy a partitioned data set with members to Unix a directory and files using the default file transfer profile.

```
$ scpg3 -r user1@zos:/_TEST2.PDS /tmp/pds/
```

Example 4: File transfers between Unix and z/OS using **sftpg3**.

```
$ sftpg3 user1@zos ❶
user1@zos's password:
sftp> sget /_TEST2.PDS/MEMBER1 /tmp/member1 ❷
sftp> sget /FTADV:X=BIN/__TEST.PS.FILE1 ❸
sftp> sput /tmp/local_file.txt /FTADV:P=FB80/___&SYSUID..SSZ.JCL1 ❹
```

❶ Connect from Unix to z/OS using **sftpg3**.

❷ Fetch an MVS PDS member into a Unix file.

❸ Fetch an MVS data set. Use a file transfer advice string to set `TRANSFER_MODE` (`X`) to binary.

❹ Put a Unix file to an MVS data set using file transfer profile `FB80`.

Note that, by default, a sequential data set - not a partitioned data set - is created. If you want to store your source file to a PDS, you can do it in one of the following ways:

- First create the PDS using the **mkdir** command. After this you can put your source file to the PDS, giving a valid member name if the source file name is not suitable.
- Specify the directory size (`DIRECTORY_SIZE|M`) in the file transfer advice string as follows:

  ```
  sftp> sput /tmp/local_file.txt /FTADV:P=FB80,M=10/___&SYSUID..SSZ.JCL1
  ```

Example 5: Using the **sftpg3 site** command to define additional data set parameters.

Note

The **sftpg3 (l)site** commands are recognized only by Tectia products. File transfer advice strings should be used with other clients than Tectia.

Parameters can be entered either one by one, or several parameters can be delimited by commas or spaces. Both long parameters and abbreviations can be used. The plain **site** command outputs the list of entered parameters.

```
sftp> site LRECL=80 ❶
sftp> site RECFM=FB,VOLUMES=TEST ❷
sftp> site X=TEXT C=ISO8859-1 D=IBM-1047 ❸
sftp> site ❹
LRECL=80
RECFM=FB
TRANSFER_CODESET=ISO8859-1
TRANSFER_FILE_CODESET=IBM-1047
```

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```
TRANSFER_MODE=TEXT
VOLUMES=TEST
```

❶ Set record length (`LRECL`).

❷ Set record format (`RECFM`) and volumes (`VOLUMES`), separated by a comma

❸ Set `TRANSFER_MODE|X`, `TRANSFER_CODESET|C` and `TRANSFER_FILE_CODESET|D`, separated by spaces.

❹ List the currently set **site** parameters.

Example 6: File transfers using Unix OpenSSH client.

```
$ sftp user1@zos
Connecting to zos
user1@zos's password:
sftp> get /_TEST2.PDS/MEMBER1 /tmp/member1
sftp> get /FTADV:X=BIN/__TEST.PS.FILE1
sftp> put /tmp/local_file.txt /FTADV:P=FB80/___&SYSUID..SSZ.JCL1
```

Note that, by default, a sequential data set - not a partitioned data set - is created. To store your source file to a PDS, follow the instructions presented in **Example 4** above.

Unattended File Transfers Using Command-Line Applications

scpg3 commands can be used as Scheduled Tasks on Windows, or as cron jobs on Unix. With **sftpg3**, batch mode can be used. The syntaxes for **scpg3** and **sftpg3** are the same as described before.

10.7.3 File Transfers Using FTP-SFTP Conversion

Tectia provides an FTP-SFTP conversion functionality from z/OS, Windows and Unix clients to z/OS servers. This enables users to use their existing interactive and unattended FTP applications and tools.

For configuring FTP-SFTP Conversion for Windows or Unix, see the *Tectia Server Administrator Manual* at https://www.ssh.com/manuals/. Once configured, existing FTP application can be used like before.

Example: Using FTP-SFTP conversion to transfer MVS data set using existing FTP client application. All the standard FTP commands can be used.

```
$ ftp zos
Connected to zos (10.10.10.10).
220----- SSH FTP-SFTP Conversion ------
220-------------------------------------
220 Your FTP connection is now SECURED!
Name (zos:user1): user1
331 Send password please.
Password:
230 You are logged on.
Remote system type is MVS.

ftp> ls
227 Entering Passive Mode (127,0,0,1,78,32).
```

```
150 Connecting to data port.
Volume Referred    Recfm Lrecl BlkSz Dsorg    Space  Dsname
Z6SYS1 Jul 17 2006 VB     1024 27998 PS       50001  BINARY.FILE
Z6SYS1 Jul 17 2006 VB     1024 27998 PS       50001  FILE1.PS
Z6SYS1 Jul 17 2006 FB       80  6080 PS       50001  FILE1.VSAM
Z6SYS1 Jul 17 2006 FB       80 27920 PO       50001  PDS
Z6SYS1 Jul 25 2006 VB     1024 27998 PO       50001  SAMPLIB
Z6SYS1 Jul 25 2006 VB     1024 27998 PS       50001  TEST.PS.FILE2
Z6SYS1 Jul 25 2006 VB     1024 27998 PO       50001  TEST2.PDS
226 List completed successfully.

ftp> get FILE1.PS /tmp/file1.txt
local: /tmp/file1.txt remote: FILE1.PS
227 Entering Passive Mode (127,0,0,1,78,33).
150 Connecting to data port.
226 Transfer completed successfully.
49 bytes received in 0.421 secs (0.11 Kbytes/sec)

ftp> cd test2
250 "'USER1.TEST2.'" is the working directory name prefix.

ftp> cd PDS
250 The working directory "'USER1.TEST2.PDS'" is a partitioned data set.

ftp> ls
227 Entering Passive Mode (127,0,0,1,78,34).
150 Connecting to data port.
MEMBER1
226 List completed successfully.

ftp> put textfile.txt member2
local: textfile.txt remote: member2
227 Entering Passive Mode (127,0,0,1,78,35).
150 Connecting to data port.
226 Transfer completed successfully.
71 bytes sent in 3.3e-05 secs (2.1e+03 Kbytes/sec)
ftp>
```

Example 2: Using the **site** command to define additional data set parameters (on Tectia Client 5.2 and later).

```
ftp> site
(arguments to SITE command) LRECL=200
200 SITE command was accepted

ftp> site recfm=FB,C=ISO8859-1,D=IBM-1047,X=TEXT
200 SITE command was accepted

ftp> rstatus
211-SSH FTP-SFTP conversion status:
        Version 5.2 Build 53
211-Connected to 10.1.49.158
211-Logged in as user1
```

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```
211-Site parameters: O=FB,R=200,X=TEXT,C=ISO8859-1,D=IBM-1047
211 End of status.

ftp>  put textfile.txt //'USER1.SITE.TEST'
local: textfile.txt remote: //'USER1.SITE.TEST'
227 Entering Passive Mode (127,0,0,1,78,38).
150 Connecting to data port.
226 Transfer completed successfully.
71 bytes sent in 4.1e-05 secs (1.7e+03 Kbytes/sec)
ftp>
```

Appendix A Connection Broker and SOCKS Proxy Configuration Files

The authentication and connection profile settings for Tectia client tools for z/OS are made in the Connection Broker configuration, because the Connection Broker handles all cryptographic operations and authentication-related tasks for Tectia client tools for z/OS.

This section describes the configuration settings of the Tectia client components on z/OS. The configuration settings are made in an XML file that follows the given DTD.

A.1 Configuration File

The elements of the XML-based configuration files `ssh-broker-config.xml` and `ssh-socks-proxy-config.xml` are described in ssh-broker-config(5).

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ssh-broker-config

ssh-broker-config -- Tectia Connection Broker configuration file format

The Connection Broker configuration file `ssh-broker-config.xml` is used by Tectia Client on Unix and Windows, and additionally by the Tectia client tools on IBM z/OS and Linux for IBM System z. The Connection Broker configuration file must be a valid XML file that follows the `ssh-broker-ng-config-1.dtd` document type definition.

The SOCKS Proxy configuration file `ssh-socks-proxy-config.xml` is used by the Tectia SOCKS Proxy on z/OS. It must be a valid XML file that follows the `ssh-broker-ng-config-1.dtd` document type definition.

Connection Broker Files

The Connection Broker reads three configuration files (if all are available):

1. The `ssh-broker-config-default.xml` file is read first. It holds the factory default settings. It is not recommended to edit the file, but you can use it to view the default settings.

   This file must be available and correctly formatted for the Connection Broker to start.

2. Next, the Connection Broker reads the global configuration file. The settings in the global configuration file override the default settings.

   If the global configuration file is missing or malformed, the Connection Broker will start normally, and will read the user-specific configuration file, instead. A malformed global configuration file is ignored and the default settings or user-specific settings, if they exist, are used instead.

3. Last, the Connection Broker reads the user-specific configuration file, if it is available. The settings in the user-specific configuration file override the settings in the global configuration file, with the following exceptions:

   - The following settings from the user-specific configuration are combined with the settings of the global configuration file:

     - In `general` element, the `key-stores`, `cert-validation` and `file-access-control` settings

     - In `profiles` element, all settings

     - In `static-tunnels` element, all settings.

   - If a connection profile with the same name has been defined in both the global configuration file and user-specific configuration file, the latter one is used.

   - If the `filter-engine` settings have been defined in the global configuration file, and the file is valid (not malformed), those settings are used, and any `filter-engine` settings made in the user-specific configuration file are ignored.

If the user-specific configuration file is missing, the Connection Broker will start using the previously read configuration files. However, if a user-specific configuration exists but is malformed, the Connection Broker will not start at all.

On z/OS, the default configuration file locations are as follows:

- the default configuration:

  `/opt/tectia/etc/ssh-tectia/auxdata/ssh-broker-ng/ssh-broker-config-default.xml`

- the global configuration: `/opt/tectia/etc/ssh-broker-config.xml`
- the user-specific configuration: `$HOME/.ssh2/ssh-broker-config.xml`
- the XML DTD:

  `/opt/tectia/etc/ssh-tectia/auxdata/ssh-broker-ng/ssh-broker-ng-config-1.dtd`

The following sections describe the options available in the Connection Broker configuration file. For more information on the syntax of the configuration file, see Section A.3.

SOCKS Proxy Files

The SOCKS Proxy also reads three configuration files (if all are available). The files are read in the same order as with the Connection Broker. See the section called "Connection Broker Files" above.

On z/OS, the default configuration file locations are as follows:

- the default configuration:

  `/opt/tectia/etc/ssh-tectia/auxdata/ssh-broker-ng/ssh-socks-proxy-config-default.xml`

- the global configuration: `/opt/tectia/etc/ssh-socks-proxy-config.xml`
- the user-specific configuration: `$HOME/.ssh2/ssh-socks-proxy-config.xml`
- the XML DTD:

  `/opt/tectia/etc/ssh-tectia/auxdata/ssh-broker-ng/ssh-broker-ng-config-1.dtd`

Note

We recommend you to use either the global or the user-specific configuration file, but not both. If the user-specific configuration file is to be used, please remove the global configuration file. This is to ensure that no settings in the user-specific configuration file will be unexpectedly overridden by settings in the global configuration file.

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The information in the following sections on the options of the Connection Broker configuration file is also valid for the options of the SOCKS Proxy configuration file. For more information on the syntax of the configuration file, see Section A.3.

Environment Variables

Two kinds of environment variables can be used in the Connection Broker configuration file. In addition to the system-level environment variables, you can use special variables that are Tectia specific. The environment variables take precedence over the special variables. So if an environment variable and a special variable have the same name, the environment variable will be used.

All alphanumeric characters and the underscore '`_`' sign are allowed in environment variables. The variable name ends to the first character that is not allowed.

You can define for example file or directory paths with environment variables, and they will be expanded to their values as explained below.

%VARIABLENAME%
: Replaced with the value of the environment variable if one has been defined. The variable is matched case-insensitively. If the variable is not defined, the string '`%VARIABLENAME%`' is the result.

$VARIABLENAME
: Replaced with the value of the environment variable if one has been defined. The variable is matched case-sensitively on Unix and case-insensitively on Windows. If the variable is not defined, it is replaced with an empty string.

${VARIABLENAME}*text*
: Replaced with the value defined for '`$VARIABLENAME`' with the '*`text`*' appended to it.

${VARIABLENAME:-*default_value*}
: Replaced with the value defined for '`$VARIABLENAME`', or replaced with the '*`default_value`*' if the variable is not set.

The Tectia specific special variables are:

%U or %username%
: Replaced with the currently logged in user name.

%username-without-domain%
: Replaced with the currently logged in user name in short format, i.e. without the domain part. Available on Windows.

%G or %groupname%
: Replaced with the group name of the currently logged in user.

%D or %homedir%
: Replaced with the home directory defined for the currently logged in user.

%IU or %userid%
: Replaced with the user identifier defined for the currently logged in user.

%IG or %groupid%
: Replaced with the group identifier defined for the currently logged in user.

The special variables can also be entered using the Unix format, for example, `$username`.

Document Type Declaration and the Root Element

The Connection Broker configuration file is a valid XML file and starts with the Document Type Declaration.

The root element in the configuration file is `secsh-broker`. It can include `general`, `default-settings`, `profiles`, `static-tunnels`, `gui`, `filter-engine`, and `logging` elements.

An example of an empty configuration file is shown below:

```
<!DOCTYPE secsh-broker SYSTEM "ssh-broker-ng-config-1.dtd">
<secsh-broker version="1.0">
  <general />
  <default-settings />
  <profiles />
  <static-tunnels />
  <gui />
  <filter-engine />
  <logging />

</secsh-broker>
```

The `general` Element

The `general` element contains settings such as the cryptographic library and the key stores to be used.

The `general` element can contain zero or one instance of the following elements: `crypto-lib`, `cert-validation`, `key-stores`, `user-config-directory`, `protocol-parameters`; and multiple `known-hosts` elements.

crypto-lib

This element selects the cryptographic library mode to be used. Either the standard version (`standard`) or the FIPS 140-2 certified version (`fips`) of the cryptographic library can be used. The library name is given as a value of the `mode` attribute. By default, standard cryptographic libraries are used. The OpenSSL cryptographic library is used in the *FIPS mode*.

```
<crypto-lib mode="standard" />
```

Note

The FIPS library is not available on z/OS.

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For a list of platforms on which the FIPS library has been validated or tested, see *Tectia Client/Server Product Description*.

cert-validation

This element defines public-key infrastructure (PKI) settings used for validating remote server authentication certificates. The element can have the following attributes: `end-point-identity-check`, `default-domain`, `http-proxy-url`, `socks-server-url` and `max-path-length`.

The `end-point-identity-check` attribute specifies whether the client will verify the server's host name or IP address against the Subject Name or Subject Alternative Name (DNS Address) specified in the server host certificate. The default value is `yes`. If set to `no`, the fields in the server host certificate are *not* verified and the certificate is accepted based on the validity period and CRL check only.

Caution

Setting `end-point-identity-check="no"` is a security risk. Then anyone with a certificate issued by the same trusted certification authority (CA) that issues the server host certificates can perform a man-in-the-middle attack on the server.

Alternatively, if set to `ask`, the user can decide to either cancel or continue establishing the connection in case that the server's host name does not match the one in the certificate.

The `default-domain` attribute can be used when the end-point identity check is enabled. It specifies the default domain part of the remote system name and it is used if only the base part of the system name is available. The `default-domain` is appended to the system name if it does not contain a dot (`.`).

If the default domain is not specified, the end-point identity check fails, for example, when a user tries to connect to a host `"rock"` giving only the short host name and the certificate contains the full DNS address `"rock.example.com"`.

The `http-proxy-url` attribute defines an HTTP proxy and the `socks-server-url` attribute defines a SOCKS server for making LDAP or OCSP queries for certificate validity.

The address of the server is given as the value of the attribute. The format of the address is `socks://username@socks_server:port/network/netmask,network/netmask ...` (with a SOCKS server) or `http://username@proxy_server:port/network/netmask,network/netmask ...` (with an HTTP proxy).

For example, to make the SOCKS server use host `socks.ssh.com` and port `1080` for connections outside of networks `192.196.0.0` (16-bit domain) and `10.100.23.0` (8-bit domain), and to get these networks connected directly, set `socks-server-url` as follows:

```
"socks://mylogin@socks.ssh.com:1080/192.196.0.0/16,10.100.23.0/24"
```

The `max-path-length` attribute limits the length of the certification paths when validating certificates. It can be used to safeguard the paths or to optimize against the paths getting too long in a deeply hierarch-

ical PKI or when the PKI is heavily cross-certified with other PKIs. Using the attributes requires knowing the upper limit of the paths used in certificate validation. For example:

```
<cert-validation max-path-length="6">
  <ldap-server address="ldap://myldap.com" port="389" />
  <dod-pki enable="yes" />
  <ca-certificate name="CA 1" file="ca-certificate1.crt" />
</cert-validation>
```

In the example, the path is limited to six certificates, including the end-entity and root CA certificates. If not specified, the default value is 10. Decrease the value to optimize the validation if the maximum length of the encountered paths in the certificate validation is known.

The `cert-validation` element can contain multiple `ldap-server`, `ocsp-responder`, `crl-prefetch` elements, one `dod-pki` element, and multiple `ca-certificate` and `key-store` elements. The elements have to be in the listed order.

ldap-server

This element specifies an LDAP server `address` and `port` used for fetching CRLs and/or subordinate CA certificates based on the issuer name of the certificate being validated. Several LDAP servers can be specified by using several `ldap-server` elements.

CRLs are automatically retrieved from the CRL distribution point defined in the certificate to be verified if the point exists.

The default value for `port` is `389`.

ocsp-responder

This element specifies an OCSP (Online Certificate Status Protocol) responder service address in URL format with attribute `url`. Several OCSP responders can be specified by using several `ocsp-responder` elements.

If the certificate has a valid Authority Info Access extension with an OCSP Responder URL, it will be used instead of this setting. Note that for the OCSP validation to succeed, both the end-entity certificate and the OCSP Responder certificate must be issued by the same CA.

The `validity-period` (in seconds) can be optionally defined. During this time, new OCSP queries for the same certificate are not made but the old result is used. The default validity period is `0` (a new query is made every time).

crl-prefetch

This element instructs Tectia client tools for z/OS to periodically download a CRL from the specified URL. The `url` value can be an LDAP or HTTP URL, or it can refer to a local file. The file format must be either binary DER or base64, PEM is not supported.

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To download CRLs from the local file system, define the file URL in this format:

```
file:///absolute/path/name
```

To download CRLs from an LDAP server, define the LDAP URL in this format:

```
ldap://ldap.server.com:389/CN=Root%20CA,
       OU=certification%20authorities,DC=company,
       DC=com?certificaterevocationlist
```

Use the `interval` attribute to specify how often the CRL is downloaded. The default is `3600` seconds.

dod-pki

This element defines whether the certificates are required to be compliant with the US Department of Defense Public-Key Infrastructure (DoD PKI). In practice, this means that the Digital Signature bit must be set in the Key Usage of the certificate. The `enable` attribute can have a value of `yes` or `no`. The default is `no`.

ca-certificate

This element defines a certification authority (CA) used in server authentication. It can have four attributes: `name`, `file`, `disable-crls`, and `use-expired-crls`.

The `name` attribute must contain the name of the CA.

The element must either contain the path to the X.509 CA certificate file as a value of the `file` attribute, or include the certificate as a base64-encoded ASCII block.

CRL checking can be disabled by setting the `disable-crls` attribute to `yes`. The default is `no`.

Expired CRLs can be used by setting a numeric value (in seconds) for the `use-expired-crls` attribute. The default is `0` (do not use expired CRLs).

key-store

This element defines CA certificates stored in an external key store for server authentication. Currently it is used only on z/OS for CA certificates stored in System Authorization Facility (SAF).

The `cert-validation/key-store` element has four attributes: `type`, `init`, `disable-crls`, and `use-expired-crls`.

The `type` attribute defines the key store type. Currently the only supported type is `"zos-saf"`.

The `init` attribute is the key-store-provider-specific initialization info.

CRL checking can be disabled by setting the `disable-crls` attribute to `yes`. The default is `no`.

Expired CRLs can be used by setting a numeric value (in seconds) for the `use-expired-crls` attribute. The default is `0` (do not use expired CRLs).

For key store configuration examples, see the section called “Key Store Configuration Examples”.

An example of a certificate validation configuration is shown below:

```
<cert-validation  end-point-identity-check="yes"
                  default-domain="example.com"
                  http-proxy-url="http://proxy.example.com:8080">
  <ldap-server    address="ldap://ldap.example.com:389" />
  <ocsp-responder url="http://ocsp.example.com:8090"
                  validity-period="0" />
  <crl-prefetch   url="file:///full.path.to.crlfile"
                  interval="1800" />
  <dod-pki        enable="no" />
  <ca-certificate name="ssh_ca1"
                  file="ssh_ca1.crt"
                  disable-crls="no"
                  use-expired-crls="100" />
</cert-validation>
```

key-stores

This element defines settings for user public-key and certificate authentication.

Under the `<general>` element, there can be one `<key-stores>` instance which in turn can have any number of `<key-store>`, `<user-keys>`, and `<identification>` elements, and the order of the elements is free.

Special variables and environment variables can be used when defining the values for the elements. The following variables can be used and they will be expanded as follows:

- `%U` = `%USERNAME%` = user name
- `%USERNAME-WITHOUT-DOMAIN%` = user name without the domain part
- `%IU` = `%USERID%` = user ID
- `%IG` = `%GROUPID%` = user group ID
- `%D` = `%HOMEDIR%` = the user's home directory
- `%G` = `%GROUPNAME%` = the name of the user's default group

Also environment variables are replaced with their current values. For example it is possible to use strings `$HOME` or `%HOME%` to expand to user's home directory (if environment variable `HOME` is set).

Note

Short alias names (for example, `%U`) are case-sensitive and long alias names (for example, `%USERNAME%`) are case-insensitive.

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key-store

Each of the `key-store` elements configures one key store provider. The `key-stores/key-store` element can take the following attributes: `type` and `init`.

The `type` attribute is the key store type. The currently supported types are , , `"software"`, and `"zos-saf"`.

The `init` attribute is the initialization info specific to the key-store-provider. The initialization string can contain special strings explained above in **key-stores**.

For key store configuration examples, see the section called "Key Store Configuration Examples".

user-keys

The `user-keys` element can be used to override the default directory for the user keys. The `user-keys` element can take the following attributes:

The `directory` attribute defines the directory where the user private keys are stored. Enter the full path.

The `passphrase-timeout` attribute defines the time (in seconds) after which the passphrase-protected private key will time out, and the user must enter the passphrase again. The default is `0`, meaning that the passphrase does not time out. The value of this element should be longer than the `passphrase-idle-timeout` value.

By default, the Connection Broker keeps the passphrase-protected private keys open once the user has entered the passphrase successfully. This can be changed with the passphrase timeout options. When `passphrase-timeout` is set, the private key stays open (usable without further passphrase prompts) until the timeout expires. The `passphrase-timeout` attribute sets the hard timeout, that is set only once when the key is opened and will not be reset even if the key is used multiple times.

The `passphrase-idle-timeout` attribute defines the time (in seconds) after which the passphrase-protected private key will time out unless the user accesses or uses the key. The `passphrase-idle-timeout` is reset every time the key is accessed. The default is `0`, meaning that the passphrase never times out.

Both of the timeout options can be set simultaneously, but notice that if the idle timeout is set longer than the hard timeout, the idle timeout has no effect.

identification

The `identification` element can be used to override the default location of the identification file that defines the user keys. The `identification` element can take the following attributes:

The `file` attribute specifies the location of the identification file. Enter the full path.

The `base-path` attribute defines the directory where the identification file expects the user private keys to be stored. This element can be used to override the default relative path interpretation of the identification file (paths relative to the identification file directory).

The `passphrase-timeout` attribute defines the time (in seconds) after which the user must enter the passphrase again. The default is `0`, meaning that the passphrase is not re-requested.

The `passphrase-idle-timeout` attribute defines a time (in seconds) after which the passphrase times out if there are no user actions. The default is `0`, meaning that the passphrase does not time out.

The timeout settings affect only those private keys that are listed in the identification file.

strict-host-key-checking

Note

This element is deprecated starting from Tectia client tools for z/OS version 6.1.4.

This element is supported in configuration for backwards compatibility and used only if the `policy` attribute of the `server-authentication-methods/auth-server-publickey` element under `default-settings` or `profiles/profile` is not defined. In this case, the host key policy is interpreted based on the values of this option and the `host-key-always-ask` and `accept-unknown-host-keys` options. See **auth-server-publickey** for details.

host-key-always-ask

Note

This element is deprecated starting from Tectia client tools for z/OS version 6.1.4.

This element is supported in configuration for backwards compatibility and used only if the `policy` attribute of the `server-authentication-methods/auth-server-publickey` element under `default-settings` or `profiles/profile` is not defined. In this case, the host key policy is interpreted based on the values of this option and the `strict-host-key-checking` and `accept-unknown-host-keys` options. See **auth-server-publickey** for details.

accept-unknown-host-keys

Note

This element is deprecated starting from Tectia client tools for z/OS version 6.1.4.

This element is supported in configuration for backwards compatibility and used only if the `policy` attribute of the `server-authentication-methods/auth-server-publickey` element under `default-settings` or `profiles/profile` is not defined. In this case, the host key policy is interpreted based on

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the values of this option and the `strict-host-key-checking` and `host-key-always-ask` options. See **auth-server-publickey** for details.

Caution

Consider carefully before enabling this option. Disabling the host-key checks makes you vulnerable to man-in-the-middle attacks.

user-config-directory

This element can be used to change the storage location of the user-specific configuration files away from the default which is `$HOME/.ssh2/` on Unix, and "`%APPDATA%\SSH`" on Windows. It can be used for example, if you want to store all client-side configurations to a centralized location.

When this element is added to the global configuration file, the Connection Broker reads the following user-specific files in the defined location:

- User's key file
- User's own configuration files
- User's known host keys
- User's random_seed file
- Windows GUI profile files: `1.ssh2, 2.ssh2`
- The startup batch file for the **sftpg3** client: `ssh_sftp_batch_file`

Note

Stop all existing SSH applications before modifying the `user-config-directory` setting in the Connection Broker configuration.

The `user-config-directory` setting affects all Tectia products running on the same host.

The `user-config-directory` option takes an attribute `path`, whose value can be either a directory path or one of the following variables:

- `%U`: The user name.
- `%username%`: The user name.
- `%username-without-domain%`: The user name without domain definition.
- `%D`: The user's home directory.
- `%homedir%`: The user's home directory.

- `%USER_CONFIG_DIRECTORY%`: The user-specific configuration directory.
- `%IU`: The user's ID, on Unix only
- `%userid%`: The user's ID, on Unix only
- `%IG`: The group ID, on Unix only
- `%groupid%`: The group ID, on Unix only

The default is `%USER_CONFIG_DIRECTORY%`. This variable refers to the user-specific configuration directory: `$HOME/.ssh2` on Unix, and `%APPDATA%\SSH` on Windows. The `%USER_CONFIG_DIRECTORY%` variable cannot be used in other settings.

file-access-control

On Unix, this element can be used to enable checking of file access permissions defined for the global and user-specific configuration files, and for the private keys files. If the permissions are not as expected, the Connection Broker will refuse to start, or to use certain private keys.

By default this setting is disabled. On Windows, this element has no effect.

The file permissions are checked differently, if the `file-access-control` element is set in both the global and user configuration files, or just in one of them.

In the table: `"no"` means `file-access-control enable="no"`. The `"-"` sign means that the setting is not defined in the file at all.

When the file access permissions are checked, the controls are applied as follows:

- Expected permissions for the global configuration file: read rights for all, write rights only for the user and group. If the permissions are any wider, the Connection Broker will not start.
- Expected permissions for the user configuration file: only the user has read and write rights. If the permissions are any wider, the Connection Broker will not start.
- Expected permissions for the private key files: only the user has read and write rights. If the permissions are any wider, keys that do not pass the check will be ignored.

protocol-parameters

This element contains protocol-specific values that can be used to tune the performance. It should be used only in very specific environments. In normal situations the default values should be used.

The `threads` attribute can be used to define the number of threads the protocol library uses (fast path dispatcher threads). This attribute can be used to allow more concurrent cryptographic transforms in the protocol on systems with more than four CPUs. If the value is set to zero, the default value is used.

Example of the `threads` attribute:

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```
<protocol-parameters threads="8" />
```

known-hosts

This element can be used to specify locations for storing the host keys of known server hosts, and to define the storage format of the host key files. If no `known-hosts` directories are specified, the known host keys are stored to the default directories. See the section called "Files" for the default locations. On z/OS (only), this element can contain `key-store` elements.

This element can be used:

- To specify non-default directories that contain the public-key data or public-key files of known server hosts.
- To specify a non-default location for OpenSSH-style known_hosts files that contain the public-key data of known server hosts.
- (*On z/OS*) To specify a SAF key store that contains the certificates of known server hosts.

The server host keys are searched in the `known-hosts` paths in the order they are specified in the configuration. The settings of the last defined `known-hosts` element are used when storing new host keys.

If you define any `known-hosts` file settings, the default OpenSSH files will be overridden. So if you wish to make the Connection Broker use both the default OpenSSH locations and other locations specified in the configuration, you need to specify all the locations separately.

You can define several `known-hosts` elements, and each of them can contain one or several attributes: `path`, `directory`, `file` and `filename-format`.

The `path` attribute requires a full path to the known-hosts file or directory as the value. For example:

```
<known-hosts path="/u/username/.ssh/known_hosts" />
<known-hosts path="/etc/ssh2/hostkeys" />
<known-hosts path="/u/username/.ssh2/hostkeys" />
<known-hosts path="/h/username/hostkeys" filename-format="plain" />
```

The `directory` attribute is used to define that known host keys are saved to a non-default directory. Enter the complete path to the directory as the value. If the defined directory does not exist, it will be created during the first connection attempt. If a file is found in its place, the connection will be made but the host key will not be stored, and the user gets a warning about it. The `filename-format` attribute can be used together with the `directory` setting to define in which format the host key files will be stored. Example of the `directory` attribute:

```
<known-hosts directory="<path_to_dir>/MyKEYS"
             filename-format="plain" />
```

The `path` or `directory` (whichever is present) defined in the last `known-hosts` element in the configuration file will be used when storing new known host keys. If both attributes are present in the last `known-hosts` element, the location specified in the `directory` attribute will be used.

The `file` attribute is used to point to an OpenSSH-style known_hosts file. Enter the complete path to the file as the value. If a directory is found in its place, it is considered an error, and the connection attempt will fail. In case the `known-hosts` element only contains the `file` attribute, and the defined OpenSSH known_hosts file exists, the received host keys are searched first in the defined file, and if not found there, the search continues in the default Tectia-specific locations.

Example of the `file` attribute:

```
<known-hosts file="<path_to_file>/.ssh2/openSSH_keys" />
```

An empty `file` or `path` attribute will disable the handling of the OpenSSH known_hosts file:

```
<known-hosts file="" />
or
<known-hosts path="" />
```

The `filename-format` attribute defines the format in which new host key files are stored. The `filename-format` attribute is only relevant for the last specified `known-hosts` element and for the default directory.

The `filename-format` attribute takes the values: `hash` (default), `plain`, and `default` (equals to hash).

With value `hash`, the host key files will be stored in format: `keys_<hash>`, for example `"keys_182166d2efe5a134d3fb948646e0b48f780bff6c"`.

With value `plain`, the file name format will be `key_<port>_<hostname>.pub`, where `<port>` is the port the Secure Shell server is running on and `<hostname>` is the host name you use when connecting to the server; for example `"key_22_my.example.com.pub"`.

Setting `<known-hosts filename-format="plain" />` changes the storage format of host key files for the next `known-hosts` elements or for the default storage location if no other `known-hosts` elements are present.

The `filename-format="default"` alternative can be used as the last option when the same `known-hosts` element is used to define several locations for the host keys some of which store the keys in plain format.

For more information on the host key storage formats, see Section 4.2.1.

key-store

This element defines an external key store for certificates of known server hosts. Currently it is used only on z/OS for server certificates stored in System Authorization Facility (SAF).

The `known-hosts/key-store` element has two attributes: `type` and `init`.

The `type` attribute defines the key store type. Currently the only supported type is `"zos-saf"`.

The `init` attribute is the key-store-provider-specific initialization info.

For key store configuration examples, see the section called “Key Store Configuration Examples”.

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extended

This element is reserved for future use.

Key Store Configuration Examples

Example with Software Provider

The software provider handles key pairs stored on disk in standard Secure Shell v2 or legacy OpenSSH formats and X.509 certificates stored in native X.509, PKCS #7, and PKCS #12 formats.

To add a single key file (for example, `/u/exa/keys/enigma` and `/etc/my_key`), specify both the private key file and the public key file:

```
<key-stores>
  <key-store type="software"
             init="key_files(/u/exa/keys/enigma.pub,/u/exa/keys/enigma)" />
  <key-store type="software"
             init="key_files(/etc/my_key.pub,/etc/my_key)" />
</key-stores>
```

To add all keys from a specific directory (for example all keys from `/u/exa/keys` and `/etc/keys`):

```
<key-stores>
  <key-store type="software"
             init="directory(path(/u/exa/keys))" />
  <key-store type="software"
             init="directory(path(/etc/keys))" />
</key-stores>
```

To add all keys from .ssh2 directory in user home directory and all private key objects in ICSF PKCS11 token:

```
<key-stores>
  <user-keys directory="pkcs11:ssz.$username.ssh2" poll-interval="0"/>
  <user-keys directory="$homedir/.ssh2" poll-interval="0"/>
</key-stores>
```

Example with z/OS SAF Provider

The `zos-saf` provider is used for accessing keys stored in the IBM z/OS System Authorization Facility (SAF).

The initialization string for the `zos-saf` provider specifies the key(s) to be used and it has the following components:

```
{KEYS([ID(xxx)]RING(xxx) [LABEL(xxx)|DEFAULT])}... [TRUST-ANCHORS]
```

`KEYS(..)` may repeat. The subattributes are:

`ID`

A SAF user ID signifying the owner of the key ring. If missing, the current user's ID is used.

`RING`
: Key ring name. Mandatory.

`LABEL`
: The SAF key label. If missing, and `DEFAULT` is missing, use all the keys in the key ring.

`DEFAULT`
: Use the key that is marked as the default key on the key ring. Do not specify together with `LABEL`.

`TRUST-ANCHORS`
: Specifies that the certificates in the key ring are trusted CA certificates.

Specifying CA certificates stored in SAF as trusted for server authentication:

```
<cert-validation>
...
  <key-store type="zos-saf"
             init="KEYS(ID(SSHD2) RING(SSH-HOSTCA)) TRUST-ANCHORS"
             disable-crls="no"
             use-expired-crls="100" />
</cert-validation>
```

Specifying server certificates stored in SAF for server authentication:

```
<known-hosts>
...
  <key-store type="zos-saf"
             init="KEYS(ID(USER) RING(SSH-HOSTKEYS))" />
</known-hosts>
```

Specifying user certificates stored in SAF for user authentication:

```
<key-stores>
 <key-store type="zos-saf"
            init="KEYS(ID(%U) RING(%U))" />
</key-stores>
```

The `default-settings` Element

The `default-settings` element defines the default connection-related settings. Profile-specific settings can override these settings. See the section called “The `profiles` Element”.

The `default-settings` element can contain zero or one instance of the following elements in the listed order: `ciphers`, `macs`, `kexs`, `hostkey-algorithms`, `rekey`, `authentication-methods`, `compression`, `proxy`, `idle-timeout`, `tcp-connect-timeout`, `keepalive-interval`, `exclusive-connection`, `server-banners`, `forwards`, `extended`, `remote-environment`, `server-authentication-methods`, `authentication-success-message`, `sftpg3-mode`, `display-connection-summary`, `terminal-selection`, `terminal-bell`, `close-window-on-disconnect`, `quiet-mode`, `checksum`, and `address-family`.

The **default-settings** element can take one attribute:

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The `user` attribute can be used to define a default user name to be used when connecting to remote servers. The value of the `user` attribute can be one of the following:

- A generic user name that will be used in connections unless another user name is specified in the connection profile settings or in the connection attempt. Note that the user name is treated case sensitively.
- "`%USERNAME%`" can be used to apply the user name of the currently logged in user.
- In case this option is used but left empty, the Connection Broker will prompt the user for a user name.

The **default-settings** element can contain the following elements:

ciphers

This element defines the ciphers that the client will propose to the server. The `ciphers` element can contain multiple `cipher` elements.

The ciphers are tried in the order they are specified.

cipher

This element selects a cipher `name` that the client requests for data encryption.

The supported ciphers are:

`3des-cbc`	`aes256-cbc`	`aes256-ctr`
`aes128-cbc`	`aes128-ctr`	`aes128-gcm@openssh.com`
`aes192-cbc`	`aes192-ctr`	`aes256-gcm@openssh.com`

The default ciphers used by the Connection Broker are, in order: `aes128-cbc`, `aes128-ctr`, `aes128-gcm@openssh.com`, `aes192-cbc`, `aes192-ctr`, `aes256-cbc`, `aes256-ctr`, `aes256-gcm@openssh.com`, and `3des-cbc`.

```
<ciphers>
  <cipher name="aes128-cbc" />
  <cipher name="3des-cbc" />
</ciphers>
```

macs

This element defines the MACs that the client will propose to the server. The `macs` element can contain multiple `mac` elements.

The MACs are tried in the order they are specified.

mac

This element selects a MAC `name` that the client requests for data integrity verification.

The supported MAC algorithms are:

```
hmac-sha1
hmac-sha1-96
hmac-sha2-256
hmac-sha256-2@ssh.com
hmac-sha224@ssh.com
hmac-sha256@ssh.com
hmac-sha384@ssh.com
hmac-sha2-512
hmac-sha512@ssh.com
```

The default MACs used by the Connection Broker are, in order:

```
hmac-sha1
hmac-sha1-96
hmac-sha2-256
hmac-sha256-2@ssh.com
hmac-sha224@ssh.com
hmac-sha256@ssh.com
hmac-sha384@ssh.com
hmac-sha2-512
hmac-sha512@ssh.com
```

```
<macs>
  <mac name="hmac-sha1" />
</macs>
```

kexs

This element defines the key exchange methods (KEXs) that the client will propose to the server. The `kexs` element can contain multiple `kex` elements.

The KEXs are tried in the order they are specified.

kex

This element selects a KEX `name` that the client requests for the key exchange method.

The supported KEX methods are:

```
diffie-hellman-group1-sha1
diffie-hellman-group14-sha1
diffie-hellman-group14-sha256
diffie-hellman-group16-sha512
diffie-hellman-group18-sha512
diffie-hellman-group14-sha224@ssh.com
diffie-hellman-group14-sha256@ssh.com
diffie-hellman-group15-sha256@ssh.com
diffie-hellman-group15-sha384@ssh.com
diffie-hellman-group16-sha384@ssh.com
diffie-hellman-group16-sha512@ssh.com
diffie-hellman-group18-sha512@ssh.com
```

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```
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
ecdh-nistp521-kyber1024-sha512@ssh.com
curve25519-frodokem1344-sha512@ssh.com
sntrup761x25519-sha512@openssh.com
mlkem768nistp256-sha256
mlkem1024nistp384-sha384
mlkem768x25519-sha256
```

The default KEX methods used by the Connection Broker are, in order:

```
ecdh-sha2-nistp521
ecdh-sha2-nistp384
ecdh-sha2-nistp256
diffie-hellman-group-exchange-sha256
diffie-hellman-group14-sha1
diffie-hellman-group14-sha256
diffie-hellman-group14-sha256@ssh.com
diffie-hellman-group16-sha512
diffie-hellman-group18-sha512
curve25519-sha256
curve25519-sha256@libssh.org
ecdh-nistp521-kyber1024-sha512@ssh.com
curve25519-frodokem1344-sha512@ssh.com
sntrup761x25519-sha512@openssh.com
mlkem768nistp256-sha256
mlkem1024nistp384-sha384
mlkem768x25519-sha256
```

```
<kexs>
   <kex name="diffie-hellman-group14-sha256@ssh.com" />
   <kex name="ecdh-sha2-nistp256" />
</kexs>
```

hostkey-algorithms

This element defines the host key signature algorithms used for server authentication. The algorithms that will be used are those that are defined in both Tectia Server and Connection Broker configuration files. This way the use of only certain algorithms, such as SHA-2, can be enforced by the server. The `hostkey-algorithms` element can contain multiple `hostkey-algorithm` elements.

The hostkey algorithms are tried in the order they are specified. Exception: If a host key of a server already exists in the host key store of the client, its algorithm is preferred.

hostkey-algorithm

This element selects a host key signature algorithm `name` to be used in server authentication with host keys or certificates.

The supported host key signature algorithms are:

```
rsa-sha2-256
rsa-sha2-512
ssh-dss
ssh-dss-sha224@ssh.com
ssh-dss-sha256@ssh.com
ssh-dss-sha384@ssh.com
ssh-dss-sha512@ssh.com
ssh-rsa
ssh-rsa-sha224@ssh.com
ssh-rsa-sha256@ssh.com
ssh-rsa-sha384@ssh.com
ssh-rsa-sha512@ssh.com
ecdsa-sha2-nistp256
ecdsa-sha2-nistp384
ecdsa-sha2-nistp521
x509v3-sign-dss
x509v3-sign-dss-sha224@ssh.com
x509v3-sign-dss-sha256@ssh.com
x509v3-sign-dss-sha384@ssh.com
x509v3-sign-dss-sha512@ssh.com
x509v3-sign-rsa
x509v3-sign-rsa-sha224@ssh.com
x509v3-sign-rsa-sha256@ssh.com
x509v3-sign-rsa-sha384@ssh.com
x509v3-sign-rsa-sha512@ssh.com
x509v3-ecdsa-sha2-nistp256
x509v3-ecdsa-sha2-nistp384
x509v3-ecdsa-sha2-nistp521
```

The default host key signature algorithms used by the Connection Broker are, in order:

```
x509v3-ecdsa-sha2-nistp521
x509v3-ecdsa-sha2-nistp384
x509v3-ecdsa-sha2-nistp256
ecdsa-sha2-nistp521
ecdsa-sha2-nistp384
ecdsa-sha2-nistp256
rsa-sha2-256
rsa-sha2-512
ssh-dss
ssh-rsa
ssh-dss-sha256@ssh.com
ssh-rsa-sha256@ssh.com
x509v3-sign-dss
x509v3-sign-rsa
x509v3-sign-dss-sha256@ssh.com
x509v3-sign-rsa-sha256@ssh.com
```

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```
<hostkey-algorithms>
   <hostkey-algorithm name="ssh-dss-sha512@ssh.com" />
   <hostkey-algorithm name="ssh-rsa-sha224@ssh.com" />
</hostkey-algorithms>
```

rekey

This element specifies the number of transferred `bytes` after which the key exchange is done again. The value `"0"` turns rekey requests off. This does not prevent the server from requesting rekeys, however. The default is 1000000000 (1 GB).

```
<rekey bytes="1000000000" />
```

authentication-methods

This element specifies the authentication methods that are requested by the client-side components. The `authentication-methods` element can contain one of each: `auth-password`, `auth-publickey`, and `auth-keyboard-interactive`. Alternatively, you can specify multiple `authentication-method` elements. The order of these elements is free.

The authentication methods are tried in the order the `auth-*` or `authentication-method` elements are listed. This means that the least interactive methods should be placed first.

When several interactive authentication methods are defined as allowed, Tectia client tools for z/OS will alternate between the methods and offers each of them in turn to the server in case the previous method failed.

authentication-method

This element specifies an authentication method `name`. It is included for backwards compatibility. Use the `auth-*` elements instead.

auth-password

This element specifies that password authentication will be used.

auth-publickey

This element specifies that public-key authentication will be used.

The `auth-publickey` element can include a `key-selection` element.

The `auth-publickey` element can include a `signature-algorithms` attribute. The attribute defines the public-key signature algorithms used for client authentication, given as a comma-separated list. The algorithms that will be used are those that are defined in Connection Broker configuration file. This way the use of only certain algorithms, such as SHA-2, can be enforced.

signature-algorithms

This element selects a public key signature algorithm `signature-algorithms` to be used in user authentication.

The supported public key signature algorithms are:

`ssh-dss`	`x509v3-sign-dss-sha256@ssh.com`
`ssh-dss-sha256@ssh.com`	`x509v3-sign-rsa`
`ssh-rsa`	`x509v3-sign-rsa-sha256@ssh.com`
`ssh-rsa-sha256@ssh.com`	`ecdsa-sha2-nistp256`
`rsa-sha2-256`	`ecdsa-sha2-nistp384`
`rsa-sha2-512`	`ecdsa-sha2-nistp521`
`x509v3-sign-dss`	`ssh-ed25519`

```
<authentication-methods>
  <auth-publickey signature-algorithms="ssh-dss,ssh-dss-sha512@ssh.com"/>
</authentication-methods>
```

key-selection

This element specifies the key selection policy the client uses when proposing user public keys to the server. The `policy` attribute can take the values `automatic` (default) and `interactive-shy`.

In the `automatic` mode, the client tries keys in the following order:

1. Keys with public key available and private key without a passphrase (no user interaction)
2. Keys with public key available but private key behind a passphrase (one passphrase query)
3. Keys that need a passphrase to get the public key but private key without passphrase (one user query for each key which is considered and proposed to server, but no user interaction for actual public-key login)
4. The rest of the keys, that is, keys that need a passphrase to get the public key and also to get the private key

In the `interactive-shy` mode, the client does not try any keys automatically, but it prompts the user to select the key from a list of available keys. If the authentication with the selected key fails, the client will prompt the user again, removing the already tried key(s) from the list. If there is only one key candidate available, the key will be tried automatically without asking the user.

The `key-selection` element can include the `public-key` and `issuer-name` elements.

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public-key

This element can be used to specify that only plain public keys or only certificates are tried during public-key authentication. The `type` attribute can take the values `plain` and `certificate`. The default is to try both plain public keys and certificates.

issuer-name

This element can be used to filter the user certificates that will be included in the list presented to the user. The client-side user certificates can be filtered according to the issuer name that is compared to the certificate issuers requested or accepted by the server. The `match-server-certificate` attribute takes values `yes` and `no`. With value `yes`, Connection Broker tries matching the user certificate issuer name to the server certificate issuer name. Option `no` means that the issuer names are not used as a filter. By default, the filtering is not done.

The `issuer-name` is useful when a user has several certificates with different access rights to the same server, for example for a testing role and for an administrator role. The Connection Broker chooses the relevant certificates that are applicable on the remote host, and the user can choose the correct certificate from the short-listed ones.

auth-keyboard-interactive

This element specifies that keyboard-interactive methods will be used in authentication.

An example of authentication-methods configuration is shown below:

```
<authentication-methods>
  <auth-publickey>
    <key-selection policy="interactive-shy">
      <public-key type="plain" />
    </key-selection>
  </auth-publickey>
  <auth-keyboard-interactive />
  <auth-password>
    <password file="/path/filename" />
  </auth-password>
</authentication-methods>
```

compression

This element specifies whether the client sends the data compressed (PUT operation). When activated, compression is applied on-the-fly to all data sent out through the connection and on all channels in it.

The name of the compression algorithm and the compression level can be given as attributes. The `name` attribute can be defined as `none` (compression not used) or `zlib`, which utilizes z/OS zEDC zlib provided by IBM, and is currently the only supported algorithm. By default, compression is not used.

For zlib compression, the `level` attribute can be given an integer from `0` to `9`. The default compression level is `6`, when compression is activated but no level is given (or level is set to `0`).

Example: to activate maximum level compression of sent data, make the following setting:

```
<compression name="zlib" level="9" />
```

Compression can also be activated per connection with command line tools. For information, see the sshg3(1), sftpg3(1) and scpg3(1) man pages.

Note that this `compression` setting does not affect received data (GET operations), but their compression is defined on the Secure Shell server. Tectia Server always uses compression level 6.

proxy

This element defines rules for HTTP proxy or SOCKS servers the client will use for connections. It has a single attribute: `ruleset`.

The format of the attribute value is a sequence of rules delimited by semicolons (`;`). Each rule has a format that resembles the URL format. In a rule, the connection type is given first. The type can be `direct`, `socks`, `socks4`, `socks5`, or `http-connect` (`socks` is a synonym for `socks4`). This is followed by the server address and port. If the port is not given, the default ports are used: 1080 for SOCKS and 80 for HTTP.

After the address, zero or more conditions delimited by commas (`,`) are given. The conditions can specify IP addresses or DNS names.

```
direct:///[cond[,cond]...];
socks://server/[cond[,cond]...];
socks4://server/[cond[,cond]...];
socks5://server/[cond[,cond]...];
http-connect://server/[cond[,cond]...]
```

The IP address/port conditions have an address pattern and an optional port range:

```
ip_pattern[:port_range]
```

The `ip_pattern` may have one of the following forms:

- a single IP address `x.x.x.x`
- an IP address range of the form `x.x.x.x-y.y.y.y`
- an IP sub-network mask of the form `x.x.x.x/y`

The DNS name conditions consist of a host name which may be a regular expression containing the characters "*" and "?" and a port range:

```
name_pattern[:port_range]
```

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An example `proxy` element is shown below. It causes the server to access the loopback address and the `ssh.com` domain directly, access `*.example` with HTTP CONNECT, and all other destinations with SOCKS4.

```
<proxy ruleset="direct:///127.0.0.0/8,*.ssh.com;
                http-connect://http-proxy.ssh.com:8080/*.example;
                socks://fw.ssh.com:1080/" />
```

idle-timeout

This element specifies how long idle time (after all connection channels are closed) is allowed for a connection before automatically closing the connection. The `time` is given in seconds. The `type` is always `connection`.

The default setting is 5 seconds. Setting a longer time allows the connection to the server to remain open even after a session (for example, **sshg3**) is closed. During this time, a new session to the server can be initiated without re-authentication. Setting the time to 0 (zero) terminates the connection immediately when the last channel to the server is closed.

```
<idle-timeout time="5" />
```

tcp-connect-timeout

This element specifies a timeout for the TCP connection. When this setting is made, connection attempts to a Secure Shell server are stopped after the defined time if the remote host is down or unreachable. This timeout overrides the default system TCP timeout, and this timeout setting can be overridden by defining a `tcp-connect-timeout` setting per connection profile (in the `profiles` settings) or per connection (on command line).

The `time` is given in seconds. The factory default value is 0. Value 0 (zero) disables this feature and the default system TCP timeout will be used.

```
<tcp-connect-timeout time="0" />
```

keepalive-interval

This element specifies an interval for sending keepalive messages to the Secure Shell server. The `time` value is given in seconds. The default setting is 0, meaning that the keepalive messages are disabled.

```
<keepalive-interval time="0" />
```

exclusive-connection

In the Connection Broker configuration file, the `exclusive-connection` element can be used to specify that a new connection is opened for each new channel. This setting takes one attribute `enable`, with value `yes` or `no`. The default is `no`, meaning that open connections are reused for new channels requested by a client.

On z/OS, the SOCKS Proxy always uses the exclusive connection type, meaning it opens a new connection for each new channel. This element is not needed in the SOCKS Proxy configuration file, and irrespective of the value set by the user, the SOCKS Proxy always interprets this setting as: `exclusive-connection enable="yes"`.

server-banners

This element defines whether the server banner message file (if it exists) is visible to the user before login. The word `yes` or `no` is given as the value of the `visible` attribute. The default is `yes`.

To eliminate server banners:

```
<server-banners visible="no" />
```

forwards

This element contains `forward` elements that define whether X11 or agent forwarding (tunneling) are allowed on the client side.

Note

X11 forwarding is not available on z/OS.

forward

This element defines X11 or agent forwarding settings.

The `type` attribute defines the forwarding type (either `x11` or `agent`). The `state` attribute sets the forwarding `on`, `off`, or `denied`. If the forwarding is set as `denied`, the user cannot enable it on the command-line.

An example forward configuration, which denies X11 forwarding and allows agent forwarding globally, is shown below:

```
<forwards>
  <forward type="x11" state="denied" />
  <forward type="agent" state="on" />
</forwards>
```

extended

This element is reserved for future use.

remote-environment

This element contains `environment` elements which define the environment variables to be passed to the server from the client side. The environment variables are then set on the server when requesting a command, shell or subsystem.

Note that the server can restrict the setting of environment variables.

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environment

This element defines the name and value of the environment variables, and whether the Connection Broker should process the value. Possible attributes are `name`, `value`, and `format`.

An example remote environment configuration:

```
<remote-environment>
  <environment name="FOO" value="bar" />
  <environment name="QUX" value="%Ubaz" format="yes" />
  <environment name="ZAPPA" value="%Ubaz" />
</remote-environment>
```

You can use `%U` in the `value` to indicate a user name. When `format="yes"` is also defined, the Connection Broker processes the `%U` into the actual user name before sending it to the server.

Let's assume the user name is `joedoe` in this example. The example configuration results in the following environment variables on the server side, provided that the server allows setting the environment variables:

```
FOO=bar
QUX=joedoebaz
ZAPPA=%Ubaz
```

You can override the remote environment settings made in the configuration file if you use the **sshg3** command with the following arguments on the command-line client: `--remote-environment` or `--remote-environment-format`

For information on the command-line options, see sshg3(1).

server-authentication-methods

This `server-authentication-methods` element can be used to force the Connection Broker to use only certain methods in server authentication. This element can contain `auth-server-publickey` and `auth-server-certificate` elements (one of each). The order of these elements is free.

If only `auth-server-certificate` is specified, server certificate is needed. If no server certificate is received, connection fails.

If only `auth-server-publickey` is specified, (plain) server public key is needed. If no server public key is received, connection fails.

If both `auth-server-certificate` and `auth-server-publickey` are specified, server certificate is used if present. Otherwise server public key is used.

auth-server-certificate

The `auth-server-certificate` element specifies that certificates are used for server authentication.

auth-server-publickey

The `auth-server-publickey` element specifies that public host keys are used for server authentication.

Note

The host key policy settings have changed in version 6.1.4 and are now defined in the `auth-server-publickey` element.

The element takes attribute `policy` that defines how unknown server host keys are handled. It can have the following values:

- `strict`: Connect to the server only if the host key is found from the host key store and matches.

  If the policy is set to `strict`, the Connection Broker never adds host keys to the user's `.ssh2/hostkeys` directory upon connection, and refuses to connect to hosts whose key has changed. This provides maximum protection against man-in-the-middle attacks. However, it also means you must always obtain host keys via out-of-band means, which can be troublesome if you frequently connect to new hosts.

- `ask` (default): If the server host key is not found from the host key store, the user will be asked if he wants to accept the host key. If the host key has changed, the user is warned about it and asked how to proceed. If the client application is not able to ask the user (for example, **sftpg3** in batch mode, `-B`), the connection will be disconnected.

- `trust-on-first-use` or `tofu`: If the server host key is not found, it is stored to the user's `.ssh2/hostkeys` directory. If the host key has changed, the connection will be disconnected.

- `advisory`: Use of this setting effectively disables server authentication, which makes the connection vulnerable to active attackers.

  If the server host key is not found in the host key store, it will be added to the user's `.ssh2/hostkeys` directory without user interaction. If the host key has changed, the connection will be continued without user interaction. The incident will be audited if logging is enabled.

  When the policy is set to `advisory`, the keys from new hosts are automatically accepted and stored to the host key database without prompting acceptance from the user. However, changed host keys (from hosts whose keys are already in the database) are not stored, but they are accepted for that connection only.

  This setting should be used only if logging is enabled for the Connection Broker.

  ## Caution

  Consider carefully before setting the policy to `advisory`. Disabling the host-key checks makes you vulnerable to man-in-the-middle attacks.

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In policy modes other than `strict`, if logging is enabled for the Connection Broker, Tectia client tools for z/OS will log information about changed and new host public keys with their fingerprints in the syslog (on Unix) or Event Viewer (on Windows).

Note

When transparent FTP tunneling or FTP-SFTP conversion is used, accepting the host key cannot be prompted from the user. Either this setting must be set to `tofu` in the `ssh-socks-proxy-config.xml` file or the host keys of the Secure Shell tunneling and SFTP servers must be obtained beforehand and stored based on the IP addresses of the servers, for example, by using the **ssh-keydist-g3** key distribution tool. See Section 4.9.1.

If the `policy` attribute is not defined, the host key policy is interpreted based on the values of the old `strict-host-key-checking`, `host-key-always-ask`, and `accept-unknown-host-keys` options.

Note

In version 6.1.4 and later, the host key policy setting in the user-specific configuration file always takes precedence over the setting in the global configuration file.

authentication-method

The `server-authentication-methods/authentication-method` element specifies an authentication method `name`. This element is included for backwards compatibility. Use the `auth-server-*` elements instead.

```
<server-authentication-methods>
  <authentication-method name="publickey" />
  <authentication-method name="certificate" />
</server-authentication-methods>
```

An example `server-authentication-methods` element is shown below:

```
<server-authentication-methods>
  <auth-server-publickey policy="ask" />
  <auth-server-certificate />
</server-authentication-methods>
```

authentication-success-message

This setting defines whether the `AuthenticationSuccessMsg` messages are output. The `authentication-success-message` element takes attribute `enable` with value `yes` or `no`. The default is `yes`, meaning that the messages are output and logged.

sftpg3-mode

This setting defines how the **sftpg3** client behaves when transferring files. The `sftpg3-mode` element takes attribute `compatibility-mode` with the following values:

- `tectia` (the default) - **sftpg3** fransfers files recursively, meaning that files from the current directory and all its subdirectories are transferred.
- `ftp` - the **get/put** commands are executed as **sget/sput** meaning that they transfer a single file; and commands **mget/mput** have recursion depth set to 1 meaning that they only transfer files from the specified directory, not from subdirectories.
- `openssh` - commands **get/put/mget/mput** behave alike, and the recursion depth is set to 1, meaning that only files from the specified directory are transferred, not from subdirectories.

The recursion depth can be overridden by using the **sftpg3** client's commands **get/put/mget/mput** with command-line option `--max-depth="LEVEL"`. For more information, see sftpg3(1).

display-connection-summary

This setting defines if client programs (**sftpg3**, **scpg3**, or **sshg3**) display the connection summary of an established connection. It will force the client to display information relating to the connection, such as, connection destination, connection ID, session ID, selected authentication method, server version, and selected algorithms.

The `display-connection-summary` element can take two attributes `client-type` and `enable` with the following values:

The `enable` attribute takes the following values:

`yes|YES` - enables displaying the connection summary

`no|NO` - disables displaying the connection summary

The `client-type` attribute selects which client program displays or hides the connection summary.

The supported client-types are: `sftpg3`, `scpg3`, `sshg3`, and `all`.

The following is an example of how to enable/disable the connection summary for each client type:

```
<display-connection-summary client-type="sftpg3" enable="no"/>
<display-connection-summary client-type="scpg3" enable="yes"/>
<display-connection-summary client-type="sshg3" enable="yes"/>
```

The following shows how to enable the connection summary for all client types:

```
<display-connection-summary enable="yes"/>
or
<display-connection-summary client-type="all" enable="yes"/>
```

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The following shows how to disable the connection summary for all client types:

```
<display-connection-summary enable="no"/>
or
<display-connection-summary client-type="all" enable="no"/>
```

The `display-connection-summary` is disabled by default or can be overridden using **sftpg3** and **scpg3** with the command-line option `--display-conn-summary` (`-X`). For more information, see sftpg3(1) or scpg3(1).

Note

The `display-connection-summary` cannot be overridden with a command-line option using **sshg3**.

terminal-selection

This element defines how the Tectia terminal behaves when the user selects text with double-clicks. The element takes one attribute: `selection-type`, whose value can be:

`select-words` - double-clicking selects one word at a time, space and all punctuation characters are used as delimiters. This is the default.

`select-paths` - selects strings of characters between spaces, meaning a selection is extended over characters `\/.-_`, so that for example a path to a file can be selected by double-clicking anywhere in the path.

terminal-bell

This element defines whether Tectia terminal repeats audible notifications from the destination server. This option is only applied to connections with Unix servers. The element takes one attribute, `bell-style`, whose value can be:

`none` - no audible notifications are used

`pc-speaker` - the user's PC speakers beep when an audible notification is indicated by the destination server

`system-default` - the Tectia terminal sounds the default alerts defined in the system on the destination server. This is the default.

close-window-on-disconnect

This element defines that also the Tectia terminal window is to be closed while disconnecting from a server session by pressing **CTRL+D**. The element takes one attribute, `enable`, whose value can be `yes` or `no`. The default is `no` meaning that **CTRL+D** closes only the server connection but the Tectia terminal window remains open.

quiet-mode

This setting defines whether the command line clients should suppress warnings, error messages and authentication success messages. The `quiet-mode` element takes attribute `enable` with value `yes` or `no`. The default is `no`, meaning that the errors and messages are output and logged.

The `quiet-mode` element affects command line tools **scpg3**, **sshg3**, and **sftpg3**. Enabling the quiet mode here with setting `quiet-mode enable="yes"` is the same as running these clients with option `-q`. Note that the `-q` command line parameter will take priority over the `quiet-mode` element set in this configuration file.

checksum

The `checksum` element can be used to define a default setting for comparing checksums. This default overwrites the factory setting that checksums are not checked for files smaller than 32kB.

The `checksum` element takes attribute `type`, whose value can be:

`yes|YES` - MD5 checksums are checked on files larger than 32kB. This is the default value.

`no|NO` - checksums are not used.

`md5|MD5` - only MD5 checksums are checked on files larger than 32kB. When the `--fips` parameter is set with the command line clients **scpg3** and **sftpg3**, this hash is not used.

`sha1|SHA1` - only SHA1 checksums are checked on files larger than 32kB. When the `--fips` parameter is set with the command line clients **scpg3** and **sftpg3**, this hash is used.

`md5-force|MD5-FORCE` - MD5 checksums are forced, except when the `--fips` parameter is set with the command line tools **scpg3** and **sftpg3**.

`sha1-force|SHA1-FORCE` - SHA1 checksums are forced on all files.

`checkpoint|CHECKPOINT` - checkpointing is forced on large files that are transferred one by one.

Note

If the Connection Broker is started in FIPS mode and the `md5` attribute is defined in the configuration file, but **scpg3** or **sftpg3** are not started with the `--fips` parameter, then `md5` is used.

Note that checksums can also be defined with the command line clients **scpg3** and **sftpg3**, or with environment variables. The order of priority of the three checksum settings (in case they are different) is as follows, the later one always overwrites the previous value:

- `checksum` setting in the configuration file
- `SSH_SFTP_CHECKSUM_MODE` environment variable

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- Command line arguments

address-family

The `address-family` element defines the IP address family. Give the address family as the value of the `type` attribute. Tectia client tools for z/OS will operate using IPv4 (`inet`) addressing, IPv6 (`inet6`), or both (`any`). The default value for `type` is `any`.

The `profiles` Element

The `profiles` element defines the connection profiles for connecting to the specified servers. Element `profiles` can contain multiple `profile` elements. Each profile defines the connection rules to one server. The settings in the `profile` element override the default connection settings.

When a profile is used for the connection, the settings in the profile override the default settings. See the section called "The `default-settings` Element".

profile

The `profile` element defines a connection profile. It has the following attributes: `id`, `name`, `host`, `port`, `protocol`, `host-type`, `connect-on-startup`, `user`, and `gateway-profile`.

The profile `id` must be a unique identifier that does not change during the lifetime of the profile.

An additional `name` can be given to the profile. This is a free-form text string. The name can be used for connecting with the profile on the command line, so define a unique name for each profile.

The `host` attribute defines the address of the Secure Shell server host and it is a mandatory setting. The address can be either an IP address or a domain name. The value `host="*"` can be used to prompt the user to enter the host address when starting the session.

An empty value `host=""` can be used when the profile is used with transparent TCP or FTP tunneling or FTP-SFTP conversion and the host name is taken from the application (`filter-engine/rule[@host-name-from-app="yes"]`). See **rule** for details.

The `port` is a mandatory setting. It defines the port number of the Secure Shell server listener. The default port is `22`.

The `protocol` is a mandatory setting. It defines the used communications protocol. Currently the only allowed value is `secsh2`.

If you want to make the connection specified by the profile automatically when the Connection Broker is started, set the value of the `connect-on-startup` attribute to `yes`. In this case, give also the `user` attribute (the user name the connection is made with). You also need to set up some form of non-interactive authentication for the connection.

The `host-type` attribute sets the server type for ASCII (text) file transfer. This specifies the line break convention that is used for ASCII files. The default value is `default`, meaning that the line break con-

vention is determined by the local platform. If the client is running on Windows, Windows compatible line breaks (CR + LF, `'\r\n'`) are used. If the client is running on any other platform, Unix compatible line breaks (LF, `'\n'`) are used. Other possible values for `host-type` are `windows` (for Windows remote host) and `unix` (for Unix remote host). Define the value if you are using any other server than Tectia Server.

For FTP-SFTP conversion, set the server type here according to your target server to transfer ASCII files with correct line break convention.

The `user` attribute specifies the user name for opening the connection. The value "`%USERNAME%`" can be used to apply the user name of the currently logged in user. The value `user="*"` can be used to prompt the user to enter the user name when logging in. When the `user` attribute is not defined, the user name defined in the default connection settings will be used.

An empty value `user=""` can be used when the profile is used with transparent FTP tunneling or FTP-SFTP conversion and the user name is taken from the application (`filter-engine/rule[@username-from-app="yes"]`). See **rule** for details.

The `gateway-profile` attribute can be used to create nested tunnels. The tunnels defined under the `local-tunnel` element of the profile, and the tunnels defined under `filter-engine` and `static-tunnels` that refer to the profile can be nested. The profile name through which the connection is made is given as the value of the attribute. The first tunnel is created using the gateway host profile and from there the second tunnel is created to the host defined in this profile.

hostkey

This element gives the path to the remote server host public key file as a value of the `file` attribute.

Alternatively, the public key can be included as a base64-encoded ASCII block.

ciphers

This element defines the ciphers used with this profile. See **ciphers** for details.

macs

This element defines the MACs used with this profile. See **macs** for details.

kexs

This element defines the KEXs used with this profile. See **kexs** for details.

hostkey-algorithms

This element defines the hostkey signature algorithms used with this profile.

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rekey

This element defines the rekeying settings used with this profile. See **rekey** for details.

authentication-methods

This element defines the authentication methods used with this profile. See **authentication-methods** for details.

display-connection-summary

This element defines if client programs display the connection summary with this profile. See **display-connection-summary** for details.

user-identities

This element specifies the identities used in user public-key authentication. In contrast to the `key-stores` element that specifies all the keys that are available for the Connection Broker, this element can be used to control the keys that are attempted in authentication when this connection profile is used and to specify the order in which they are attempted.

The `user-identities` element can contain multiple `identity` elements. When multiple `identity` elements are used, they are tried out in the order they are listed.

identity

The `identity` element has the following attributes: `identity-file`, `file`, `hash`, `id`, and `data`.

The `identity-file` attribute specifies that the user identity is read in the identification file used with public-key authentication. Enter the full path to the file if it is located somewhere else than the default identification file directory which is `$HOME/.ssh2`. See also ssh-broker-g3(1).

The `file` attribute specifies the path to the public-key file (primarily) or to a certificate. Enter the full path and file name as the value.

The `hash` attribute is used to enter the hash of the public key that will be used to identify the related private key. The key must be available for the Connection Broker The public key hashes of the available keys can be listed with the **ssh-broker-ctl** tool. See also ssh-broker-ctl(1).

The `id` attribute is reserved for future use.

The `data` attribute is reserved for future use.

An example `user-identities` element is shown below:

```
<user-identities>
  <identity identity-file="C:\\ mykey" />
  <identity file="$HOME/user/.ssh2/id_rsa_2048_a" />
  <identity file="C:\\private_keys\id_rsa_2048_a" />
```

```
  <identity hash="#a8edd3845005931aaa658b5573609e7d31e23afd" />
</user-identities>
```

compression

This element defines the compression settings used with this profile. See **compression** for details.

proxy

This element defines the HTTP proxy and SOCKS server settings used with this profile. See **proxy** for details.

If `gateway-profile` has been defined for this profile, the proxy setting is ignored and the default proxy setting or the proxy setting of the gateway profile is used instead.

idle-timeout

This element defines the idle timeout settings used with this profile. See **idle-timeout** for details.

tcp-connect-timeout

This element defines the TCP connection timeout for this profile. The timeout is used to terminate connection attempts to Secure Shell servers that are down or unreachable. The default value is 0. See **tcp-connect-timeout** for details.

keepalive-interval

This element defines an interval for sending keepalive messages to the Secure Shell server. The setting applies to this profile. The default value is 0, meaning that no keepalive messages are sent. See **keepalive-interval** for details.

exclusive-connection

In the Connection Broker configuration, this element defines whether a new connection is opened for each new channel when a connection is made with this profile. This setting takes one attribute `enable`, with value `yes` or `no`. The default is `no`, meaning that open connections are reused for new channels requested by a client. See also **exclusive-connection**.

On z/OS, the SOCKS Proxy always uses the exclusive connection type, meaning it opens a new connection for each new channel. This element is not needed in the SOCKS Proxy configuration file, and irrespective of the value set by the user, the SOCKS Proxy always interprets this setting as: `exclusive-connection enable="yes"`.

server-banners

This element defines the server banner setting used with this profile. See **server-banners** for details.

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forwards

This element defines the forwards allowed with this profile. See **forwards** for details.

tunnels

The `tunnels` element defines the tunnels that are opened when a connection with this profile is made. The element can contain multiple `local-tunnel` and `remote-tunnel` elements.

local-tunnel

This element defines a local tunnel (port forwarding) that is opened automatically when a connection is made with the connection profile. It has five attributes: `type`, `listen-port`, `listen-address`, `dst-host`, `dst-port`, and `allow-relay`.

The `type` attribute defines the type of the tunnel. This can be `tcp` (default, no special processing), `ftp` (temporary forwarding is created for FTP data channels, effectively securing the whole FTP session), or `socks` (Tectia client tools for z/OS will act as a SOCKS server for other applications, creating forwards as requested by the SOCKS transaction).

The `listen-port` attribute defines the listener port number on the local client.

The `listen-address` attribute can be used to define which network interfaces on the client should be listened. Its value can be an IP address belonging to an interface on the local host. Value `0.0.0.0` listens to all interfaces. The default is `127.0.0.1` (localhost loopback address on the client). Setting any other value requires setting `allow-relay="yes"`.

For `address-family` option `inet6`, the default listen address is `::1`. To listen on all interfaces, specify `::`. For `address-family` option `any`, the listen address is both `127.0.0.1` and `::1` by default; to listen on all interfaces, specify `::`.

Whenever a connection is made to the specified listener, the connection is tunneled over Secure Shell to the remote server and another connection is made from the server to a specified destination host and port (`dst-host`, `dst-port`). The connection from the server onwards will not be secure, it is a normal TCP connection.

The `dst-host` and `dst-port` attributes define the destination host address and port. The value of `dst-host` can be either an IP address or a domain name. The default is `127.0.0.1` (localhost = server host).

The `allow-relay` attribute defines whether connections to the listened port are allowed from outside the client host. The default is `no`. If you use `allow-relay="yes"`, it will check also the `listen-address` setting.

remote-tunnel

This element defines a remote tunnel (port forwarding) that is opened automatically when a connection is made with the connection profile. It has four attributes: `type`, `listen-port`, `listen-address`, `dst-host`, `dst-port`, and `allow-relay`.

The `type` attribute defines the type of the tunnel. This can be either `tcp` (default, no special processing) or `ftp` (temporary forwarding is created for FTP data channels, effectively securing the FTP session between the client and server).

The `listen-port` attribute defines the listener port number on the remote server.

The `listen-address` attribute can be used to define which network interfaces on the server should be listened. Its value can be an IP address belonging to an interface on the server host. Value `0.0.0.0` listens to all interfaces. The default is `127.0.0.1` (localhost loopback address on the server). Setting any other value requires that `allow-relay="yes"`.

For `address-family` option `inet6`, the default listen address is `::1`. To listen on all interfaces, specify `::`. For `address-family` option `any`, the listen address is both `127.0.0.1` and `::1` by default; to listen on all interfaces, specify `::`.

Whenever a connection is made to this listener, the connection is tunneled over Secure Shell to the local client and another connection is made from the client to a specified destination host and port (`dst-host`, `dst-port`). The connection from the client onwards will not be secure, it is a normal TCP connection.

The `dst-host` and `dst-port` attributes define the destination host address and port. The value of `dst-host` can be either an IP address or a domain name. The default is `127.0.0.1` (localhost = client host).

The `allow-relay` attribute defines whether connections to the listener port are allowed from outside the server host. The default is `no`.

extended

This element is reserved for future use.

remote-environment

This element defines the remote environment settings used with this profile. Within the `remote-environment` element, define an `environment` element for each environment variable to be passed to the server. See **remote-environment** for details.

server-authentication-methods

This element defines the server authentication methods allowed with this profile. See **server-authentication-methods** for details.

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password

This element can be used to specify a user password that the client will send as a response to password authentication.

The password can be given directly in the `string` attribute, or a path to a file containing the password can be given in the `file` attribute, or a path to a program or a script that outputs the password can be given in the `command` attribute.

When using the `command` option to refer to a shell script, make sure the script also defines the user's shell, and outputs the actual password. Otherwise the executed program fails, because it does not know what shell to use for the shell script. For example, if the password string is defined in a file named `my_password.txt`, and you want to use the bash shell, include these lines in the script:

```
#!/usr/bash
cat /full/pathname/to/my_password.txt
```

Caution

If the password is given using this option, it is extremely important that the `ssh-broker-config.xml` file, the password file, or the program are not accessible by anyone else than the intended user.

Note

Any password given with the command-line options will override this setting.

An example connection profile is shown below:

```
<profile name="rock"
         id="id1"
         host="rock.example.com"
         port="22"
         connect-on-startup="no"
         user="doct">

  <hostkey file="key_22_rock.pub">
  </hostkey>

  <authentication-methods>
    <auth-publickey />
    <auth-password />
  </authentication-methods>

  <server-authentication-methods>
    <auth-server-publickey policy="strict" />
  </server-authentication-methods>

  <server-banners visible="yes" />
```

```
  <forwards>
    <forward type="agent" state="on" />
    <forward type="x11" state="on" />
  </forwards>

  <tunnels>
    <local-tunnel type="tcp"
                  listen-port="143"
                  dst-host="imap.example.com"
                  dst-port="143"
                  allow-relay="no" />
  </tunnels>

  <remote-environment>
    <environment name="FOO" value="bar" />
    <environment name="QUX" value="%Ubaz" format="yes" />
    <environment name="ZAPPA" value="%Ubaz" />
  </remote-environment>

</profile>
```

The `static-tunnels` Element

The `static-tunnels` setting is used to configure the behavior of the automatic tunnels. You can create listeners for local tunnels automatically when the Connection Broker starts up. The actual tunnel is formed the first time a connection is made to the listener port. If the connection to the server is not open at that time, it will be opened automatically as well.

The `static-tunnels` element can contain any number of `tunnel` elements.

tunnel

The `tunnel` element specifies a static tunnel. It has the following attributes: `type`, `listen-port`, `listen-address`, `dst-host`, `dst-port`, `allow-relay`, and `profile`.

The `type` attribute defines the type of the tunnel. This can be either `tcp`, `ftp`, or `socks-proxy`.

- `tcp` specifies a listener for generic TCP tunneling
- `ftp` specifies a listener for FTP tunneling (also the FTP data channels are tunneled)
- `socks-proxy` specifies a listener that acts as a SOCKS proxy towards the client applications. The traffic coming to the proxy is filtered using filter rules. When this option is used, a `filter-engine` element must be defined. See filter-engine.

The `listen-port` attribute defines the listener port number on the local client.

The `listen-address` attribute can be used to define which network interfaces on the client should be listened. Its value can be an IP address belonging to an interface on the local host. Value `0.0.0.0` listens

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to all interfaces. The default is `127.0.0.1` (localhost loopback address on the client). Setting any other value requires that `allow-relay="yes"`.

For `address-family` option `inet6`, the default listen address is `::1`. To listen on all interfaces, specify `::`. For `address-family` option `any`, the listen address is both `127.0.0.1` and `::1` by default; to listen on all interfaces, specify `::`.

The `dst-host` and `dst-port` attributes define the destination host address and port. The value of `dst-host` can be either an IP address or a domain name. The default is `127.0.0.1` (localhost = server host).

The `allow-relay` attribute defines whether connections to the listened port are allowed from outside the client host. The default is `no`.

The `profile` attribute specifies the connection profile ID that is used for the tunnel.

```
<static-tunnels>
  <tunnel type="tcp"
          listen-address="127.0.0.1"
          listen-port="9000"
          dst-host="st.example.com"
          dst-port="9000"
          allow-relay="no"
          profile="id1" />
</static-tunnels>
```

The `filter-engine` Element

The `filter-engine` element defines the filter rules for FTP-SFTP conversion and transparent FTP tunneling. On z/OS, also the `static-tunnels` element with a `socks-proxy` tunnel needs to be defined for the transparent FTP security to work.

Note

The SOCKS Proxy reads the `filter-engine` element from the global configuration file (`/opt/tectia/etc/ssh-socks-proxy-config.xml`), if such a file is available. Only when the global configuration file does not contain the `filter-engine` element, this element is read from the user-specific configuration file (`$HOME/.ssh2/ssh-socks-proxy-config.xml`).

The top level element is `filter-engine`. It has two attributes: `ip-generate-start` and `ip6-generate-start`.

The `ip-generate-start` attribute defines the start address of the pseudo IPv4 address space. Pseudo IPs are generated by the Connection Broker when applications do the DNS query through the SSH connection capture component.

The `ip6-generate-start` attribute is similar to `ip-generate-start`, but it defines the start address of the pseudo IPv6 address space.

Note

Under the `filter-engine` element there can be any amount of elements `network`, `dns`, `filter`, or `rule`. The order of the elements is important, because the filter engine uses the elements in the order they were specified in the configuration file.

network

The `network` element specifies a "location" where Tectia client tools for z/OS is running. By using the `network` element, you can implement location-awareness for Tectia client tools for z/OS. It has five attributes: `id`, `address`, `domain`, `ip-generate-start` and `ip6-generate-start`.

The `id` attribute specifies a unique identifier for the `network` element. The `address` attribute specifies the address of the network. It can be missing or empty, in which case it is not used. The `domain` attribute contains the domain name of the computer. It can also be missing or empty, in which case it is not used. The `ip-generate-start` attribute defines the start address of the pseudo IPv4 space. If it is defined here, it overrides the `ip-generate-start` attribute of the `filter-engine` element. The `ip6-generate-start` attribute is similar to `ip-generate-start`, but it defines the start address of the pseudo IPv6 address space.

dns

Note

The `dns` element exists for backward-compatibility reasons. Currently the `rule` element is used for the same settings.

The `dns` element creates a DNS rule for the filter engine. It has six attributes: `id`, `network-id`, `application`, `host`, `ip-address`, and `pseudo-ip`. For their descriptions, see **rule** below.

filter

Note

The `filter` element exists for backward-compatibility reasons. Currently the `rule` element is used for the same settings.

The `filter` element specifies an action for a connection. It has the following attributes: `dns-id`, `ports`, `action`, `profile-id`, `destination`, `destination-port`, `fallback-to-plain`.

The `dns-id` attribute is a reference to a `dns` element.

For the descriptions of the other attributes, see **rule** below.

rule

The `rule` element specifies how a filtered connection will be handled. It has the following attributes: `application`, `host`, `ip-address`, `pseudo-ip`, `ports`, `action`, `profile-id`, `destination`, `destination-`

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`port`, `username`, `hostname-from-app`, `username-from-app`, `fallback-to-plain`, `show-sftp-server-banner`.

The `application` attribute can be used to specify one or more applications to which the rule is applied. This can be a regular expression using the egrep syntax. For information on the syntax, see Appendix C.

The `host` attribute specifies a target host name. It can be a regular expression using the egrep syntax.

The `ip-address` attribute specifies the target host IP address. It can be a regular expression using the egrep syntax. In this case the Connection Broker does the string matching with the assumption that the IP address is written in its canonical form. If both the host name and the IP address are defined, the `host` attribute takes precedence and the `ip-address` attribute is ignored.

The `pseudo-ip` setting has the following effects when the `ip-address` is left empty and the `host` matches:

- When `pseudo-ip="yes"`, the Connection Broker assigns a pseudo IP address for the target host and Tectia Server resolves the real IP address. The pseudo IP addresses should be used when accessing an internal network from the outside, because name resolution for the machines in the internal network is not available from the outside.
- When `pseudo-ip="no"`, a normal DNS query is made for the target host name. The default value is `no`.

The `ports` attribute can be a single port or a range. A range is specified with a hyphen between two integers (for example `"21-25"`).

The `action` attribute specifies the action to be done when a filter matches. Its value can be `DIRECT`, `BLOCK`, `TUNNEL`, `FTP-TUNNEL`, or `FTP-PROXY`.

- `DIRECT` causes the connection to be made directly as plaintext without tunneling or FTP-SFTP conversion.
- `BLOCK` causes the connection to be blocked.
- `FTP-TUNNEL` activates transparent FTP tunneling
- `FTP-PROXY` causes the FTP-SFTP conversion to start and a connection to be made to the Secure Shell SFTP server.

The `profile-id` attribute can be used to specify the connection profile that defines the connection settings.

If the `profile-id` attribute is left empty and `hostname-from-app="yes"` is specified, the Secure Shell connection is made to the server specified by the client application using default settings. If a `profile-id` is specified and also `hostname-from-app="yes"` is specified, or the referred profile has `*` (an asterisk) or empty as the value of the `host` attribute, the Secure Shell connection is made to the server specified by the client application using the profile settings.

The `destination` and `destination-port` attributes can be used to define a static destination address and port number that will be used as the end point of the connection instead of the original address and port given by the application.

The `username` attribute can be used to define the user name used for connecting to the Secure Shell server, or you can define the path from where the Connection Broker should retrieve the user name.

The `hostname-from-app` attribute defines whether the Connection Broker should extract the Secure Shell server's host name from data sent by the application, or use a Secure Shell server defined by the connection profile in `profile-id`. The value is `yes` or `no`, and the default is `no`.

When `hostname-from-app="no"`, the tunnel or FTP-SFTP conversion will be created to the Secure Shell server specified in the connection profile referred in the `profile-id` attribute. Note that with transparent tunneling, the connection from the Secure Shell server to the final destination application will be unsecured and in plaintext. To achieve end-to-end security, the Secure Shell server should reside on the same host as the application.

When `hostname-from-app="yes"`, the tunnel or FTP-SFTP conversion will be created to the destination server specified by the application. This setting can be used with both FTP and TCP tunneling and FTP-SFTP conversion. When using `hostname-from-app="yes"`, it is no longer necessary to create a separate connection profile for each destination host. Note that this requires that a Secure Shell server is installed to each destination server (or, in the case of tunneling, that `fallback-to-plain` is enabled to allow direct connections to those servers that do not have Secure Shell installed).

The `username-from-app` attribute defines whether the FTP tunneling or FTP-SFTP conversion extracts the user name from data sent by the FTP application. The value is `yes` or `no`. The default is `no`.

When `username-from-app="yes"`, the user name received from the FTP client application is used. This setting can be used with FTP tunneling and FTP-SFTP conversion. This setting will override any user name settings made in a related connection profile. When `username-from-app="no"`, the user name is taken from the connection profile defined with the `profile-id` attribute.

In transparent tunneling, the `fallback-to-plain` attribute can be used to define whether a direct (unsecured) connection is used if creating the tunnel fails. The default value is `no`. Normally, when creating the secure tunnel fails when applying a filter rule, the Connection Broker will return an error about not being able to establish a connection.

Note

Do not enable the `fallback-to-plain` attribute for the FTP-SFTP conversion.

Note

Do not enable the `fallback-to-plain` and `pseudo-ip` options at the same time. If they both are enabled, and a secure connection fails, the application will try a direct connection with the pseudo IP, which will not work.

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In FTP-SFTP conversion, if the target SFTP server is configured to send a banner to the client, the `show-sftp-server-banner` attribute can be used to make the Connection Broker forward the SFTP server banner to the FTP client. The allowed values for `show-sftp-server-banner` are `yes` and `no`. The default value is `no` (the SFTP server banner is not forwarded to the FTP client).

Note

If you have made changes to the Connection Broker default configuration, make sure that showing the server banner is enabled (`server-banners visible="yes"`) in the `default-settings` or in `profiles`.

Note

Sending the SFTP server banner to the FTP client will cause an extra connection opening to the target SFTP server for retrieving the banner message.

In case of a failure in retrieving the banner message from the target SFTP server, the banner that Connection Broker forwards to the FTP client includes an error description, a default banner, and the following text:

```
Can't fetch banner from SFTP Server
```

The `logging` Element

The `logging` element changes the logging settings that define the log event severities and logging facilities. The element contains one or more `log-target` and `log-events` elements.

log-target

This element specifies the log target for auditing. By default, the broker does not log anything. This element can be used to direct log data to a file or syslog.

The `log-target` element can have `file` and `type` as attributes.

The `type` attribute specifies the logging facility where the audit data is output to. The value can be `file`, `syslog` or `discard`.

The `file` attribute sets the file system path where the audit data is written to. If the `type` attribute has `syslog` or `discard` set, the `file` attribute is not allowed.

log-events

This element sets the severity and facility of different logging events. The events have reasonable default values, which are used if no explicit logging settings are made. This setting allows customizing the default values.

The element can also contain one or more `log-target` elements. When defined here, the `log-target` element will override the definition given in the `logging/log-target`.

For the events, `facility` and `severity` can be set as attributes. The events itself should be listed inside the `log-events` element.

The facility can be `normal`, `daemon`, `user`, `auth`, `local0`, `local1`, `local2`, `local3`, `local4`, `local5`, `local6`, `local7`, or `discard`. Setting the facility to `discard` causes the server to ignore the specified log events.

The severity can be `informational`, `notice`, `warning`, `error`, `critical`, `security-success`, or `security-failure`.

Any events that are not specifically defined in the configuration file will use the default values. The defaults can be overridden for all remaining events by giving an empty `log-events` element after all other definitions and by setting a severity value for it.

In the names of log events, the characters '*' and '?' can be used as wildcards.

An example logging configuration that logs all events, which are programmed to be logged by default, both to `/tmp/foo` and to `syslog`.

```
<logging>
  <log-target file="/tmp/foo" />
  <log-target type="syslog" />
</logging>
```

An example logging configuration in which events are logged to `/tmp/foo`, except those whose event name matches "`Key_store_*`", which will be discarded.

```
<logging>
  <log-target file="/tmp/foo" />
  <log-events facility="discard">
    Key_store_*
  </log-events>
</logging>
```

A.2 Configuration File Quick Reference

This Appendix contains a quick reference to the elements of the XML-based configuration files `ssh-broker-config.xml` and `ssh-socks-proxy-config.xml`. The quick reference is divided into four tables:

- Table A.1: The `general` element
- Table A.2: The `default-settings` element
- Table A.3: The `profiles` element
- Table A.4: Other elements (`static-tunnels`, `filter-engine`, and `logging`)

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The tables list the available configuration file elements with their attributes, attribute values (with the default value, if available, marked in bold) and descriptions. The element names in the tables are links that take you to detailed descriptions of the elements in ssh-broker-config(5).

The element hierarchy is expressed with slashes ('/') between parent and child elements.

Table A.1. Configuration File Quick Reference - the `general` element

Element	Attributes and their values	Description
crypto-lib	`mode = "`**`standard`**`|fips"`	Cryptographic library mode: standard or FIPS 140-2 certified.
cert-validation	`end-point-identity-check = "`**`yes`**`|no|ask"`	Client will verify server's host name or IP address against the server host certificate
	`default-domain = `*`domain_name`	Default domain part of the remote system name
	`http-proxy-url = `*`HTTP_proxy`	HTTP proxy for making queries for certificate validity
	`socks-server-url = `*`SOCKS_server`	SOCKS server for making queries for certificate validity
	`max-path-length = `*`number` (default: "**`10`**")	Maximum length of certification paths when validating certificates
cert-validation / **ldap-server**	`address = `*`LDAP_server_address`	LDAP server address for fetching CRLs and/or subordinate CA certificates
	`port = `*`port_number` (default: "**`389`**")	LDAP server port for fetching CRLs and/or subordinate CA certificates
cert-validation / **ocsp-responder**	`url = `*`URL_address`	OCSP (Online Certificate Status Protocol) responder service address
	`validity-period = `*`seconds` (default: "**`0`**")	Time period during which new OCSP queries for the same certificate are not made (the old result is used)
cert-validation / **crl-prefetch**	`url = `*`LDAP_URL`*`|`*`HTTP_URL`*`|`*`file_URL`	Tectia client tools for z/OS periodically downloads a CRL from this URL
	`interval = `*`seconds` (default: "**`3600`**")	How often the CRL is downloaded
cert-validation / **dod-pki**	`enable = "yes|`**`no`**`"`	Require certificates to be compliant with DoD PKI
cert-validation / **ca-certificate**	`name = `*`CA_name`	Name of the certification authority (CA) used in server authentication
	`file = `*`path`	Path to the X.509 CA certificate file
	`disable-crls = "yes|`**`no`**`"`	Disable CRL checking
	`use-expired-crls = `*`seconds` (default: "**`0`**")	Time period for using expired CRLs

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Element	Attributes and their values	Description
cert-validation / **key-store** (*z/OS only*)	`type = "zos-saf"`	CA certificates are stored in an external key store (System Authorization Facility) for server authentication
	`init = init_info`	Key-store-provider-specific initialization info
	`disable-crls = "yes|no"`	Disable CRL checking
	`use-expired-crls = seconds` (default: `"0"`)	Time period for using expired CRLs
key-stores / **key-store**	`type = "software|zos-saf"`	Key store type
	`init = init_info`	Key-store-provider-specific initialization info
key-stores / **user-keys**	`directory = path`	Directory where the user private keys are stored
	`passphrase-timeout = seconds` (default: `"0"`)	Time after which the passphrase-protected private key will time out
	`passphrase-idle-timeout = seconds` (default: `"0"`)	Time after which the passphrase-protected private key will time out unless the user accesses or uses the key
key-stores / **identification**	`file = path`	Location of the identification file that defines the user keys
	`base-path = path`	Directory where the identification file expects the user private keys to be stored
	`passphrase-timeout = seconds` (default: `"0"`)	Time after which the user must enter the passphrase again
	`passphrase-idle-timeout = seconds` (default: `"0"`)	Time after which the passphrase times out if there are no user actions
user-config-directory	`path = path` (default: `"%USER_CONFIG_DIRECTORY%"`)	Non-default location of user-specific configuration files
file-access-control *(Unix only)*	`enable = "yes|no"`	Enable checking of file access permissions defined for global and user-specific configuration files and private keys files
protocol-parameters	`threads = number` (if set to `0`, default value is used)	The number of threads the protocol library uses (fast path dispatcher threads)

Element	Attributes and their values	Description
known-hosts	`path = path`	Non-default location of known hosts file or directory
	`file = path`	Location of OpenSSH-style `known_hosts` file
	`directory = path`	Non-default directory for storing known host keys
	`filename-format = "hash|plain|`**`default`**`" ("default" = "hash")`	The format in which new host key files will be stored
known-hosts / key-store *(z/OS only)*	`type = "zos-saf"`	Certificates of known server hosts are stored in an external key store (System Authorization Facility)
	`init = init_info`	Key-store-provider-specific initialization info

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Table A.2. Configuration File Quick Reference - the `default-settings` element

Element	Attributes and their values	Description
	`user = user_name`	Default user name to be used when connecting to remote servers
ciphers / **cipher**	`name = cipher_name`	A cipher that the client requests for data encryption
macs / **mac**	`name = MAC_name`	A MAC that the client requests for data integrity verification
kexs /**kex**	`name = KEX_name`	A KEX that the client requests for the key exchange method
hostkey-algorithms / **hostkey-algorithm**	`name = hostkey-algorithm_name`	A host key signature algorithm to be used in server authentication with host keys or certificates
rekey	`bytes = number` (default: "**1000000000**" (1 GB))	Number of transferred bytes after which key exchange is done again
authentication-methods / **auth-password**	-	Password authentication will be used
authentication-methods / **auth-publickey**	-	Public-key authentication will be used
	`signature-algorithms = comma-separated_list`	Public-key signature algorithms used for client authentication
authentication-methods / **auth-publickey** / **key-selection**	`policy = "automatic|interactive-shy"`	Key selection policy used by the client when proposing user public keys to the server
authentication-methods / **auth-publickey** / **key-selection** / **public-key**	`type = "plain|certificate"` (by default, both are tried)	Only plain public keys or only certificates are tried during public-key authentication
authentication-methods / **auth-publickey** / **key-selection** / **issuer-name**	`name = certificate_issuer_name`	Client-side user certificates can be filtered by comparing this name to the certificate issuers requested or accepted by the server
	`match-server-certificate = "yes|no"`	The Connection Broker tries matching the user certificate issuer name to the server certificate issuer name
authentication-methods / **auth-keyboard-interactive**	-	Keyboard-interactive methods will be used in authentication
compression	`name = "none|zlib"`	Compress the data that the client sends
	`level = [0 to 9]` (default: "**0**" (= level 6))	For `zlib`, compression level.

Element	Attributes and their values	Description
proxy	`ruleset = rule_sequence`	Rules for HTTP proxy or SOCKS servers the client will use for connections
idle-timeout	`type = "connection"`	Idle timeout is always defined for connections
	`time = seconds` (default: "**5**")	Idle time (after all connection channels are closed) allowed for a connection before automatically closing the connection
tcp-connect-timeout	`time = seconds` (default: "**0**")	Timeout for TCP connections (after which connection attempts to a Secure Shell server are stopped if the remote host is down or unreachable)
keepalive-interval	`time = seconds` (default: "**0**")	Time interval for sending keepalive messages to the Secure Shell server
exclusive-connection	`enable = "yes|no"`	A new connection is opened for each new channel
server-banners	`visible = "yes|no"`	Show server banner message file (if it exists) to the user before login
forwards / **forward**	`type = "x11|agent"`	Forwarding type
	`state = "on|off|denied"`	Set forwarding on or off, or deny it
remote-environment / **environment**	`name = env_var_name`	Name of an environment variable that is to be passed to the server from the client side
	`value = string`	Value of the environment variable
	`format = "yes|no"`	The Connection Broker processes Tectia-specific special variables in `value` (e.g. `%U%`)
server-authentication-methods / **auth-server-certificate**	-	Use certificates for server authentication
server-authentication-methods / **auth-server-publickey**	-	Use public host keys for server authentication
	`policy = "strict|ask|tofu|advisory"`	Policy for handling unknown server host keys
authentication-success-message	`enable = "yes|no"`	Output and log the `AuthenticationSuccessMsg` messages
sftpg3-mode	`compatibility-mode = "tectia|ftp|openssh"`	Behavior of **sftpg3** when transferring files

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Element	Attributes and their values	Description
display-connection-summary	`client-type = "sftpg3|scpg3|sshg3|all"`	Client type
	`enable = "yes|no"`	Enable or disable connection summary
terminal-selection	`selection-type = "`**`select-words`**`|select-paths"`	Behavior of the Tectia terminal when the user selects text with double-clicks
terminal-bell	`bell-style = "none |pc-speaker|`**`system-default`**`"`	Tectia terminal repeats audible notifications from destination (Unix) server
close-window-on-disconnect	`enable = "yes|`**`no`**`"`	Tectia terminal window is to be closed while disconnecting from a server session by pressing **CTRL+D**
quiet-mode	`enable = "yes|`**`no`**`"`	Make **scpg3**, **sshg3**, and **sftpg3** suppress warnings, error messages and authentication success messages
checksum	`type = "`**`yes`**`|no|md5|sha1|md5-force|sha1-force|checkpoint"`	Default setting for comparing checksums
address-family	`type = "`**`any`**`|inet|inet6"`	IP address family: both, IPv4, or IPv6

Table A.3. Configuration File Quick Reference - the `profiles` element

Element	Attributes and their values	Description
profile	`id = ID`	Unique identifier that does not change during the lifetime of the profile
	`name = string`	Unique name (free-form text string) that can be used for connecting with the profile on the command line
	`host = IP_address|FQDN |short_hostname`	Secure Shell server host address
	`port = port_number` (default: "**22**")	Secure Shell server listener port number
	`protocol = "secsh2"`	The communications protocol used by the profile
	`host-type = "default|windows|unix"`	Server type for ASCII (text) file transfer
	`connect-on-startup = "yes|no"`	Connect automatically with the profile when the Connection Broker is started
	`user = user_name`	User name for opening the connection
	`gateway-profile = profile_name`	Create nested tunnels
profile / **hostkey**	`file = path`	Path to the remote server host public key file
profile / **ciphers** / **cipher**	`name = cipher_name`	A cipher used with this profile
profile / **macs** / **mac**	`name = MAC_name`	A MAC used with this profile
profile / **kexs** / **kex**	`name = KEX_name`	A KEX used with this profile
profile / **hostkey-algorithms** / **hostkey-algorithm**	`name = hostkey-algorithm_name`	Host key signature algorithm used with this profile
profile / **rekey**	`bytes = number` (default: "**1000000000**" (1 GB))	Number of transferred bytes after which key exchange is done again when using this profile
profile / **authentication-methods**	Define the authentication methods for this profile using the same child elements as with `default-settings / authentication-methods` (see Table A.2)	
profile / **user-identities** / **identity**	`identity-file = path`	The user identity is read in the identification file used with public-key authentication
	`file = path`	Path to the public-key file (primarily) or to a certificate
	`hash = hash`	Hash of the public key that will be used to identify the related private key

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Element	Attributes and their values	Description
profile / **compression**	`name = "`**`none`**`|zlib"`	Compression settings (for the data that the client sends) used with this profile
	`level = [0 to 9]` (default: "**`0`**" (= level 6))	For `zlib`, compression level.
profile / **proxy**	`ruleset = `*`rule_sequence`	Rules for HTTP proxy or SOCKS servers the client will use for connections with this profile
profile / **idle-timeout**	`type = "connection"`	Idle timeout is always defined for connections
	`time = `*`seconds` (default: "**`5`**")	Idle time (after all connection channels are closed) allowed for a connection before automatically closing the connection opened with this profile
profile / **tcp-connect-timeout**	`time = `*`seconds` (default: "**`5`**")	Timeout for TCP connections with this profile: Connection attempts to a Secure Shell server are stopped after the defined time if the remote host is down or unreachable
profile / **keepalive-interval**	`time = `*`seconds` (default: "**`0`**")	Time interval for sending keepalive messages to the Secure Shell server with this profile
profile / **exclusive-connection**	`enable = "yes|`**`no`**`"`	A new connection is opened for each new channel with this profile
profile / **server-banners**	`visible = "`**`yes`**`|no"`	Show server banner message file (if it exists) to the user before login with this profile
profile / **forwards** / **forward**	`type = "x11|agent"`	Forwarding type for this profile
	`state = "on|off|denied"`	Set forwarding on, off, or deny it (i.e. the user cannot enable it on the command-line) with this profile

Element	Attributes and their values	Description
profile / **tunnels** / **local-tunnel**	`type = "tcp|ftp|socks"`	Type of the local tunnel that is opened automatically when a connection is made with this profile
	`listen-address = IP_address` (default: **127.0.0.1**)	The network interfaces that should be listened on the client
	`listen-port = port_number`	Listener port number on the local client
	`dst-host = IP_address|domain_name` (default: **127.0.0.1**)	Destination host address
	`dst-port = port_number`	Destination port
	`allow-relay = "yes|no"`	Allow connections to the listened port from outside the client host
profile / **tunnels** / **remote-tunnel**	`type = "tcp|ftp"`	Type of the remote tunnel that is opened automatically when a connection is made with this profile
	`listen-address = IP_address` (default: **127.0.0.1**)	The network interfaces that should be listened on the server
	`listen-port = port_number`	Listener port number on the remote server
	`dst-host = IP_address|domain_name` (default: **127.0.0.1**)	Destination host address
	`dst-port = port_number`	Destination port
	`allow-relay = "yes|no"`	Allow connections to the listener port from outside the server host
profile / **remote-environment** / **environment**	`name = env_var_name`	Name of an environment variable that is to be passed to the server from the client side
	`value = string`	Value of the environment variable
	`format = "yes|no"`	The Connection Broker processes Tectia-specific special variables in `value` (e.g. `%U%`)
profile / **server-authentication-methods**	Define the server authentication methods allowed with this profile using the same child elements as with `default-settings / server-authentication-methods` (see Table A.2)	

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Element	Attributes and their values	Description
profile / **password**	`string = password`	User password that the client will send as a response to password authentication
	`file = password_file`	File containing the password
	`command = path`	Path to a program or script that outputs the password

Table A.4. Configuration File Quick Reference - the `static-tunnels`, `filter-engine`, and `logging` elements

Element	Attributes and their values	Description
static-tunnels / **tunnel**	`type = "tcp|ftp"`	Type of the static tunnel
	`listen-address = IP_address` (default: **`127.0.0.1`**)	The network interfaces that should be listened on the client
	`listen-port = port_number`	Listener port number on the local client
	`dst-host = IP_address|domain_name` (default: **`127.0.0.1`**)	Destination host address
	`dst-port = port_number`	Destination port
	`allow-relay = "yes|no"`	Allow connections to the listened port from outside the client host
	`profile = ID`	Connection profile ID that is used for the tunnel
filter-engine	`ip-generate-start = IPv4_address`	Start address of the pseudo IPv4 address space
	`ip6-generate-start = IPv6_address`	Start address of the pseudo IPv6 address space
filter-engine / **network**	`id = ID`	Unique identifier for the element
	`address = network_address`	(*Optional*) network address
	`domain = domain_name`	Domain name of the computer
	`ip-generate-start = IPv4_address`	Start address of the pseudo IPv4 address space
	`ip6-generate-start = IPv6_address`	Start address of the pseudo IPv6 address space

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Element	Attributes and their values	Description
filter-engine / **rule**	`application = application`	One or more applications to which the rule is applied. Regular expressions (egrep) can be used.
	`host = host_name`	Filtered connection's target host name. Regular expressions (egrep) can be used.
	`ip-address = IP_address`	Filtered connection's target host IP address. Regular expressions (egrep) can be used.
	`pseudo-ip = "yes|no"`	The Connection Broker assigns a pseudo IP address for the target host and Tectia Server resolves the real IP address.
	`ports = port_number|port_range`	Filtered connection's target ports
	`action = "direct|block|tunnel|ftp-tunnel|ftp-proxy"`	The action to be done when a filter matches
	`profile-id = ID`	The connection profile that defines the connection settings
	`destination = address`	Static destination address that will be used as the end point of the connection
	`destination-port = port_number`	Static destination port that will be used as the end point of the connection
	`username = user_name|path`	User name used for connecting to the Secure Shell server, or the path from where the user name should be retrieved
	`hostname-from-app = "yes|no"`	The Connection Broker should either extract the Secure Shell server's host name from data sent by the application, or use a Secure Shell server defined by the connection profile in `profile-id`.
	`username-from-app = "yes|no"`	FTP tunneling or FTP-SFTP conversion extracts the user name from data sent by the FTP application
	`fallback-to-plain = "yes|no"`	Direct (unsecured) connection is used if creating the tunnel fails
	`show-sftp-server-banner = yes|no`	In FTP-SFTP conversion, make the Connection Broker forward the SFTP server banner to the FTP client

Element	Attributes and their values	Description
logging / **log-target**	`file = path`	File where the audit data is written to
	`type = "file|syslog|discard"`	Logging facility to which audit data is output
logging / **log-events**	`facility = "normal|daemon |user|auth|local0|local1|local2 |local3|local4|local5|local6 |local7|discard"` (On Windows: `facility = "normal|discard"`)	Facility of logging event
	`severity = "informational |notice|warning|error| critical|security-success |security-failure"`	Severity of logging event
logging / **log-events** / **log-target**	The same as `logging / log-target`	

A.3 Broker Configuration File Syntax

The DTD of the Connection Broker configuration file is shown below:

```
<!-- secsh-broker.dtd                                                -->
<!--                                                                 -->
<!-- Copyright (c) 2017 SSH Communications Security Corporation.     -->
<!-- This software is protected by international copyright laws.     -->
<!-- All rights reserved.                                            -->
<!--                                                                 -->
<!-- Document type definition for the Connection Broker XML          -->
<!-- configuration files.                                            -->
<!--                                                                 -->

<!-- Tunable parameters used in the policy. -->

<!-- Both ipv4 and ipv6 are enabled by default -->
<!ENTITY default-address-family-type        "any">


<!-- The top-level element -->
<!ELEMENT secsh-broker          (general?,default-settings?,profiles?,
                                 static-tunnels?,gui?,
                                 filter-engine?,logging?)>
<!ATTLIST secsh-broker
      version                   CDATA           #IMPLIED>

<!-- General element. Only "known-hosts" can appear multiple times. -->
```

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```
<!ELEMENT general               (crypto-lib|cert-validation|key-stores|
                                strict-host-key-checking|host-key-always-ask|
                                accept-unknown-host-keys|known-hosts|
                                user-config-directory|file-access-control|
                                protocol-parameters)*>

<!-- Cryptographic library. -->
<!ELEMENT crypto-lib            EMPTY>
<!ATTLIST crypto-lib
      mode                      (fips|standard) "standard">

<!-- PKI settings. "dod-pki" element may appear only once, other elements -->
<!-- may be specified multiple times.                                     -->

<!ELEMENT cert-validation       (ldap-server|
                                ocsp-responder|
                                crl-prefetch|
                                dod-pki|
                                ca-certificate|
                                key-store)*>

<!ATTLIST cert-validation
      end-point-identity-check  (yes|no|YES|NO|ask|ASK) "yes"
      default-domain            CDATA           #IMPLIED
      http-proxy-url            CDATA           #IMPLIED
      socks-server-url          CDATA           #IMPLIED
      max-path-length           CDATA           "10">

<!ELEMENT ldap-server           EMPTY>
<!ATTLIST ldap-server
      address                   CDATA           #REQUIRED
      port                      CDATA           "389">

<!ELEMENT ocsp-responder        (#PCDATA)>
<!ATTLIST ocsp-responder
      url                       CDATA           #REQUIRED
      validity-period           CDATA           "0"
      responder-certificate     CDATA           #IMPLIED>

<!-- CRL prefetch. -->
<!ELEMENT crl-prefetch          EMPTY>
<!ATTLIST crl-prefetch
      interval                  CDATA           "3600"
      url                       CDATA           #REQUIRED>

<!-- CA certificates. -->
<!ELEMENT ca-certificate        (#PCDATA)>
<!ATTLIST ca-certificate
      name                      CDATA           #REQUIRED
      file                      CDATA           #IMPLIED
      disable-crls              (yes|no|YES|NO) "no"
```

```
      use-expired-crls          CDATA           "0" >

<!-- Enable DoD PKI compliancy. -->
<!ELEMENT dod-pki               EMPTY>
<!ATTLIST dod-pki
      enable                    (yes|no|YES|NO) "no" >

<!ELEMENT key-stores            ((key-store|user-keys|identification)*)>

<!ELEMENT key-store             EMPTY>
<!ATTLIST key-store
      type                      CDATA           #REQUIRED
      init                      CDATA           #IMPLIED
      disable-crls              (yes|no|YES|NO) "no"
      use-expired-crls          CDATA           "0" >

<!ELEMENT user-keys             EMPTY>
<!ATTLIST user-keys
      directory                 CDATA           #IMPLIED
      poll-interval             CDATA           "10"
      passphrase-timeout        CDATA           "0"
      passphrase-idle-timeout   CDATA           "0">

<!ELEMENT identification        EMPTY>
<!ATTLIST identification
      file                      CDATA           #REQUIRED
      base-path                 CDATA           #IMPLIED
      passphrase-timeout        CDATA           "0"
      passphrase-idle-timeout   CDATA           "0">

<!-- This element is deprecated and included for backwards compatibility only -->
<!ELEMENT strict-host-key-checking EMPTY>
<!ATTLIST strict-host-key-checking
      enable                    (yes|no|YES|NO) #REQUIRED>

<!-- This element is deprecated and included for backwards compatibility only -->
<!ELEMENT host-key-always-ask   EMPTY>
<!ATTLIST host-key-always-ask
      enable                    (yes|no|YES|NO) #REQUIRED>

<!-- This element is deprecated and included for backwards compatibility only -->
<!ELEMENT accept-unknown-host-keys EMPTY>
<!ATTLIST accept-unknown-host-keys
      enable                    (yes|no|YES|NO) #REQUIRED>

<!ELEMENT exclusive-connection  EMPTY>
<!ATTLIST exclusive-connection
      enable                    (yes|no|YES|NO) #REQUIRED>

<!ELEMENT known-hosts           (key-store*)>
<!ATTLIST known-hosts
```

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```
      path                      CDATA           #IMPLIED
      file                      CDATA           #IMPLIED
      directory                 CDATA           #IMPLIED
      filename-format           (hash|plain|default) "default" >

<!-- Extended plugin configuration -->
<!ELEMENT extended              (ext)*>

<!ELEMENT ext                   (#PCDATA | EMPTY | ext)*>
<!ATTLIST ext
      name                      CDATA           #REQUIRED>

<!-- Default settings element.  No element may appear multiple times. -->
<!ELEMENT default-settings      (ciphers|macs|kexs|hostkey-algorithms|
                                transport-distribution|rekey|
                                authentication-methods|
                                hostbased-default-domain|
                                compression|proxy|idle-timeout|
                                tcp-connect-timeout|keepalive-interval|
                                exclusive-connection|server-banners|
                                forwards|extended|remote-environment|
                                server-authentication-methods|
                                authentication-success-message|
                                sftpg3-mode|display-connection-summary|
                                terminal-selection|terminal-bell|
                                close-window-on-disconnect|quiet-mode|
                                checksum|address-family)*>

<!ATTLIST default-settings
      user                      CDATA           #IMPLIED>

<!-- Server banners. -->
<!ELEMENT server-banners        EMPTY>
<!ATTLIST server-banners
      visible                   (yes|no|YES|NO) "yes">

<!-- Ciphers element. -->
<!ELEMENT ciphers               (cipher*)>

<!-- Cipher. -->
<!ELEMENT cipher                EMPTY>
<!ATTLIST cipher
      name                      CDATA           #REQUIRED>

<!-- Macs element. -->
<!ELEMENT macs                  (mac*)>

<!-- Mac. -->
<!ELEMENT mac                   EMPTY>
<!ATTLIST mac
      name                      CDATA           #REQUIRED>
```

```
<!-- Kexs element. -->
<!ELEMENT kexs                  (kex*)>

<!-- Kex. -->
<!ELEMENT kex                   EMPTY>
<!ATTLIST kex
      name                      CDATA           #REQUIRED>

<!-- Hostkey algorithms element. -->
<!ELEMENT hostkey-algorithms    (hostkey-algorithm*)>

<!-- Hostkey algorithm. -->
<!ELEMENT hostkey-algorithm     EMPTY>
<!ATTLIST hostkey-algorithm
      name                      CDATA           #REQUIRED>

<!ELEMENT rekey                 EMPTY>
<!ATTLIST rekey
      bytes                     CDATA           "0">

<!-- Hostbased default domain. -->
<!ELEMENT hostbased-default-domain EMPTY>
<!ATTLIST hostbased-default-domain
      name                      CDATA           #REQUIRED>

<!-- Authentication methods element. -->
<!ELEMENT authentication-methods (authentication-method|auth-hostbased
                                 |auth-password|auth-publickey|auth-gssapi
                                 |auth-keyboard-interactive)*>
<!ELEMENT server-authentication-methods (authentication-method
                                 |auth-server-publickey
                                 |auth-server-certificate)*>

<!ELEMENT auth-server-publickey EMPTY>
<!ATTLIST auth-server-publickey
      policy                    CDATA #IMPLIED><!-- "strict", "ask", "tofu", -->
                                               <!-- "advisory" -->

<!ELEMENT auth-server-certificate   EMPTY>

<!ELEMENT remote-environment    (environment*)>

<!ELEMENT environment           EMPTY>
<!ATTLIST environment
      name                      CDATA           #REQUIRED
      value                     CDATA           #REQUIRED
      format                    (yes|no|YES|NO) "no">

<!-- This element is deprecated and included for backwards compatibility only -->
<!ELEMENT transport-distribution EMPTY>
```

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```
<!ATTLIST transport-distribution
      num-transports            CDATA           #REQUIRED>

<!-- This element is deprecated and included for backwards compatibility only -->
<!ELEMENT authentication-method EMPTY>
<!ATTLIST authentication-method
      name                      CDATA           #REQUIRED>

<!ELEMENT auth-hostbased        (local-hostname?)>
<!ELEMENT local-hostname        EMPTY>
<!ATTLIST local-hostname
      name                      CDATA           #REQUIRED>

<!ELEMENT auth-password         EMPTY>

<!ELEMENT auth-publickey        (key-selection?)>
<!ATTLIST auth-publickey
      signature-algorithms      CDATA           #IMPLIED>

<!ELEMENT key-selection         (public-key|issuer-name|subject-name|
                                extended-key-usage|key-usage|policy-info)*>
<!ATTLIST key-selection
      policy                    CDATA           #IMPLIED
      exclude                   (yes|no|YES|NO) "no"
      require-all               (yes|no|YES|NO) "no">

<!ELEMENT public-key EMPTY>
<!ATTLIST public-key
      type                      CDATA           #REQUIRED>
<!ELEMENT issuer-name           EMPTY>
<!ATTLIST issuer-name
      name                      CDATA           #IMPLIED
      pattern                   CDATA           #IMPLIED
      match-server-certificate  (yes|no|YES|NO) "no">
<!ELEMENT subject-name          EMPTY>
<!ATTLIST subject-name
      name                      CDATA           #IMPLIED
      pattern                   CDATA           #IMPLIED>
<!ELEMENT extended-key-usage    (#PCDATA)>
<!ATTLIST extended-key-usage
      oid                       CDATA           #IMPLIED
      explicit                  (yes|no|YES|NO) "no">
<!ELEMENT key-usage             (#PCDATA)>
<!ATTLIST key-usage
      bit                       CDATA           #IMPLIED>
<!ELEMENT auth-keyboard-interactive EMPTY>
<!ELEMENT auth-gssapi           EMPTY>

<!-- Actually, the default for allow-ticket-forwarding is "no", but we
     don't want to override value if it is left undefined. -->
<!ATTLIST auth-gssapi
```

```
      dll-path                  CDATA           "/usr/lib/libgssapi_krb5.so,
                                                 /usr/lib64/libgssapi_krb5.so,
                                                 /usr/lib/libkrb5.so,
                                                 /usr/lib/libgss.so,
                                                 /usr/local/gss/gl/mech_krb5.so,
                                                 /usr/local/lib/libgssapi_krb5.so,
                                                 /usr/local/lib/libkrb5.so,
                                                 /usr/kerberos/lib/libgssapi_krb5.so,
                                                 /usr/kerberos/lib/libkrb5.so,
                                                 /usr/lib/gss/libgssapi_krb5.so,
                                                 /usr/kerberos/lib/libgssapi_krb5.so.2,
                                                 /usr/lib/libgssapi_krb5.so.2,
                                                 /usr/lib/amd64/gss/mech_krb5.so,
                                                 /usr/lib/amd64/libgss.so"
      allow-ticket-forwarding   (yes|no)        #IMPLIED>

<!-- User identities. -->
<!ELEMENT user-identities       (identity*)>
<!ELEMENT identity              EMPTY>
<!ATTLIST identity
      identity-file             CDATA           #IMPLIED
      file                      CDATA           #IMPLIED
      hash                      CDATA           #IMPLIED
      id                        CDATA           #IMPLIED
      data                      CDATA           #IMPLIED>

<!-- Password. -->
<!ELEMENT password              (#PCDATA)>
<!ATTLIST password
      string                    CDATA           #IMPLIED
      file                      CDATA           #IMPLIED
      command                   CDATA           #IMPLIED>

<!-- Proxy rules. -->
<!ELEMENT proxy                 EMPTY>
<!ATTLIST proxy
      ruleset                   CDATA           #REQUIRED>

<!-- Idle timeout. -->
<!ELEMENT idle-timeout          EMPTY>
<!ATTLIST idle-timeout
      type                      (connection)    "connection"
      time                      CDATA           #IMPLIED>

<!-- Connect timeout. -->
<!ELEMENT tcp-connect-timeout   EMPTY>
<!ATTLIST tcp-connect-timeout
      time                      CDATA           #REQUIRED>

<!-- Keepalive interval. -->
<!ELEMENT keepalive-interval    EMPTY>
```

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```
<!ATTLIST keepalive-interval
      time                      CDATA           #REQUIRED>

<!-- Forwards element. -->
<!ELEMENT forwards              (forward*)>

<!-- Forward. -->
<!ELEMENT forward               EMPTY>
<!ATTLIST forward
      type                      (x11|agent)     #REQUIRED
      state                     (on|off|denied) #REQUIRED>


<!-- Compression. -->
<!ELEMENT compression           EMPTY>
<!ATTLIST compression
      name                      CDATA           #IMPLIED
      level                     CDATA           #IMPLIED>

<!ELEMENT authentication-success-message EMPTY>
<!ATTLIST authentication-success-message
      enable                    (yes|no|YES|NO) "yes">

<!ELEMENT quiet-mode            EMPTY>
<!ATTLIST quiet-mode
      enable                    (yes|no|YES|NO) "no">

<!ELEMENT sftpg3-mode           EMPTY>
<!ATTLIST sftpg3-mode
      compatibility-mode        CDATA           "tectia">

<!ELEMENT display-connection-summary EMPTY>
<!ATTLIST display-connection-summary
          client-type   (sftpg3|scpg3|sshg3|all) "all"
          enable               (yes|no|YES|NO) "no">

<!ELEMENT terminal-selection    EMPTY>
<!ATTLIST terminal-selection
      selection-type            (select-words|select-paths)
                                                "select-words">

<!ELEMENT terminal-bell         EMPTY>
<!ATTLIST terminal-bell
      bell-style                (none|pc-speaker|system-default)
                                                "system-default">

<!ELEMENT close-window-on-disconnect EMPTY>
<!ATTLIST close-window-on-disconnect
      enable                    (yes|no)        "no">

<!ELEMENT checksum EMPTY>
```

```
<!ATTLIST checksum
      type          (yes|no|md5|sha1|md5-force|sha1-force|checkpoint|
                    YES|NO|MD5|SHA1|MD5-FORCE|SHA1-FORCE|CHECKPOINT) "yes">

<!ELEMENT user-config-directory EMPTY>
<!ATTLIST user-config-directory
      path                      CDATA           "%USER_CONFIG_DIRECTORY%">

<!ELEMENT file-access-control   EMPTY>
<!ATTLIST file-access-control
      enable                    (yes|no|YES|NO) "no">

<!-- address-family mode setting ipv4 & ipv6-->
<!ELEMENT address-family        EMPTY>
<!ATTLIST address-family
      type                      (any|inet|inet6)
                                                "&default-address-family-type;">

<!ELEMENT protocol-parameters   EMPTY>
<!ATTLIST protocol-parameters
      threads                   CDATA           #IMPLIED>

<!-- Profiles element. -->
<!ELEMENT profiles              (profile*)>

<!-- Connection profile.  No element may appear multiple times. -->
<!ELEMENT profile               (hostkey|ciphers|macs|kexs|hostkey-algorithms|
                                transport-distribution|rekey|
                                authentication-methods|
                                user-identities|
                                compression|proxy|idle-timeout|
                                tcp-connect-timeout|keepalive-interval|
                                exclusive-connection|server-banners|
                                display-connection-summary|
                                forwards|tunnels|extended|remote-environment|
                                server-authentication-methods|password|
                                profile-group)*>
<!ATTLIST profile
      id                        CDATA           #IMPLIED
      name                      CDATA           #IMPLIED
      host                      CDATA           #REQUIRED
      port                      CDATA           "22"
      protocol                  CDATA           "secsh2"
      host-type                 (unix|windows|default) "default"
      connect-on-startup        (yes|no|YES|NO) "no"
      user                      CDATA           #IMPLIED
      gateway-profile           CDATA           #IMPLIED>

<!ELEMENT profile-group EMPTY>
<!ATTLIST profile-group
      name                      CDATA           #REQUIRED>
```

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```
<!-- Hostkey. -->
<!ELEMENT hostkey               (#PCDATA)>
<!ATTLIST hostkey
      file                      CDATA           #IMPLIED>

<!-- Tunnels element. -->
<!ELEMENT tunnels               (local-tunnel*,remote-tunnel*)>

<!-- Local tunnel. -->
<!ELEMENT local-tunnel          EMPTY>
<!ATTLIST local-tunnel
      type                      CDATA           "tcp"
      listen-address            CDATA           "127.0.0.1"
      listen-port               CDATA           #REQUIRED
      dst-host                  CDATA           "127.0.0.1"
      dst-port                  CDATA           #REQUIRED
      allow-relay               (yes|no|YES|NO) "no">

<!-- Remote tunnel. -->
<!ELEMENT remote-tunnel         EMPTY>
<!ATTLIST remote-tunnel
      type                      CDATA           "tcp"
      listen-address            CDATA           "127.0.0.1"
      listen-port               CDATA           #REQUIRED
      dst-host                  CDATA           "127.0.0.1"
      dst-port                  CDATA           #REQUIRED
      allow-relay               (yes|no|YES|NO) "no">

<!-- Static tunnels element. -->
<!ELEMENT static-tunnels        (tunnel*)>

<!-- Static tunnel. -->
<!ELEMENT tunnel                EMPTY>
<!ATTLIST tunnel
      type                      CDATA           "tcp"
      listen-address            CDATA           "127.0.0.1"
      listen-port               CDATA           #REQUIRED
      dst-host                  CDATA           "127.0.0.1"
      dst-port                  CDATA           #REQUIRED
      allow-relay               (yes|no|YES|NO) "no"
      profile                   CDATA           #REQUIRED>

<!-- GUI. -->
<!ELEMENT gui                   EMPTY>
<!ATTLIST gui
      hide-tray-icon            (yes|no|YES|NO) "no"
      show-exit-button          (yes|no|YES|NO) "yes"
      show-admin                (yes|no|YES|NO) "yes"
      enable-connector          (yes|no|YES|NO) "yes"
      show-security-notification (yes|no|YES|NO) "yes">
```

```
<!ELEMENT filter-engine         (network|dns|filter|rule)*>
<!ATTLIST filter-engine
      ip-generate-start         CDATA           "198.18.0.1"
      ip6-generate-start        CDATA           "2001:db8::ff00:42:8329"
      ftp-filter-at-signs       (yes|no|YES|NO) "no">

<!ELEMENT network               EMPTY>
<!ATTLIST network
      id                        ID              #REQUIRED
      address                   CDATA           #IMPLIED
      domain                    CDATA           #IMPLIED
      ip-generate-start         CDATA           #IMPLIED
      ip6-generate-start        CDATA           #IMPLIED>

<!ELEMENT dns                   EMPTY>
<!ATTLIST dns
      id                        ID              #REQUIRED
      network-id                IDREF           #IMPLIED
      application               CDATA           #IMPLIED
      host                      CDATA           #IMPLIED
      ip-address                CDATA           #IMPLIED
      pseudo-ip                 (yes|no|YES|NO) "no">

<!ELEMENT filter                EMPTY>
<!ATTLIST filter
      dns-id                    IDREF           #REQUIRED
      ports                     CDATA           #REQUIRED
      action                    (block|direct|tunnel|ftp-tunnel|ftp-proxy|
                                BLOCK|DIRECT|TUNNEL|FTP-TUNNEL|FTP-PROXY)
                                                #REQUIRED
      profile-id                CDATA           #IMPLIED
      destination               CDATA           #IMPLIED
      destination-port          CDATA           #IMPLIED
      fallback-to-plain         (yes|no|YES|NO) "no">

<!ELEMENT rule                  EMPTY>
<!ATTLIST rule
      application               CDATA           #IMPLIED
      host                      CDATA           #IMPLIED
      ip-address                CDATA           #IMPLIED
      pseudo-ip                 (yes|no|YES|NO) "no"
      ports                     CDATA           #REQUIRED
      action                    (block|direct|tunnel|ftp-tunnel|ftp-proxy|
                                BLOCK|DIRECT|TUNNEL|FTP-TUNNEL|FTP-PROXY)
                                                #REQUIRED
      profile-id                CDATA           #IMPLIED
      destination               CDATA           #IMPLIED
      destination-port          CDATA           #IMPLIED
      username                  CDATA           #IMPLIED
      hostname-from-app         (yes|no|YES|NO) "no"
```

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```
      username-from-app         (yes|no|YES|NO) "no"
      fallback-to-plain         (yes|no|YES|NO) "no"
      show-sftp-server-banner   (yes|no|YES|NO) "no">


<!ELEMENT logging               (log-target*,log-events*)>

<!-- Log events. -->
<!-- Log event facility. -->
<!ENTITY default-log-event-facility       "normal">

<!-- Log event severity. -->
<!ENTITY default-log-event-severity       "notice">

<!ELEMENT log-target            EMPTY>
<!ATTLIST log-target
      file                      CDATA                           #IMPLIED
      type                      (file|syslog|socket|discard)    "file"
      format                    (syslog|csv|xml)                "syslog" >

<!ELEMENT log-events            (log-target|#PCDATA)*>
<!ATTLIST log-events
      facility      (normal|daemon|user|auth|local0|local1|
                    local2|local3|local4|local5|local6|local7|discard)
                                                "&default-log-event-facility;"
      severity      (informational|notice|warning|error|critical|
                    security-success|security-failure)
                                                "&default-log-event-severity;">
```

Appendix B Command-Line Tools and Man Pages

Tectia Server for IBM z/OS contains several command-line tools. Their functionality is explained in the following appendices. The same information is also available in manual pages that are installed to `/opt/tectia/man`.

- ssh-broker-g3(1): Connection Broker – Generation 3
- ssh-broker-ctl(1): Connection Broker control utility
- ssh-broker-ctl probe-key(1) Connection Broker probe-key host-key utility
- ssh-troubleshoot(8): utility for collecting system information for troubleshooting purposes
- sshg3(1): Secure Shell terminal client – Generation 3
- scpg3(1): Secure Shell file copy client – Generation 3
- sftpg3(1): Secure Shell file transfer client – Generation 3
- ssh-translation-table(1): Secure Shell file transfer translation table
- ssh-sft-stage(1): stage and destage MVS data sets and HFS files
- ssh-keygen-g3(1): authentication key pair generator
- ssh-keydist-g3(1): Tectia key distribution tool
- ssh-keyfetch(1): utility for downloading server host keys
- ssh-cmpclient-g3(1): certificate CMP enrollment client
- ssh-scepclient-g3(1): certificate SCEP enrollment client
- ssh-certview-g3(1): certificate viewer
- ssh-ekview-g3(1): external key viewer

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For a description of the Connection Broker and SOCKS Proxy configuration file options, see ssh-broker-config(5).

Note

On the man pages, *Unix* is generally used to refer to all Unix-like operating systems, including Unix System Services (USS) of z/OS.

ssh-broker-g3

ssh-broker-g3 -- Tectia Connection Broker - Generation 3

Synopsis

`ssh-broker-g3 [-a, --broker-address=ADDR] [-f, --config-file=FILE] [-D, --debug=LEVEL] [-l, --debug-log-file=FILE] [--pid-file=FILE] [--console] [--exit] [-h] [-V]`

Note

The information presented here is also valid for the **ssh-socks-proxy** command. Running **ssh-socks-proxy**, will actually run **ssh-broker-g3** in the SOCKS Proxy mode, using the `ssh-socks-proxy-config.xml` configuration files and with connection caching disabled. The SOCKS Proxy uses a separate Connection Broker address that is meant only for transparent FTP tunneling and FTP-SFTP conversion. Normal clients (for example, **sshg3**) should not connect to that address.

Description

ssh-broker-g3 is a component of Tectia client tools for z/OS. It handles all cryptographic operations and authentication-related tasks for the Tectia client programs **sshg3**, **scpg3**, and **sftpg3**.

ssh-broker-g3 uses the Secure Shell version 2 protocol to communicate with a Secure Shell server.

You can start the Connection Broker manually by using the **ssh-broker-g3** command. This starts **ssh-broker-g3** in the background and all following uses of **sshg3**, **sftpg3**, or **scpg3** will connect via this instance of the Connection Broker instead of starting a new Broker session.

If a command-line client (**sshg3**, **sftpg3**, or **scpg3**) is started when the Connection Broker is not running in the background, the client starts the Broker in *run-on-demand* mode. In this mode, **ssh-broker-g3** will exit after the last client has disconnected.

If there is an **ssh-broker-g3** process running in the run-on-demand mode, and the Connection Broker is started from the command line, the new **ssh-broker-g3** process sends a message to the old **ssh-broker-g3** process to change from the run-on-demand mode to the background mode, keeping the Broker running after the clients disconnect.

The status of the running Connection Broker can be checked using the **ssh-broker-ctl** and **ssh-broker-gui** utilities.

Authentication

The Connection Broker operates automatically as an authentication agent, storing user's public keys and forwarding the authentication over Secure Shell connections. Key pairs can be created with `ssh-keygen-g3`.

The Connection Broker can also serve OpenSSH clients as an authentication agent.

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The public key pairs used for user authentication are by default stored in the `$HOME/.ssh2` directory. See the section called "Files" for more information.

The Connection Broker automatically maintains and checks a database containing the public host keys used for authenticating Secure Shell servers. When logging in to a server host for the first time, the host's public key is stored in the user's `$HOME/.ssh2/hostkeys` directory. See the section called "Files" for more information.

Options

The most important options of **ssh-broker-g3** are the following:

`-a, --broker-address=`*`ADDR`*
: Listens to Connection Broker connections on a local address *`ADDR`*.

`-D, --debug=`*`LEVEL`*
: Sets the debug level string to *`LEVEL`*.

`-f, --config-file=`*`FILE`*
: Reads the Connection Broker configuration file from *`FILE`* instead of the default location.

`-l, --debug-log-file=`*`FILE`*
: Dumps debug messages to *`FILE`*.

`--pid-file=`*`FILE`*
: Stores the process ID of the Connection Broker to *`FILE`*.

`--console`
: Runs the Connection Broker in console mode (in foreground) instead of daemon mode. Useful for debugging purposes. (Note: already running daemonized or run-on-demand Connection Broker has to be stopped or alternate broker address specified for debugging in console mode.)

`--exit`
: Make the currently running Connection Broker exit. This will terminate all connections.

`-V, --version`
: Displays program version and exits.

`-h, --help`
: Displays a short summary of command-line options and exits.

Environment Variables

In order to run **ssh-broker-g3** the following environment variables must be set:

_BPXK_AUTOCVT=`ON`

If this variable is not set correctly, **ssh-broker-g3** fails to start.

_BPXK_SHAREAS=`NO`

This variable defines that **ssh-broker-g3** and the client processes are run in separate address spaces.

The following optional environment variable is required in certain situations:

SSH_SECSH_BROKER=*`ADDRESS`*

This variable defines an address to a separate Tectia Connection Broker process to which a connection is made.

This variable becomes necessary to define the location of the Connection Broker process, if you are running it from a non-default location, or using a userID other than that of the **ssh-broker-g3** process owner.

The following environment variables are optional:

SSH_ZCONSOLE_MSGLEVEL=*`LEVEL`*

This variable specifies the amount of WTO messages that appear on the operator console. Possible values are:

- `0`: All WTO messages are shown.
- `1`: Unsolicited WTO messages are suppressed.
- `2`: All WTO messages are suppressed.

If this environment variable is not set, Unsolicited WTO messages are suppressed.

SSH_ZCONSOLE_ROUTING_CODE=*`CODE`*

This variable specifies the z/OS routing codes of WTO messages. Possible values are 1 to 128. The default value is `1,11`

Files

ssh-broker-g3 uses the following files:

`$HOME/.ssh2/ssh-broker-config.xml`

This is the user-specific configuration file used by **ssh-broker-g3** (and **sshg3**, **scpg3**, and **sftpg3**). The format of this file is described in ssh-broker-config(5). This file does not usually contain any sensitive information, but the recommended permissions are *read/write* for the user, and *not accessible* for others.

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`$HOME/.ssh2/random_seed`

This file is used for seeding the random number generator. It contains sensitive data and its permissions should be *read/write* for the user and *not accessible* for others. This file is created the first time the program is run and it is updated automatically. You should never need to read or modify this file.

`$HOME/.ssh2/identification`

This file contains information on public keys and certificates used for user authentication when contacting remote hosts.

With Tectia Client G3, using the `identification` file is not necessary if all user keys are stored in the default directory and you allow all of them to be used for public-key and/or certificate authentication. If the `identification` file does not exist, the Connection Broker attempts to use each key found in the `$HOME/.ssh2` directory. If the `identification` file exists, the keys listed in it are attempted first.

The identification file contains a list of private key filenames each preceded by the keyword `IdKey` (or `CertKey`). An example file is shown below:

```
IdKey       mykey
```

This directs the Connection Broker to use `$HOME/.ssh2/mykey` when attempting login using public-key authentication.

The files are by default assumed to be in the `$HOME/.ssh2` directory, but also a path to the key file can be given. The path can be absolute or relative to the `$HOME/.ssh2` directory. If there is more than one `IdKey`, they are tried in the order that they appear in the identification file.

```
IdKey       mykey
IdKey       pkcs11:ssz.tstusr.ssh2/000000AB
IdKey       pkcs11:ssz.tstusr.ssh2/000000AC
```

The above example file adds two private key objects in ICSF PKCS11 token ssz.tstusr.ssh2.

`$HOME/.ssh2/hostkeys`

This is the user-specific default directory for storing the public keys of server hosts. You are prompted to accept new or changed keys automatically when you connect to a server, unless you have set `strict-host-key-checking` to `yes` in the `ssh-broker-config.xml` file. You should verify the key fingerprint before accepting new or changed keys.

When the host key is received during the first connection to a remote host (or when the host key has changed) and you choose to save the key, its filename is stored by default in hashed format. The hashed host key format is a security feature to make address harvesting on the hosts difficult.

The storage format can be controlled with the `filename-format` attribute of the `known-hosts` element in the `ssh-broker-config.xml` configuration file. The attribute value must be `plain` or `hash` (default).

If you are adding the keys manually, the keys should be named with *key_<port>_<host>.pub* pattern, where *<port>* is the port the Secure Shell server is running on and *<host>* is the hostname you use when connecting to the server (for example, *key_22_alpha.example.com.pub*).

If both hashed and plain-text format keys exist, the hashed format takes precedence.

Note that the identification is different based on the host and port the client is connecting to. For example, the short hostname *alpha* is considered different from the fully qualified domain name *alpha.example.com*. Also a connection with an IP, for example *10.1.54.1*, is considered a different host, as is a connection to the same host but different port, for example *alpha.example.com#222*.

For more information on host keys, see Section 4.2.

`$HOME/.ssh2/hostkeys/salt`

This is the initialization file for hashed host key names.

`/opt/tectia/etc/ssh-tectia/auxdata/ssh-broker-ng/ssh-broker-config-default.xml`

This is the configuration file used by **ssh-broker-g3** (and **sshg3**, **scpg3**, and **sftpg3**) that contains the factory default settings. It is not recommended to edit the file, but you can use it to view the default settings. The format of this file is described in ssh-broker-config(5).

`/opt/tectia/etc/ssh-broker-config.xml`

This is the global (system-wide) configuration file used by **ssh-broker-g3** (and **sshg3**, **scpg3**, and **sftpg3**). The format of this file is described in ssh-broker-config(5).

`/opt/tectia/etc/hostkeys`

If a host key is not found in the user-specific `$HOME/.ssh2/hostkeys` directory, this is the next location to be checked for all users. Host key files are not automatically put here but they have to be updated manually by the system administrator (`root`).

If the administrator obtains the host keys by connecting to each host, the keys will be by default in the hashed format. In this case, also the administrator's `$HOME/.ssh2/hostkeys/salt` file has to be copied to the `/opt/tectia/etc/hostkeys` directory.

`/opt/tectia/etc/hostkeys/salt`

This is the initialization file for hashed host key names. The file has to be copied here manually by the same administrator that obtains the host keys.

`/etc/ssh/ssh_known_hosts`

This is the default system-wide file used by OpenSSH clients for storing the public key data of known server hosts. It is supported also by Tectia client tools for z/OS.

If a host key is not found in the user-specific `$HOME/.ssh/known_hosts` file, this is the next location to be checked for all users.

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The `ssh_known_hosts` file is never automatically updated by Tectia Client, since it always stores new host keys in the Tectia user-specific directory `$HOME/.ssh2/hostkeys`.

`$HOME/.ssh/known_hosts`

This is the default user-specific file used by OpenSSH clients for storing the public key data of known server hosts. The `known_hosts` file is supported also by Tectia client tools for z/OS.

The `known_hosts` file contains a hashed or plain-text format entry of each known host key and the port used on the server, in case it is non-standard (other than 22). For more information on the format of the `known_hosts` file, see the OpenSSH sshd(8) man page.

The `known_hosts` file is never automatically updated by Tectia Client, since it always stores new host keys in the Tectia directory `$HOME/.ssh2/hostkeys`.

`$HOME/.ssh2/authorized_keys` (on the server host)

This directory is the default location used by Tectia Server for the user public keys that are authorized for login.

On Tectia Server on Windows, the default directory for user public keys is `%USERPROFILE%\.ssh2\authorized_keys`.

`$HOME/.ssh2/authorization` (on the server host)

This is the default file used by earlier versions of Tectia Server (**sshd2**) that lists the user public keys that are authorized for login. The file can optionally be used with Tectia Server G3 (**ssh-server-g3**) as well.

On Tectia Server on Windows, the authorization file is by default located in `%USERPROFILE%\.ssh2\authorization`.

For information on the format of this file, see the ssh-server-g3(8) man page.

`$HOME/.ssh/authorized_keys` (on the server host)

This is the default file used by OpenSSH server (**sshd**) that contains the user public keys that are authorized for login.

For information on the format of this file, see the OpenSSH sshd(8) man page.

ssh-broker-ctl

ssh-broker-ctl -- Tectia Connection Broker control utility

Synopsis

`ssh-broker-ctl` *`command`*
[`options`...]

Note

The information presented here is also valid for the **ssh-socks-proxy-ctl** command. Running **ssh-socks-proxy-ctl** is otherwise equal to running **ssh-broker-ctl**, but the command controls the **ssh-socks-proxy** process instead of the **ssh-broker-g3** process. **ssh-socks-proxy-ctl** locates automatically the Connection Broker address that the **ssh-socks-proxy** process is using.

Description

ssh-broker-ctl is a control utility for the Connection Broker (**ssh-broker-g3**). It can be used, for example, to view the status of the Connection Broker, to stop the Connection Broker, to manage keys and certificates, and to manage connections.

Options

The following general options are available:

`-a, --broker-address` *`ADDRESS`*
: Defines an address to a separate Tectia Connection Broker process to which a connection is made.

The same effect can be achieved by defining a Connection Broker address with environment variable `SSH_SECSH_BROKER`.

Tip

If you are running **ssh-broker-ctl** using a userID other than that of the **ssh-broker-g3** process owner, the `-a` option must be given so that **ssh-broker-ctl** knows where to connect. In this case, you must also run **ssh-broker-ctl** as a privileged user (root).

For example, when user *`SSHBRKR`* owns the **ssh-broker-g3** process, run the **ssh-broker-ctl** with commands:

```
# ssh-broker-ctl -a /tmp/ssh-SSHBRKR/ssh-broker status -s
# ssh-broker-ctl -a /tmp/ssh-SSHBRKR/ssh-broker status --pid
# ssh-broker-ctl -a /tmp/ssh-SSHBRKR/ssh-broker list-connections
```

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`-D, --debug STR`
Defines the debug level.

`-e, --charset=CS`
Defines the character set to be used in the output. The supported character sets are `utf8`, `iso-8895-1`, `latin1`, `iso-8859-15`, `latin9`, and `ascii`.

`-q, --quiet`
Defines that little or no output is to be displayed, depending on the command.

`-s, --short`
Defines that a shorter, more machine readable, output format is to be used.

`--time-format=FMT`
Defines the time format to be used in the output. The default depends on the system locale settings.

`-v, --verbose`
Defines that more information, if available, is to be output.

`-V, --version`
Displays the version string.

`-w, --wide`
Defines that the output will not be truncated, even if it means long lines.

`-h, --help`
Displays a context-sensitive help text on command-line options. Help is available also on specific commands. For example, to get help on the `status` command, run:

```
$ ssh-broker-ctl status --help
```

Commands

Note

For a detailed description of the command options, use the command-specific `--help` option.

ssh-broker-ctl accepts the following commands:

`add-certificate [options] <certificate-file>`
Adds the given X.509 sub-CA certificate to the Connection Broker certificate cache. The certificate can be used in certificate validations but it is not stored permanently. Restarting the Connection Broker will remove the certificate.

`add-crl [options] <crl-file>`
Adds the given X.509 CRL to the Connection Broker CRL cache. The CRL can be used in certificate validations but it is not stored permanently. Restarting the Connection Broker will remove the CRL.

`add-key` *`filename`*

Adds a new private key from the given file name. The private key is not stored permanently in the configuration. Stopping the Connection Broker will remove the key.

`add-provider` *`type parameter`*

Registers a key provider to the Connection Broker. The `type` option is one of the supported provider types and the `parameter` option is a parameter string specific to the provider type.

For a list of the supported key provider types and the corresponding parameter formats, use the command-specific `--help` option.

`auth-handler` [`options`]

Registers itself as the default authentication form handler. All authentication prompts for clients that are unable to handle them (mostly SOCKS proxy and other tunnels) are directed to this client.

For a list of the supported key provider types and the corresponding parameter formats, use the command-specific `--help` option.

`close-channel` *`channel-id ...`*

Closes the defined channel. You can also enter multiple channel-IDs to close several channels.

`close-connection` *`connection-id ...`*

Closes the defined connection. You can also enter multiple connection-IDs to close several connections.

`close-tunnel-listener` *`tunnel-id ...`*

Closes open tunnel listener. Tunnel id is either the id number returned by **ssh-broker-ctl list-tunnel-listeners** command or a listen address and port pair separated by a colon. If the listen address is omitted, local listeners (127.0.0.1) are selected. As an example, the following command closes the listener with id 7, and the ones listening at 168.192.0.15 port 1234 and 127.0.0.1 port 2112:

```
$ ssh-broker-ctl ctl 7 168.192.0.15:1234 :2112
```

`config-value` [`options`] *`path`*

Retrieves configuration values from the Connection Broker based on the defined path and displays them.

`connection-status` [`--show-channels`] [`--write-hostkey=`*`FILE`*] *`connection-id`*

Displays a detailed connection status for the connection ID (the numeric identifier shown by the **list-connections**) command.

`connector` [`options`] [`enable|disable`]

Enables and disables the Connector functionality in the Connection Broker. Without parameters prints the current state.

`disconnect-client` *`client-id`*

Disconnects a Connection Broker client process.

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`debug` [`--append`] [`--clear`] [`--log-file=`*`file`*] [`--monitor`] [`--protocol-dump`] [*`debug-level`*]

Sets the Connection Broker debug level to the defined level. If no `debug-level` parameter is given here, the current debug level is not changed.

`keylog` [`--remove`] [`--all`] [`--update <`*`key-id`*`|`*`key-hash`*`>`] [`--init`] [`--uninit`] [`--close`] [`-v, --verbose`] [`key-id|key-hash|hostname`]

Keylog is used to manage uploaded public keys and to display a log of them. The Keylog does not store the public keys, it only stores information about the keys and the hosts where the keys have been uploaded to. The information can be used to manage the keys at a later stage, for example, to track hosts where a key has been uploaded to. The keylog is not on by default, it must be enabled first.

Without the options, displays a list of the uploaded keys. If a key or a hostname is specified, only the selected keys are displayed.

`key-passphrase` [`--all`] [`--clear`] [`--passphrase-file=`*`filename`*] [`--passphrase-string=`*`passphrase`*] [*`key-id`*`|`*`key-hash`*]

Prompts the user's private-key passphrase or PIN code.

`key-upload` [`options`] *`key`* [*`user@`*]*`server`* [*`#port`*]

Uploads the selected key (`key` can be a key ID number, a public key hash or a file name) into the authorized keys directory or file on the server, depending on the automatically detected upload method. After the operation, the key can be used in public-key authencation to log in to the server without a password. If the keylog is enabled, the command prompts for a keylog passphrase (if needed), and information about the public keys is stored in the key upload log.

For example, upload user public key file derived from private key object in ICSF PKCS11 token to remote host:

```
$ ssh-broker-ctl key-upload --kip --upload-method openssh \
/u/tstusr/.ssh2/PKCS11-SSZ_TSTUSR_SSH2-000000B5.pub ruser@remotehost
```

`list-connections` [`-c, --show-channels`] [`-s, --short`] [`--client-pid=`*`PID`*] [`--disconnected`]

Displays a list of the currently open connections together with connection parameters and traffic statistics. Displays also the connection ID which can used with other commands to identify the connection.

`list-channels` [`-s, --short`]

Displays a list of the currently open connection channels, together with channel type and traffic statistics. Displays also the channel ID which is used by other commands to identify the connection.

`list-clients` [`-c, --show-channels`] [`-s, --short`] [`--all`]

Displays a list of the currently connected client processes.

`list-keys` [`-s, --short`] [`--extra certificates`] [`--provider=`*`ID`*]

Displays a list of the user's private keys, together with the basic key attributes such as the key type, size, and possible file name or key provider information. Outputs also the fingerprint and the identifier of the key. The identifier is used by other Connection Broker commands to identify the private key.

`list-profiles` [`-s, --short`] [`-v, --verbose`] [*`name ...`*]

Displays a list of connection profiles in the Connection Broker. Shows the profile name and basic connection settings, such as the host and the user name. If profile names are given, only those profiles are listed.

`list-providers` [*`provider ...`*]

Displays a list of the key providers in the Connection Broker. If one or more provider names or ID numbers are given, only those providers will be listed. The provider name can be either a full provider name or a prefix.

`list-tunnel-listeners` [`options`]

Displays a list of the currently active tunnel listeners (also called port forwards).

`open-tunnel-listener` [`options`] *`listen-port`* [*`user@`*]*`server`* [*`#port`*] [*`dst-host`*] [*`dst-port`*]

Opens a tunnel listener, similar to **sshg3** `-L` and `-R` options. The difference is that **ssh-broker-ctl** will exit after the tunnel is opened. The tunnel status can be viewed with **ssh-broker-ctl list-tunnel-listeners** command and the tunnel can be closed with **ssh-broker-ctl close-tunnel-listener** command.

In local mode (default), the listener is opened to localhost listen-port. All connections will be tunneled through server and from there to the final destination address and port. Tunnel types `socks` and `socks-proxy` do not require destination information as it will be obtained from SOCKS client. Tunnel types `tcp`, `ftp` and `local` require destination information.

`pkcs10-sign` [`options`] *`key-id`* [*`subject-name`*]

Signs a PKCS#10 certificate request with the given key. The `key-id` can be either a key id or a key hash. The subject name parameter is required unless the `template` option is used. If the subject name is not a valid distinguished name, it will be wrapped automatically into a common name component. For example, a subject name string `My Name` will be converted to `CN=My Name`.

`probe-key` [`options`] [`--add-hostkey`] [`--save-hostkey`] [`--hostkey-fp=`*`fingerprint`*] [`--write-hostkey=`*`filename`*] *`address#port`*

Probes for a Secure Shell server hostkey. Connects to the given address and port (defaults to 22) and displays the server's public key or certificate.

For more details about the available options, see ssh-broker-ctl probe-key(1).

`remove-key` [`options`] *`key-id`*

Removes a private key permanently.

`remove-provider` [`--all`] *`provider-id`*

Removes a key provider from the Connection Broker.

`start`

Starts the Connection Broker in daemon mode if it is not already running.

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`status` [`-s, --short`] [`-q, --quiet`] [`--pid`] [`--all`]

Without parameters, displays short statistics and a configuration summary for the currently running Connection Broker process.

`stop`

Stops the Connection Broker.

`validate-certificate` [`options`] <*`certificate-file`*>

Validates the given X.509 certificate. If a host name is given, also checks if the certificate would be accepted as a host certificate for the host.

`view-key` [`-s, --short`] [`-v, --verbose`] [`--clear`] [`--write-key=` *`file`*] *`key-id`*

Displays information on the defined key. If the key has certificates, a short summary of them is also shown.

Environment Variables

In order to run **ssh-broker-ctl** the following environment variables must be set:

_BPXK_AUTOCVT=`ON`

If this variable is not set correctly **ssh-broker-ctl** fails to start.

ssh-broker-ctl probe-key

ssh-broker-ctl probe-key -- Tectia Connection Broker probe-key host-key utility

Synopsis

`ssh-broker-ctl probe-key` [`options`...]
`host`

Description

probe-key is a **ssh-broker-ctl** command for downloading server host keys, and for optionally setting them as known host keys for the Secure Shell client. It is typically used by the system administrator during the initial setup phase. **probe-key** is intended to be a preferred method over **ssh-keyfetch** for managing host keys and it supports the same crypto algorithms as the Secure Shell client.

Options

The following general options are available:

`--add-hostkey`
: If host key is found, automatically add host key as trusted.

Caution

When using either `--add-hostkey` or `--save-hostkey` options, received host keys are accepted automatically. To avoid potential man-in-the-middle attacks, we recommend verifying the key fingerprints before accepting them.

To only accept verified keys, obtain the expected host-key fingerprint from a trusted source (for example by calling the server administrator), and specify the expected host-key fingerprint with the `--hostkey-fp` option.

`--save-hostkey`
: If host key is found, automatically add host key as trusted, and remove any old host keys associated with the host.

Caution

When using either `--add-hostkey` or `--save-hostkey` options, received host keys are accepted automatically. To avoid potential man-in-the-middle attacks, we recommend verifying the key fingerprints before accepting them.

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To only accept verified keys, obtain the expected host-key fingerprint from a trusted source (for example by calling the server administrator), and specify the expected host-key fingerprint with the `--hostkey-fp` option.

`--hostkey-fp=`*`fingerprint`*

Save or add host key only if it matches the fingerprint. Cannot be used with `--write-hostkey`.

`--write-hostkey=`*`filename`*

Writes a public key or a certificate into a file.

Caution

If `--write-hostkey=`*`filename`* is specified in the format:

```
$home/.ssh2/hostkeys/key_port_hostname.pub
```

Then the host key is automatically accepted and all other options are ignored.

ssh-troubleshoot

ssh-troubleshoot -- tool for collecting system information

Synopsis

`ssh-troubleshoot` [`options`] [`command` [`command-options`]]

Description

ssh-troubleshoot is a tool for collecting information on the operating system (its version, patches, configuration settings, installed software components, and the current environment and state) and on the Tectia installation (installed product components and versions, their state, and the global and user-specific configurations).

The collected information will be stored in a file named `ssh_troubleshoot_<host>_<date>_<time>.tar` . Send the file to the SSH technical support for analysis to help in troubleshooting situations.

To get all necessary information, run the command as an administrator, because it might need root access to some directories.

The default location of this tool is `/opt/tectia/sbin/`, and that path should be set in the user's PATH. Otherwise `ssh-troubleshoot` can be run only by pointing directly to the executable file. In case you want to install Tectia tools to any non-default directory, for example to `/usr/lpp/tectia/`, you must set that directory in the user's PATH.

Options

Enter each option separately, they cannot be combined. The following options are available:

`-d, --debug` *`LEVEL`*
: Sets the debug level string to *`LEVEL`*.

`-k, --keep-going`
: Defines that the data collecting is continued as long as possible, even after errors are encountered.

`-o, --output` *`FILENAME`*
: Defines a non-default output file for storing the collected data.

  If *`FILENAME`* is '`-`', the collected data is added to the standard output. The default output file is created in a temporary archive directory and stored as `ssh-troubleshoot-data-<hostname>-<timestamp>.tar`. The timestamp is in format: `yyyymmdd-hhmmUTC`.

`-u, --user` *`USERNAME`*
: Defines another user for the **info** command, the default is the current user. This affects the home directory from which the user-specific Tectia configuration files are fetched.

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`-q, --quiet`
: Suppresses detailed reporting about the command progress, reports only errors.

`-h, --help`
: Displays this help text.

Commands

ssh-troubleshoot accepts the following command:

`info`
: Gathers information about the system configuration. The collected data will be stored as a `tar` file.

  Options:

  `--include-private-keys`
  : Collects everything from the specified user's configuration directories, including the private keys. By default, the private keys nor unrecognized files are not included in the result data.

sshg3

sshg3 -- Secure Shell terminal client - Generation 3

Synopsis

`sshg3` [`options`...]
`profile` | [*`user@`*] *`host`* [*`#port`*]
[*`command`*]

Description

sshg3 is a program for logging in to a remote machine and executing commands on a remote machine. **sshg3** provides secure, encrypted communication channels between two hosts over an unsecured network. It can be used to replace the unsecured **rlogin**, **rsh**, and **telnet** programs. Also X11 connections and arbitrary TCP/IP ports can be forwarded over secure channels with **sshg3**.

To connect to a remote host using **sshg3**, give either the name of a connection profile defined in the `ssh-broker-config.xml` file (*`profile`*) or the IP address or DNS name of the remote host, optionally with the remote user name and the port of the Secure Shell server (*`[user@]host[#port]`*). If no user name is given, the local user name is assumed. If no port is given, the default Secure Shell port 22 is assumed. The remote host must be running a Secure Shell version 2 server.

sshg3 acts as a Connection Broker client and launches the actual Connection Broker process, **ssh-broker-g3** as a transport (in run-on-demand mode), or uses an already running Connection Broker process. The Connection Broker will ask the user to enter a password or a passphrase if they are needed for authentication. Connection Broker uses the configuration specified in the `ssh-broker-config.xml` file.

When the user's identity has been accepted by the server, the server either executes the given command, or logs in to the machine and gives the user a normal shell. All communication with the remote command or shell will be automatically encrypted.

If no pseudo-tty has been allocated, the session is transparent and can be used to securely transfer binary data.

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 **sshg3**.

Agent Forwarding

ssh-broker-g3 acts as an authentication agent, and the connection to the agent is automatically forwarded to the remote side unless disabled in the `ssh-broker-config.xml` file or on the **sshg3** command line (with the `-a` option).

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TCP Port Forwarding

Forwarding of arbitrary TCP/IP connections over the secure channel can be specified either in the `ssh-broker-config.xml` file or on the **sshg3** command line (with the `-L` and `-R` options).

Options

Command-line options override the settings in the `ssh-broker-config.xml` file if the same option has been configured in both places. The following options are available:

`-a, --no-agent-forwarding`
: Disables authentication agent forwarding. In the factory settings, agent forwarding is enabled.

`+a`
: Enables authentication agent forwarding. In the factory settings, agent forwarding is enabled, but it can be denied in the Connection Broker configuration file, in which case users cannot enable it on the command-line and this `+a` will be ignored.

`-B, --batch-mode`
: Uses batch mode. Fails authentication if it requires user interaction on the terminal.

  Using batch mode requires that you have previously saved the server host key on the client and set up a non-interactive method for user authentication (for example, host-based authentication or public-key authentication without a passphrase).

`-C`
: Disables compression from the current connection.

`+C`
: Enables zlib compression for this particular connection.

`-c, --ciphers=`*`LIST`*
: Sets the allowed ciphers to be offered to the server. List the cipher names in a comma-separated list. For example:

```
--ciphers aes256-cbc
```

  Enter `help` as the value to view the currently supported cipher names.

`-D, --debug=`*`LEVEL`*
: Sets the debug level. *`LEVEL`* is a number from 0 to 99, where 99 specifies that all debug information should be displayed. This should be the first argument on the command line.

Note

The debug level can be set only when the **sshg3** command starts the Connection Broker. This option has no effect in the command if the Connection Broker is already running.

`-e, --escape-char=CHAR`
Sets escape character (none: disabled, default: ~).

`-g, --gateway`
Gateways ports, which means that also other hosts may connect to locally forwarded ports. This option has to be specified before the "`-L`" option. Note the logic of `+` and `-` in this option.

`+g`
Does not gateway ports. Listens to tunneling connections originating only from the localhost. This is the default value. Note the logic of `+` and `-` in this option.

`-i FILE`
Defines that private keys defined in the identification file are used for public-key authentication.

`-K, --identity-key-file=FILE`
Defines that the given key file of a private key or certificate is used in user authentication. The path to the key file is given in the command.

If the file is a private key, it will be read and compared to the keys already known by the Connection Broker key store. If the key is not known, it will be decoded and added to the key store temporarily. If the file is a certificate and Connection Broker knows a matching private key, it will be used. Both the certificate and the private key can be given using multiple `-K` options on command line.

`-L, --localfwd` [*protocol/*] [*listen-address:*] *listen-port:dst-host:dst-port*
Forwards a port on the local (client) host to a remote destination host and port.

This allocates a listener port (*listen-port*) on the local client. Whenever a connection is made to this listener, the connection is tunneled over Secure Shell to the remote server and another connection is made from the server to a specified destination host and port (*dst-host:dst-port*). The connection from the server onwards will not be secure, it is a normal TCP connection.

Giving the argument *protocol* enables protocol-specific forwarding. The protocols implemented are `tcp` (default, no special processing), `ftp` (temporary forwarding is created for FTP data channels, effectively securing the whole FTP session), and `socks`.

With the `socks` protocol, the syntax of the argument is "`-L` *socks/[listen-address:]listen-port*". When this is set, Tectia Client will act as a SOCKS server for other applications, creating forwards as requested by the SOCKS transaction. This supports both SOCKS4 and SOCKS5.

If *listen-address* is given, only that interface on the client is listened. If it is omitted, all interfaces are listened.

`-l, --user=USERNAME`
Logs in using this user name.

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`-m, --macs=LIST`

Sets the allowed MACs to be offered to the server. List the MAC names in a comma-separated list. For example:

```
--macs hmac-sha1-96
```

Enter `help` as the value to view the currently supported MAC names.

`-u, --kexs=kexs`

Sets the allowed key exchange (KEX) methods to be offered to the server. List the KEX names in a comma-separated list. For example:

```
--kexs diffie-hellman-group14-sha224@ssh.com,diffie-hellman-group14-sha256@ssh.com
```

Enter `help` as the value to view the currently supported KEX methods.

`-j, --hostkey-algs=algs`

Sets the allowed host key algorithms to be offered to the server. List the host key algorithms in a comma-separated list. For example:

```
--hostkey-algs ssh-dss-sha224@ssh.com,ssh-dss-sha256@ssh.com
```

Enter `help` as the value to view the currently supported host key algorithms.

`-n, --dev-null`

Redirects input from `/dev/null`.

`-o option`

Processes an option as if it was read from a Tectia Client 4.x-style configuration file. The supported options are `ForwardX11`, `ForwardAgent`, `AllowedAuthentications` and `PidFile`. For example, `-o "ForwardX11=yes"`. Also `-o "PidFile=/tmp/sshg3.pid"` makes sshg3 to store its process ID into file "/tmp/sshg3.pid" if it goes into background.

`-P, --password= PASSWORD | file://PASSWORDFILE | extprog://PROGRAM`

Sets user password that the client will send as a response to password authentication. The *PASSWORD* can be given directly as an argument to this option (not recommended). Better alternatives are entering a path to a file containing the password (`--password=file://PASSWORDFILE`), or entering a path to a program or script that outputs the password (`--password=extprog://PROGRAM`).

When using the `extprog://` option to refer to a shell script, make sure the script also defines the user's shell, and outputs the actual password. Otherwise the executed program fails, because it does not know what shell to use for the shell script. For example, if the password string is defined in a file named `my_password.txt`, and you want to use the bash shell, include these lines in the script:

```
#!/usr/bash
cat /full/pathname/to/my_password.txt
```

Caution

Supplying the password on the command line is not a secure option. For example, in a multi-user environment, the password given directly on the command line is trivial to recover from the process table. You should set up a more secure way to authenticate. For non-interactive batch jobs, it is more secure to use public-key authentication without a passphrase, or host-based authentication. At a minimum, use a file or a program to supply the password.

`-p, --port=`*`PORT`*

Connects to this port on the remote host. A Secure Shell server must be listening on the same port.

`-q`

Quiet mode, reports only fatal errors. This option overrides the `quiet-mode` setting made in the Connection Broker configuration file.

`-R, --remotefwd` [*`protocol/`*] [*`listen-address:`*] *`listen-port:dst-host:dst-port`*

Forwards a port on the remote (server) host to a destination host and port on the local side.

This allocates a listener port (*`listen-port`*) on the remote server. Whenever a connection is made to this listener, the connection is tunneled over Secure Shell to the local client and another connection is made from the client to a specified destination host and port (*`dst-host:dst-port`*). The connection from the client onwards will not be secure, it is a normal TCP connection.

Giving the argument *`protocol`* enables protocol-specific forwarding. The protocols implemented are `tcp` (default, no special processing) and `ftp` (temporary forwarding is created for FTP data channels, effectively securing the whole FTP session).

If *`listen-address`* is given, only that interface on the server is listened. If it is omitted, all interfaces are listened.

`-S, --no-session-channel`

Does not request a session channel. This can be used with port-forwarding requests if a session channel (and tty) is not needed, or the server does not give one.

`+S`

Requests a session channel. This is the default value.

`-s, --subsystem` *`subsystem remote_server`*

Sets a subsystem or a service to be invoked on the remote server. The subsystem is specified as a remote command. For example: `sshg3 -s sftp <server>`

`-t, --tty`

Allocates a tty even if a command is given.

`-v, --verbose`

Uses verbose mode. More information or error diagnostics are output if a connection fails.

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`-z, --broker-log-file=FILE`

Sets the Connection Broker log file to *FILE*. This option works only if **ssh-broker-g3** gets started by this process).

`--aa, --allowed-authentications=METHODS`

Defines the only allowed methods that can be used in user authentication. List the methods in a comma-separated list. For example:

```
--allowed-authentications keyboard-interactive,password
```

Enter `help` as the value to view the currently supported authentication methods.

`--abort-on-failing-tunnel`

Aborts if creating a tunnel listener fails (for example, if the port is already reserved).

`--charset-conversion=FORCE|NO`

Specifies whether character set conversion is to be performed. The default is `FORCE`.

`--compressions=METHODS`

Sets the allowed compression methods to be offered to the server. List the methods in a comma-separated list.

Enter `help` as the value to view the currently supported compression methods.

`--exclusive`

Defines that a new connection will be opened for each connection attempt, otherwise Connection Broker can reuse recently closed connections.

`--hostkey-policy=POLICY`

Defines the policy for checking server host keys and handling unknown server host keys. The possible values are:

- `ask` (default): The user will be asked to verify and accept the server host keys, if the keys are not found in the host key storage or if the keys have changed.
- `strict`: The connection to the server will be allowed only if the host key is found in the user's known host keys storage.
- `tofu`: Trust on first use; new host keys are stored without prompting the user to accept them.
- `advisory` (*not recommended*): New host keys are stored without prompting the user to accept them, and connections are allowed also to servers offering a changed host key.

Caution

Consider carefully before setting the policy to `advisory`. Disabling the host-key checks makes the connection vulnerable to attacks.

You can also configure the host key policy in the `ssh-broker-config.xml` configuration file with the `<auth-server-publickey>` element in the `default-settings` and per profile. See **auth-server-publickey**.

If this option is set on the command-line client and configured in the `ssh-broker-config.xml`, the command-line value will be used.

`--identity=ID`
Defines that the ID of the private key is used in user authentication. The ID can be Connection Broker-internal ordinary number of the key, the key hash or the key file name.

`--identity-key-hash ID`
Defines the private key used in user authentication with the corresponding public key hash.

`--identity-key-id ID`
Defines that the Connection Broker-internal ordinary number of the key is used in user authentication.

`--keep-alive=VALUE`
Defines how often keep-alive messages are sent to the Secure Shell server. Enter the value as seconds. The default value is 0, meaning that keep-alive messages are disabled.

`--kip`
Defines keyboard-interactive and password as the allowed methods for user authentication; the same as

```
--allowed-authentications keyboard-interactive,password
```

`--local-charset=VALUE`
The default is the character set specified in the user's (local) locale. If that is not available, the default is IBM-1047.

`--remote-charset=VALUE`
Defines the character set used on the remote end. The default is `UTF8`.

`--remote-environment name=VALUE`
When this option is used, the defined environment variables are passed to the server from the client side. The environment variables are applied on the server when requesting a command, shell or subsystem.

Note that the server can restrict the setting of environment variables.

You can also configure the environment variables to be passed to the server in the `ssh-broker-config.xml` configuration file with the `<remote-environment>` element in the `default-settings` and per profile. See **remote-environment**.

If the same variable is entered on the command-line client and configured in the `ssh-broker-config.xml`, the command-line version will be used.

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`--remote-environment-format name=VALUE`

The defined environment variables are passed to the server from the client side. The Connection Broker processes the value before sending it to the server.

You can use `%U` in the `value` to indicate a user name. The Connection Broker replaces the `%U` with the actual user name before sending it to the server.

For more information, see the `--remote-environment` option above.

`--tcp-connect-timeout=VALUE`

Defines a timeout period (in seconds) for establishing a TCP connection to the Secure Shell server. Enter the value as a positive number.

`-V, --version`

Displays program version and exits.

`-h, --help, -?`

Displays a short summary of command-line options and exits.

Commands

sshg3 can take as a command either of the following ones:

`remote_command [arguments] ...`

Runs the command on a remote host.

`-s service`

Enables a service in remote server.

Escape Sequences

sshg3 supports escape sequences to manage a running session. For an escape sequence to take effect, it must be typed directly after a newline character (press **Enter** first). The escape sequences are not displayed on screen during typing.

The following escape sequences are supported:

`~.`

Terminates the connection.

`~Ctrl-Z`

Suspends the session.

`~~`

Sends the escape character literally.

~#
: Lists forwarded connections.

~-
: Disables the escape character irrevocably.

~?
: Displays a summary of escape sequences.

~r
: Initiates rekeying manually.

~s
: Gives connection statistics, including server and client version, packets in, packets out, compression, key exchange algorithms, public-key algorithms, and symmetric ciphers.

~u
: Uploads the chosen public key automatically to the server. If the user has only one key, it will be uploaded. Otherwise the largest key with a name that matches `id_rsa_<size>_a` will be selected.

~U
: Uploads a public key to the server. A list of available keys is printed and the user is prompted to select one to be uploaded.

~c
: Gives statistics for individual channels (data window sizes etc). This is for debugging purposes.

~V
: Dumps the client version number to stderr (useful for troubleshooting).

Environment Variables

In order to run **sshg3** the following environment variables must be set:

_BPXK_AUTOCVT`=ON`
: If this variable is not set correctly **sshg3** fails to start.

_BPX_BATCH_UMASK`=0022`
: This variable defines the permissions for newly created files.

_BPXK_SHAREAS`=NO`
: This variable defines that **ssh-broker-g3** and **sshg3** processes are run in separate address spaces.

Upon connection, the Secure Shell server will automatically set a number of environment variables that can be used by **sshg3**. The exact variables set depend on the Secure Shell server. The following variables can be used by **sshg3**:

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HOME
The user's home directory.

LOGNAME
Synonym for `USER`; set for compatibility with systems using this variable.

MAIL
The user's mailbox.

PATH
Set to the default PATH, depending on the operating system or, on some systems, `/etc/environment` or `/etc/default/login`.

SSH_SOCKS_SERVER
The address of the SOCKS server used by **sshg3**.

SSH2_AUTH_SOCK
If this exists, it is used to indicate the path of a Unix-domain socket used to communicate with the authentication agent (or its local representative).

SSH2_CLIENT
Identifies the client end of the connection. The variable contains three space-separated values: client IP address, client port number, and server port number.

SSH2_ORIGINAL_COMMAND
This will be the original command given to **sshg3** if a forced command is run. It can be used, for example, to fetch arguments from the other end. This does not have to be a real command, it can be the name of a file, device, parameters or anything else.

SSH2_TTY
This is set to the name of the tty (path to the device) associated with the current shell or command. If the current session has no tty, this variable is not set.

TZ
The time-zone variable is set to indicate the present time zone if it was set when the server was started (the server passes the value to new connections).

USER
The name of the user.

For a list of varibles set by Tectia Server, see the ssh-server-g3(8) man page.

Exit Values

sshg3 returns the following values based on the result of the operation:

```
0     Operation was successful.
1     sshg3 has encountered an error,
      the reason is usually given in an error message.
```

When executing remote commands, **sshg3** exits with the status of the command run indicated with exit codes:

```
0     The remote command was run successfully.
127   The requested remote command was not found.
```

Note

When the command is run from JCL using BPXBATCH, the exit values are multiplied by 256.

Examples

Connect as the local user name to host *`remotehost`*, port 2222, and open shell:

```
$ sshg3 remotehost#2222
```

Connect to host using private key object stored in ICSF PKCS11 token *`remotehost`*, and open shell:

```
$ sshg3 -i pkcs11:ssz.tstusr.ssh2/00000002 ruser@remotehost
```

Connect to the host specified by the connection profile *`profile1`* in the `ssh-broker-config.xml` file, and run the `who` command (and exit after running the command):

```
$ sshg3 profile1 who
```

Connect as *`user`* to host *`remotehost`*, and open a local port forwarding from port 143 on the client to port 143 on *`imapserver`*. Do not open shell. Also other hosts may connect to the local port. The connection from *`remotehost`* to *`imapserver`* will not be secured:

```
$ sshg3 -L 143:imapserver:143 -g -S user@remotehost
```

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scpg3

scpg3 -- Secure Shell file copy client - Generation 3

Synopsis

`scpg3` [`options`...]
[*`src_profile`*: | [*`user@`*] *`src_host`* [*`#port`*]:] *`src_file`*...
[*`dst_profile`*: | [*`user@`*] *`dst_host`* [*`#port`*]:] *`dst_file_or_dir`*

Description

scpg3 is used to securely copy files over the network. **scpg3** launches **ssh-broker-g3** to provide a secure transport using the Secure Shell version 2 protocol. **ssh-broker-g3** will ask for passwords or passphrases if they are needed for authentication. **scpg3** uses the configuration specified in the `ssh-broker-config.xml` file.

Copies between two remote hosts are permitted. The remote host(s) must be running a Secure Shell version 2 server with the **sftp-server** (or **sft-server-g3**) subsystem enabled. Tectia Server has **sft-server-g3** enabled by default.

Any filename may contain a host, user, and port specification to indicate that the file is to be copied to or from that host ([*`user@`*] *`host`* [*`#port`*]). If no user name is given, the local user name is assumed. If no port is given, the default Secure Shell port 22 is assumed. Alternatively, a connection profile defined in the `ssh-broker-config.xml` file (*`profile`*) can be given.

Note

When entering a connection profile in the **scpg3** command, note that Tectia client tools for z/OS deduces the meaning of the argument differently depending on its format. If there is an `@` sign in the given attribute value, Tectia client tools for z/OS always interprets it to be `<username@hostname>`, i.e. not a profile.

Also, if there are dots in a profile name (for example `host.x.example.com`, the dots need to be escaped on command line. Enter `host\.x\.example\.com`, instead. Otherwise the profile name is taken as a host name and the current Windows user name is used for logging in.

The *`host`* parameter can optionally be enclosed in square brackets (**[]**) to allow the use of semicolons. The *`file`* argument can contain simple wildcards: asterisk (*****) for any number of any characters, and question mark (**?**) for any one character.

For information on special characters in file names, see the section called “Filename Support”.

Options

The following command-line parameters can be used to further specify the **scpg3** options.

`-4`

Defines that all connection-related DNS resolutions will be resolved as an IPv4 address.

`-6`

Defines that all connection-related DNS resolutions will be resolved as an IPv6 address.

`-a` [*arg*]

Transfers files using the ASCII mode, that is, newlines will be converted on the fly. For transfers between Tectia on z/OS and other hosts, this also enables automatic ASCII-EBCDIC conversions. See the **sftpg3 ascii** command in the section called "Commands".

If the server does not advertise the newline convention, and you are not using a host profile that specifies its host type, you can give **scpg3** a hint by giving an argument after `-a`. The default is to set the destination newline convention, but you can specify either one by prefixing the argument with `src:` or `dest:` for source or destination convention, respectively. The available conventions are `dos`, `unix`, and `mac`, using `\r\n`, `\n`, and `\r` as newlines, respectively. Note that there is no space between the `-a` and its argument. An example is shown below:

```
$ scpg3 -asrc:unix -adest:dos src_host:src_file dest_host:dest_file
```

To force the newline conventions, use these values: `force-dos`, `force-unix`, and `force-mac`. These settings force the newline mode irrespective of what the remote SSH server suggests to the SCP client.

`-B, --batch-mode`

Uses batch mode. Fails authentication if it requires user interaction on the terminal.

Using batch mode requires that you have previously saved the server host key on the client and set up a non-interactive method for user authentication (for example, host-based authentication or public-key authentication without a passphrase).

`-b` *`buffer_size_bytes`*

Defines the maximum buffer size for one SFTP protocol read or write request (default: *`32768`* bytes).

The maximum number of SFTP protocol read or write requests sent in parallel within the transfer of a single file can be specified with the `-N` option.

Note that when streaming (see `--streaming`) is used (as it is by default when transferring files larger than *`buffer_size_bytes`* to/from Tectia Server), this option is not used for defining buffer sizes.

`-C`

Disables compression from the current connection.

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`+C`

Enables zlib compression for this particular connection.

`-c, --ciphers=LIST`

Sets the allowed ciphers to be offered to the server. List the cipher names in a comma-separated list. For example:

```
--ciphers aes256-cbc
```

Enter `help` as the value to view the currently supported cipher names.

`-D, --debug=LEVEL`

Sets the debug level. *LEVEL* is a number from 0 to 99, where 99 specifies that all debug information should be displayed. This should be the first argument on the command line.

Note

The debug level can be set only when the **scpg3** command starts the Connection Broker. This option has no effect in the command if the Connection Broker is already running.

`-d`

Forces target to be a directory.

`-I, --interactive`

Prompts whether to overwrite an existing destination file (does not work with `-B`).

`-i FILE`

Defines that private keys defined in the identification file are used for public-key authentication.

`-K, --identity-key-file=FILE`

Defines that the given key file of a private key or certificate is used in user authentication. The path to the key file is given in the command.

If the file is a private key, it will be read and compared to the keys already known by the Connection Broker key store. If the key is not known, it will be decoded and added to the key store temporarily. If the file is a certificate and Connection Broker knows a matching private key, it will be used. Both the certificate and the private key can be given using multiple `-K` options on command line.

`-N max_requests`

Defines the maximum number of SFTP protocol read or write requests sent in parallel (default: 10).

The size of the buffer used in each read or write request can be specified with the `-b` option.

Note that this value applies within the transfer of a single file; it cannot be used to define the number of files sent in parallel.

When streaming (see `--streaming`) is used (as it is by default when transferring files larger than *buffer_size_bytes* specified with the `-b` option to/from Tectia Server), this option is not used.

`-O, --offset=` `r<offset>` | `w<offset>` | `l<length>` | `t<length>`

Sets offset. Offset `r<offset>` specifies the start offset in the source file. Offset `w<offset>` specifies the start offset in the destination file. Length `l<length>` specifies the amount of data to be copied. Truncate length `t<length>`, if given, specifies the length to which the destination file is truncated or expanded after the file data has been copied.

`-p`

Preserves the file permissions and the timestamps when both the source and the destination are on Unix file systems (including z/OS USS). Preserves the timestamps but not the file permissions, if either one, the source or the destination is on Windows. If the destination is on z/OS MVS, none will be preserved.

`-P port`

Connects to this Secure Shell port on the remote machine (default: *22*).

`-Q`

Does not show progress indicator. The effect of this option is the same as using `--progress-display=no`.

Do not use this option together with parameter `--statistics`.

`-q`

Uses quiet mode (only fatal errors are shown). This option overrides the `quiet-mode` setting made in the Connection Broker configuration file.

`-r`

Recurses subdirectories.

`-u, --unlink-source`

Removes source files after copying (file move).

`-v, --verbose`

Uses verbose mode (equal to `-D 2`).

`-W, --whole-file`

Does not try incremental checks. By default (if this option is not given), incremental checks are tried. This option can only be used together with the `--checksum` option.

`--aa, --allowed-authentications=METHODS`

Defines the only allowed methods that can be used in user authentication. List the methods in a comma-separated list. For example:

```
--allowed-authentications keyboard-interactive,password
```

Enter `help` as the value to view the currently supported authentication methods.

`--append`

Appends data to the end of the destination file.

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`--binary`

Uses binary transfer mode. If the server is Tectia Server for IBM z/OS, the server is requested not to perform ASCII to EBCDIC conversion, and the file is transferred using the Stream format. You can use the `--src-site` and `--dst-site` options to change the values.

`--checkpoint=b <bytes>`

Byte interval between checkpoint updates (default: 10 MB). This option can only be used when `--checksum=checkpoint`.

`--checkpoint=s <seconds>`

Time interval between checkpoint updates (default: *10* seconds). This option can only be used when `--checksum=checkpoint`.

`--checksum [ =yes | no | md5 | sha1 | md5-force | sha1-force | checkpoint ]`

Uses MD5 or SHA-1 checksums or a separate checkpoint database to determine the point in the file where file transfer can be resumed. Files smaller than *buffer_size_bytes* are not checked. Use `md5-force` or `sha1-force` with small files (default: `yes`, i.e. use SHA1 checksums in FIPS mode, MD5 checksums otherwise). Use checkpointing when transferring large files one by one.

`--compressions=METHODS`

Sets the allowed compression methods to be offered to the server. List the methods in a comma-separated list.

Enter `help` as the value to view the currently supported compression methods.

`--dst-site=PARAM`

Uses the specified site parameters with the destination files. See the **sftpg3 site** command in the section called "Commands".

`--exclusive`

Defines that a new connection will be opened for each connection attempt, otherwise Connection Broker can reuse recently closed connections.

`--fips`

Performs the checksums using the FIPS cryptographic library.

`--force-lower-case`

Destination filename will be converted to lowercase characters.

`--hostkey-algorithms=HOSTKEYALGORITHMS`

Sets the allowed host key algorithms to be offered to the server. List the host key algorithms in a comma-separated list. For example:

```
--hostkey-algorithms ssh-dss-sha224@ssh.com,ssh-dss-sha256@ssh.com
```

Enter `help` as the value to view the currently supported host key algorithms.

`--overwrite` [`=yes` | `no`]

Selects whether to overwrite existing destination file(s) (default: `yes`).

`--identity=`*`ID`*

Defines that the ID of the private key is used in user authentication. The ID can be Connection Broker-internal ordinary number of the key, the key hash or the key file name.

`--identity-key-hash=`*`ID`*

Defines the private key used in user authentication with the corresponding public key hash.

`--identity-key-id=`*`ID`*

Defines that the Connection Broker-internal ordinary number of the key is used in user authentication.

`--keep-alive=`*`VALUE`*

Defines how often keep-alive messages (non-operation packages) are sent to the Secure Shell server. Enter the value as seconds. The default value is 0, meaning that keep-alive messages are disabled.

`--kexs=`*`kexs`*

Sets the allowed key exchange (KEX) methods to be offered to the server. List the KEX names in a comma-separated list. For example:

```
--kexs diffie-hellman-group14-sha224@ssh.com,diffie-hellman-group14-sha256@ssh.com
```

Enter `help` as the value to view the currently supported KEX methods.

`--kip`

Defines keyboard-interactive and password as the allowed methods for user authentication; the same as

```
--allowed-authentications keyboard-interactive,password
```

`--macs=`*`LIST`*

Sets the allowed MACs to be offered to the server. List the MAC names in a comma-separated list. For example:

```
--macs hmac-sha1-96
```

Enter `help` as the value to view the currently supported MAC names.

`--password=` *`PASSWORD`* | `file://`*`PASSWORDFILE`* | `extprog://`*`PROGRAM`*

Sets user password that the client will send as a response to password authentication. The *`PASSWORD`* can be given directly as an argument to this option (not recommended). Better alternatives are entering a path to a file containing the password (`--password=file://`*`PASSWORDFILE`*), or entering a path to a program or script that outputs the password (`--password=extprog://`*`PROGRAM`*).

When using the `extprog://` option to refer to a shell script, make sure the script also defines the user's shell, and outputs the actual password. Otherwise the executed program fails, because it does not know what shell to use for the shell script. For example, if the password string is defined in a file named `my_password.txt`, and you want to use the bash shell, include these lines in the script:

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```
#!/usr/bash
cat /full/pathname/to/my_password.txt
```

Caution

Supplying the password on the command line is not a secure option. For example, in a multi-user environment, the password given directly on the command line is trivial to recover from the process table. You should set up a more secure way to authenticate. For non-interactive batch jobs, it is more secure to use public-key authentication without a passphrase, or host-based authentication. At a minimum, use a file or a program to supply the password.

`--prefix=PREFIX`

Adds a prefix to a filename during the file transfer. The prefix is removed after the file has been successfully transferred.

On z/OS, when applied to MVS data set names, the prefix is inserted after the High Level Qualifier (HLQ). In case you want the prefix to be a separate qualifier, include a dot at the end of the prefix:

```
--prefix=PREFIX.
```

`--retry`

Complete file transfer. To be used in situations where a file was only partially transferred. For retry to succeed, the target must contain some part of the source (may be a zero-sized part).

For example, if the partially-failed file-transfer command was:

```
$ scpg3 source target
```

Then to complete the transfer, you would give the command:

```
$ scpg3 --retry source target
```

`--suffix=SUFFIX`

Adds suffix SUFFIX to a filename during the file transfer. The prefix is removed after the file has been successfully transferred.

On z/OS, when applied to MVS data set names, the suffix will be appended to the last dataset name qualifier by default. In case you want the suffix to be a separate qualifier, include a dot at the beginning of the suffix:

```
--suffix=.SUFFIX
```

`--src-site=PARAM`

Uses the specified site parameters with the source files. See the **site** command in the section called "Commands".

`--statistics` [`=no` | `yes` | `simple`]

Note

In release 6.1.5, the behavior of the `--statistics` option has changed and the `--statistics-format` option has been removed. Instead of them, use the new `--summary-display` and `--summary-format` options.

The `--statistics` option chooses the style of the statistics to be shown after a file transfer operation. Note that `--statistics` and `--summary-display` must not be used together.

The `--statistics` option takes the following values:

`no` - no statistics will be created.

`yes` - shows a progress bar during the file transfer. This is the default. An example of the output:

```
scpg3 --statistics="yes" sourcefile destinationfile
sourcefile                 |  127MB |  42.9MiB/s | TOC: 00:00:03 | 100%
```

`simple` - simple one-line statistics will be displayed after the file transfer has ended. For example:

```
scpg3 --statistics=simple sourcefile destinationfile
sourcefile   | 127MB | 151.3MiB/s | TOC: 00:00:00 | 100%
```

`--summary-display` [`=no` | `yes` | `simple` | `bytes`]

Chooses the style of the file transfer summary data to be displayed after a file transfer operation. With the summary display, the progress bar data is also displayed by default.

Note that `--summary-display` and `--statistics` must not be used together.

The `--summary-display` option takes the following values:

`no` - no summary data will be created. This is the default.

`yes` - detailed summary data will be created. You can configure the contents with the `summary-format` option. By default, the following contents are displayed in the summary:

```
Default settings:                     Render for example this:
"Source: %c:%g\n"                     user@host1#22:/path/to/source/file
"Source parameters: %e\n"             X=TEXT, C=ISO8859-1,D=IBM.1047
"Destination: %C:%G\n"                user@host2#22:/path/to/destination/file
"Destination parameters: %E\n"        NONE
"File size: %s bytes\n"               123456 bytes
"Transferred: %t bytes\n"             123456 bytes
"Rate: %RB/s\n"                       345kiB/s
"Start: %x(%Y-%m-%d %H:%M:%S)\n"      2010-01-26 13:10:56
"Stop: %X(%Y-%m-%d %H:%M:%S)\n"       2010-01-26 13:23:30
"Time: %y\n"                          00:12:34
```

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`simple` - simple one-line summary will be displayed. For example:

```
scpg3 --summary-display=simple sourcefile destinationfile
sourcefile | 127MB | 151.3MiB/s | TOC: 00:00:00 | 100%
```

`bytes` - basic statistics reporting the transferred bytes will be displayed. For example:

```
scpg3 --summary-display=bytes sourcefile destinationfile
Transferred 12915145984 bytes, file: 'sourcefile' -> 'destinationfile'
```

`--summary-format=` *`FORMAT_STRING`*

Chooses the format and the contents of the summary. You can use this option when `--summary-display=yes`. Do not use this option with `--statistics`.

Select the contents for the summary using the following definitions:

```
%c  - source connection: user@host#port or profile
%C  - destination connection: user@host#port or profile
%D* - current date
%e  - source parameters (file transfer and data set parameters)
%E  - destination parameters (file transfer and data set parameters)
%f  - source file name
%F  - destination file name
%g  - /path/to/source/file
%G  - /path/to/destination/file
%k  - compression done ("zlib" or "none")
%p  - transfer percentage
%q  - transfer rate in bit/s
%Q  - transfer rate as "XXyb/s" (b/s, kib/s, Mib/s, Gib/s)
%r  - transfer rate in bytes/s
%R  - transfer rate as "XXyB/s" (B/s, kiB/s, MiB/s, GiB/s)
%s  - file size in bytes
%S  - file size as "XXyB" (B, kiB, MiB or GiB)
%t  - transfer size in bytes
%T  - transfer size as "XXyB" (B, kiB, MiB or GiB)
%x* - start date
%X* - end date
%y  - elapsed time
%Y  - time remaining
%z  - ETA or TOC, if transfer has finished
%Z  - string "ETA" or "TOC", if transfer has finished

Where * is one of the following:

h - hours (00-23)
m - minutes (00-59)
s - seconds (00-59)
f - milliseconds (0-999)
d - day of the month (1-31)
t - month (1-12)
y - year (1970-)
```

```
Other special characters in format strings are:

\n - line feed
\r - carriage return
\t - horizontal tab
\\ - backslash
```

`--progress-display` [`=no` | `bar` | `line`]

Chooses the mode of displaying the progress during a file transfer operation. The default is `bar`, which shows a progress bar. Option `line` shows the progress information according to the settings made in the `--progress-line-format` option.

Do not use this option with `--statistics`.

`--progress-line-format=`*`FORMAT_STRING`*

Chooses what information will be shown on the progress line. You can use this option when `--progress-display=line`.

Do not use this option with `--statistics`.

Select the contents for the progress line using the definitions described for command: `--summary-format`

`--progress-line-interval=`*`seconds`*

Defines how often the progress information is updated in line mode. The interval is given in seconds, and the default is 60 seconds.

Do not use this option with `--statistics`.

`--streaming` [`=yes` | `no` | `force` | `ext`]

Uses streaming in file transfer, if server supports it. Files smaller than *`buffer_size_bytes`* are not transferred using streaming. Use `force` with small files. Default: `yes`

Use `ext` with z/OS hosts to enable direct MVS data set access. Use this option only when the file transfer is mainly used for mainframe data set transfers, as it can slow down the transfer of small files in other environments.

The `--streaming=ext` option requires also the `--checksum=no` option, because if checksums are calculated, the file transfer uses staging, which excludes streaming.

`--sunique`

Stores data sets with unique names. In case more than one of the transferred data sets have the same name, this feature adds a sequential number to the end of the repeated data set name, for example: `DS.version`, `DS.version1`, and `DS.version2`.

`--tcp-connect-timeout=`*`VALUE`*

Defines a timeout period (in seconds) for establishing a TCP connection to the Secure Shell server. Enter the timeout value as a positive number. Value 0 (zero) disables this feature and the default system TCP timeout will be used, instead.

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`--user=USERNAME`
: Logs in using this user name if the user name is not provided in the address string.

`-V, --version`
: Displays program version and exits.

`-X, --display-conn-summary`
: Display client status for established connection

  You can also configure the displaying of the connection summary in the `ssh-broker-config.xml` configuration file with the `<display-connection-summary>` element in the `default-settings` and per profile. See **display-connection-summary**.

`-h, --help, -?`
: Displays a short summary of command-line options and exits.

Filename Support

Different operating systems allow different character sets in filenames. On Unix, some of the special characters are allowed in filenames, but on Windows, the following characters are not allowed:

```
\/ : * ? " < > |
```

When you use the **scpg3** command to copy files with special characters (for example `unixfilename*?".txt`) from a Unix server to Windows, you need to provide the files with new names that are acceptable on Windows. Enter the commands in the following format:

```
$ scpg3 user@unixserver:"unixfilename~*~?\".txt" windowsfilename.txt
```

The general rule is to follow your platform specific syntax when you enter filenames containing special characters as arguments to the **scpg3** command.

Tectia fully supports filenames containing only ASCII characters. Filenames containing characters from other character sets are not guaranteed to work.

Using Wildcards

The **scpg3** command supports `*` and `?` as wildcards.

The wildcards can be used both on the remote and the local side in the commands. The following example command will copy all text files (`*.txt`) from all subdirectories of directory `dir2` whose names begin with the prefix `data-` into the current local directory (`.`):

```
$ scpg3 -r user@server:"dir2/data-*/*.txt" .
```

Note that on Unix, the characters ***** and **?** can appear also in the filenames. So it is necessary to use escape characters to distinguish the wildcards from the characters belonging to a filename. See more information in the section called “Escaping Special Characters”.

Escaping Special Characters

Some special characters that are used in filenames in different operating system, may have a special meaning in the Tectia commands. Note also that the meaning can be different in various parts of the file transfer system.

In the **scpg3** command, the following characters have a special meaning, and they need to be escaped in commands that take filenames as arguments:

***** asterisk is a wildcard for any number of any characters

? question mark is a wildcard for any single character

`""` quotation marks placed around strings that are to be taken 'as is'

\ backslash is an escape character on Unix

~ tilde is an escape character on Windows.

The escape character tells the **scpg3** command to treat the next character "as is" and not to assume any special meaning for it. The escape character is selected according to the operating system of the local machine.

Note that the \ and ~ characters are special characters themselves, and if they are present in the filename, escape characters must be placed in front of them, too. Therefore, if you need to enter a filename containing \ in Unix or ~ in Windows to the **scpg3** command, add the relevant escape character to it:

\\ on Unix

~~ on Windows

See the examples below to learn how the escape characters are used in the Tectia **scpg3** command, and how to enter filenames with special characters in different operating systems.

Examples of filenames in the **scpg3** command:

The following filenames are valid in Unix, but they need escape characters in the commands:

```
file|name.txt
file-"name".txt
file?name.txt
file*name.txt
file\name.txt
file - name.txt
file~name.txt
```

When using the **scpg3** command on Unix, in certain cases several escape characters are needed, as they escape one another. Enter the above mentioned filenames in the following formats:

```
file\|name.txt     or  "file|name.txt"
file-\"name\".txt
file\\\?name.txt   or  "file\?name.txt"
file\\\*name.txt   or  "file\*name.txt"
```

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```
file\\\\name.txt   or  "file\\\name.txt"
file\ -\ name.txt  or  "file - name.txt"
file~name.txt
```

Example commands on Unix:

```
$ scpg3 user@server:file\\\*name.txt .
```

```
$ scpg3 user@server:file\ -\ name.txt .
```

Environment Variables

To run **scpg3** on z/OS, the following environment variables must be set:

_BPXK_AUTOCVT=`ON`
: If this variable is not set correctly **scpg3** fails to start.

_BPX_BATCH_UMASK=`0022`
: This variable defines the permissions for newly created files.

_BPXK_SHAREAS=`NO`
: This variable defines that **ssh-broker-g3** and **scpg3** processes are run in separate address spaces.

scpg3 uses the following environment variables:

SSH_DEBUG_FMT
: This environment variable can be used to specify the format of the debug messages.

  For more information, see **SSH_DEBUG_FMT** .

SSH_SFTP_CHECKSUM_MODE=`yes|no|md5|sha1|md5-force|sha1-force|checkpoint`
: Defines the setting for comparing checksums. For more information on the available values, see **checksum**.

SSH_SFTP_HOME_MVS=`yes|no`
: If this variable is set to `yes`, the **scpg3** local directory is set to USER prefix in the MVS side. If it is set to `no` (default), local directory is the current directory. For more information, see the section called "Setting the File Transfer Home Location"

SSH_SFTP_SHOW_BYTE_COUNT=`yes|no`
: If this variable is set to `yes`, the number of transferred bytes is shown after successful file transfer. Also the names of source and destination files are shown. The default is `no`.

SSH_SFTP_SMF_TYPE=`TYPE119|none`
: If this variable is set to `TYPE119`, file transfers create SMF records of type 119.

SSH_SFTP_STATISTICS=`yes|no|simple`

If this variable is set to `yes` (default), normal progress bar is shown while transferring the file. If it is set to `no`, progress bar is not shown. If it is set to `simple` file transfer statistics are shown after the file has been transferred.

Files

In addition to the files used by **ssh-broker-g3**, **scpg3** uses the following files:

`$HOME/.ssh2/ssh_ftadv_config`

This is the user-specific file that contains a list of file transfer profiles, which furnish file transfer attributes to be used when processing local files. For more information, see Section 10.4.2.

`/opt/tectia/etc/ssh_ftadv_config`

This is the global (system-wide) file that contains a list of file transfer profiles, which furnish file transfer attributes to be used when processing local files. For more information, see Section 10.4.2.

Exit Values

scpg3 returns the following values based on the result of the operation:

```
0     Operation was successful.
1     Internal error.
2     Connection aborted by the user.
3     Destination is not a directory, but a directory was specified by the user.
4     Connecting to the host failed.
5     Connection lost.
6     File does not exist.
7     No permission to access file.
8     Undetermined error from sshfilexfer.
11    Some non-fatal errors occured during a directory operation.
101   Wrong command-line arguments specified by the user.
```

Note

When the command is run from JCL using BPXBATCH, the exit values are multiplied by 256.

Examples

Copy files from your local system to a remote Unix system:

```
$ scpg3 localfile user@remotehost:/dst/dir/
```

Copy files from your local system to a remote Windows system:

```
$ scpg3 localfile user@remotehost:/C:/dst/dir/
```

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Copy files from a remote system to your local disk:

```
$ scpg3 user@remotehost:/src/dir/srcfile /dst/dir/dstfile
```

Copy files from one remote system to another using connection profiles defined in the `ssh-broker-config.xml` file:

```
$ scpg3 profile1:/src/dir/srcfile profile2:/dst/dir/dstfile
```

Copy file from a remote system to local file system using ASCII translation using private key object store in ICSF PKCS11 token:

```
$ scpg3 -a -i pkcs11:ssz.tstusr.ssh2/00000001 ruser@rhost:readme lreadme
```

sftpg3

sftpg3 -- Secure Shell file transfer client - Generation 3

Synopsis

`sftpg3` [`options`...]
[*`profile`* | [*`user@`*] *`host`* [*`#port`*]]

Description

sftpg3 is an FTP-like client that can be used for secure file transfer over the network. **sftpg3** launches **ssh-broker-g3** to provide a secure transport using the Secure Shell version 2 protocol. **ssh-broker-g3** will ask for passwords or passphrases if they are needed for authentication. **sftpg3** uses the configuration specified in the `ssh-broker-config.xml` file.

When started interactively, **sftpg3** displays a prompt where the SFTP commands can be entered. It is also possible to start **sftpg3** non-interactively with a batch file that contains the commands to be run. For information on the available commands, see the section called "Commands".

As an alternative to using the command line to set default values for various parameters, it is possible to define the commands in a startup batch file that is run each time **sftpg3** is started. By default, **sftpg3** looks for a file named `ssh_sftp_batch_file` in the user-specific directory `$HOME/.ssh2/` on Unix or `%APPDATA%\SSH\` on Windows.

sftpg3 has two connection end points, local and remote, and both of them can be connected to other hosts than the SFTP client host. If started without arguments, the local end point is connected to the file system of the SFTP client host and the remote end point is unconnected. The connected host(s), with the exception of the SFTP client host, must be running a Secure Shell version 2 server with the **sftp-server** (or **sft-server-g3**) subsystem enabled. Tectia Server has **sft-server-g3** enabled by default.

The remote connection end point can be given directly as an argument to the **sftpg3** command or it can be given with the **open** SFTP command after **sftpg3** has started. The local connection end point can be given with the **lopen** SFTP command.

When connecting, you can give either the name of a connection profile defined in the `ssh-broker-config.xml` file (*`profile`*) or the IP address or DNS name of the remote host, optionally with the remote user name and the port of the Secure Shell server ([*`user@`*] *`host`* [*`#port`*]). If no user name is given, the local user name is assumed. If no port is given, the default Secure Shell port 22 is assumed.

Note

When entering a connection profile in **sftpg3**, note that Tectia client tools for z/OS deduces the meaning of the argument differently depending on its format. If there is an @ sign in the given at-

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tribute value, Tectia client tools for z/OS always interprets it to be `<username@hostname>`, i.e. not a profile.

Also, if there are dots in a profile name (for example `host.x.example.com`, the dots need to be escaped on command line. Enter `host\.x\.example\.com`, instead. Otherwise the profile name is taken as a host name and the current local user name is used for logging in.

For information on special characters in filenames, see the section called "Filename Support".

Options

The following options are available:

`-4`

Defines that all connection-related DNS resolutions will be resolved as an IPv4 address.

`-6`

Defines that all connection-related DNS resolutions will be resolved as an IPv6 address.

`-b` *`buffer_size_bytes`*

Defines the maximum buffer size for one SFTP protocol read or write request (default: *`32768`* bytes).

The maximum number of SFTP protocol read or write requests sent in parallel within the transfer of a single file can be specified with the `-N` option.

Note that when streaming (see `--streaming`) is used (as it is by default when transferring files larger than *`buffer_size_bytes`* to/from Tectia Server), this option is not used for defining buffer sizes.

`-B` [`-` | *`batch_file`*]

The `-B -` option enables reading from the standard input. This option is useful when you want to launch processes with **sftpg3** and redirect the stdin pipes.

By defining the name of a *`batch_file`* as an attribute, you can execute SFTP commands from the given file in batch mode. The file can contain any allowed SFTP commands. For a description of the commands, see the section called "Commands".

Using batch mode requires that you have previously saved the server host key on the client and set up a non-interactive method for user authentication (for example, host-based authentication or public-key authentication without a passphrase).

`-C`

Disables compression from the current connection.

`+C`

Enables zlib compression for this particular connection.

`-c, --ciphers=LIST`

Sets the allowed ciphers to be offered to the server. List the cipher names in a comma-separated list. For example:

```
--ciphers aes256-cbc
```

Enter `help` as the value to view the currently supported cipher names.

`-D, --debug=LEVEL`

Sets the debug level. *LEVEL* is a number from 0 to 99, where 99 specifies that all debug information should be displayed. This should be the first argument on the command line.

Note

The debug level can be set only when the **sftpg3** command starts the Connection Broker. This option has no effect in the command if the Connection Broker is already running.

`-i FILE`

Defines that private keys defined in the identification file are used for public-key authentication.

`-K, --identity-key-file=FILE`

Defines that the given key file of a private key or certificate is used in user authentication. The path to the key file is given in the command.

If the file is a private key, it will be read and compared to the keys already known by the Connection Broker key store. If the key is not known, it will be decoded and added to the key store temporarily. If the file is a certificate and Connection Broker knows a matching private key, it will be used. Both the certificate and the private key can be given using multiple `-K` options on command line.

`-N max_requests`

Defines the maximum number of SFTP protocol read or write requests sent in parallel (default: 10).

The size of the buffer used in each read or write request can be specified with the `-b` option.

Note that this value applies within the transfer of a single file; it cannot be used to define the number of files sent in parallel.

When streaming (see `--streaming`) is used (as it is by default when transferring files larger than *buffer_size_bytes* specified with the `-b` option to/from Tectia Server), this option is not used.

`-P port`

Connects to this Secure Shell port on the remote machine (default: *22*).

`-q, --quiet`

Suppresses the printing of error, warning, and informational messages. This option overrides the `quietmode` setting made in the Connection Broker configuration file.

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`-v, --verbose`

Uses verbose mode (equal to `-D 2`).

`--aa, --allowed-authentications=METHODS`

Defines the only allowed methods that can be used in user authentication. List the methods in a comma-separated list. For example:

```
--allowed-authentications keyboard-interactive,password
```

Enter `help` as the value to view the currently supported authentication methods.

`--compressions=METHODS`

Sets the allowed compression methods to be offered to the server. List the methods in a comma-separated list.

Enter `help` as the value to view the currently supported compression methods.

`--exclusive`

Defines that a new connection will be opened for each connection attempt, otherwise Connection Broker can reuse recently closed connections.

`--fips`

Performs the checksums using the FIPS cryptographic library.

`--hostkey-algorithms=algorithms`

Sets the allowed host key algorithms to be offered to the server. List the host key algorithms in a comma-separated list. For example:

```
--hostkey-algorithms ssh-dss-sha224@ssh.com,ssh-dss-sha256@ssh.com
```

Enter `help` as the value to view the currently supported host key algorithms.

`--identity=ID`

Defines that the ID of the private key is used in user authentication. The ID can be Connection Broker-internal ordinary number of the key, the key hash or the key file name.

`--identity-key-hash=ID`

Defines the private key used in user authentication with the corresponding public key hash.

`--identity-key-id=ID`

Defines that the Connection Broker-internal ordinary number of the key is used in user authentication.

`--keep-alive=VALUE`

Defines how often keep-alive messages are sent to the Secure Shell server. Enter the value as seconds. The default value is 0, meaning that keep-alive messages are disabled.

`--kexs=kexs`

Sets the allowed key exchange (KEX) methods to be offered to the server. List the KEX names in a comma-separated list. For example:

```
--kexs diffie-hellman-group14-sha224@ssh.com,diffie-hellman-group14-sha256@ssh.com
```

Enter `help` as the value to view the currently supported KEX methods.

`--kip`

Defines keyboard-interactive and password as the allowed methods for user authentication; the same as

```
--allowed-authentications keyboard-interactive,password
```

`--macs=LIST`

Sets the allowed MACs to be offered to the server. List the MAC names in a comma-separated list. For example:

```
--macs hmac-sha1-96
```

Enter `help` as the value to view the currently supported MAC names.

`--password=` *PASSWORD* | `file://`*PASSWORDFILE* | `extprog://`*PROGRAM*

Sets the user password or passphrase that the client will send as a response to an authentication method requesting a password or passphrase (hereafter: password). This can be used also with password-protected certificates and public-keys.

The *PASSWORD* can be given directly as an argument to this option (not recommended). Better alternatives are entering a path to a file containing the password (`--password=file://`*PASSWORDFILE*), or entering a path to a program or script that outputs the password (`--password=extprog://`*PROGRAM*).

When using the `extprog://` option to refer to a shell script, make sure the script also defines the user's shell, and outputs the actual password. Otherwise the executed program fails, because it does not know what shell to use for the shell script. For example, if the password string is defined in a file named `my_password.txt`, and you want to use the bash shell, include these lines in the script:

```
#!/usr/bash
cat /full/pathname/to/my_password.txt
```

Caution

Supplying the password on the command line is not a secure option. For example, in a multi-user environment, the password given directly on the command line is trivial to recover from the process table. You should set up a more secure way to authenticate. For non-interactive batch jobs, it is more secure to use public-key authentication without a passphrase, or host-based authentication. At a minimum, use a file or a program to supply the password.

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`--tcp-connect-timeout=VALUE`

Defines a timeout period (in seconds) for establishing a TCP connection to the Secure Shell server. Enter a timeout value as a positive number. Value 0 (zero) disables this feature and the default system TCP timeout will be used, instead.

`--user=USERNAME`

USERNAME will be used in the logon if the user name is not specified in the address string.

`-V, --version`

Displays program version and exits.

`-X, --display-conn-summary`

Display client status for established connection

You can also configure the displaying of the connection summary in the `ssh-broker-config.xml` configuration file with the `<display-connection-summary>` element in the `default-settings` and per profile. See **display-connection-summary**.

`-h, --help, -?`

Displays a short summary of command-line options and exits.

Commands

When **sftpg3** is ready to accept commands, it will display the prompt `sftp>`. The user can then enter any of the following commands:

`!`	`append`	`ascii`	`auto`	`binary`
`break`	`cd`	`chmod`	`close`	`continue`
`debug`	`delete`	`digest`	`echo`	`exit`
`get`	`getext`	`help`	`helpall`	`lappend`
`lcd`	`lchmod`	`lclose`	`ldelete`	`ldigest`
`lls`	`llsroots`	`lmkdir`	`localopen`	`locsite`
`lopen`	`lpwd`	`lreadlink`	`lrename`	`lrm`
`lrmdir`	`ls`	`lsite`	`lsroots`	`lsymlink`
`mget`	`mkdir`	`mput`	`open`	`pause`
`put`	`pwd`	`quit`	`readlink`	`rename`
`rm`	`rmdir`	`set`	`setext`	`sget`
`site`	`sput`	`sunique`	`symlink`	`type`
`verbose`				

`!` [*command*] [*arguments*]

Invokes an interactive shell on the local machine. if a *command* is given, it is used as the command to be executed. Optional *arguments* can be given depending on the command.

`append` [`-u, --unlink-source`] [`--streaming`] [`--force-lower-case`] [`--statistics`] [`--summary-display`] [`--summary-format`] [`--progress-display`] [`--progress-line-format`] [`--progress-line-interval`] *`srcfile`* [*`dstfile`*]

Appends the specified local file to the remote file. No globbing can be used.

Options:

`-u, --unlink-source`

Removes the source file after file transfer.

`--streaming` [`=yes` | `no` | `force` | `ext`]

Uses streaming in file transfer if the server supports it. Files smaller than *`buffer_size_bytes`* are not transferred using streaming. Use `force` with small files. Default: `yes`

Use `ext` with z/OS hosts to enable direct MVS data set access. Use this option only when the file transfer is mainly used for mainframe data set transfers, as it can slow down the transfer of small files in other environments.

The `--streaming=ext` option requires also the `--checksum=no` option, because if checksums are calculated, the file transfer uses staging, which excludes streaming.

`--force-lower-case`

Destination filename will be converted to lowercase characters.

The semantics of options `--statistics`, `--summary-display`, `--summary-format`, `--progress-display`, `--progress-line-format`, and `--progress-line-interval` are the same as with **get**.

`ascii` [`-s`] [*`remote_nl_conv`*] [*`local_nl_conv`*]

Command **ascii** sets the transfer mode to ASCII.

For transfers between Tectia on z/OS and other hosts, this also enables automatic ASCII-EBCDIC conversion. Default conversion is between code sets ISO8859-1 and IBM-1047. Files are transferred using the `LINE` format. The **site** and **lsite** commands can be used to change the values.

If you enter the **ascii** command with any options, it does not set the transfer mode to ASCII, but affects the newline conventions used in the transferred files. You can also set the server's newline convention by using a host profile that specifies the host type. For more information, see the `host-type` attribute in the section called “The `profiles` Element”.

Options:

`-s`

Shows the current newline convention. The line delimiters used in different systems are:

```
dos:    CRLF (\r\n, 0x0d 0x0a)
mac:    CR (\r, 0x0d)
mvs:    NEL (\n, 0x15)
unix:   LF (\n, 0x0a)
```

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remote_nl_conv local_nl_conv

This syntax can be used to define the remote and local newline conventions. The *local_nl_conv* option operates on the local end, but notice that usually the correct local newline convention is already compiled in.

You can either set hints of the newline conventions for the underlying transfer layer, which by default tries to use the actual newline convention given by the server, or alternatively you can force the newline mode.

To set hints of the newline conventions, use these values in the *remote_nl_conv* and *local_nl_conv* options: `dos`, `unix`, and `mac`. These settings will be used if the remote SSH server does not automatically provide any newline information to the SFTP client. For example:

```
sftp> ascii
 File transfer mode is now ascii.
sftp> ascii unix dos
 Newline conventions updated.
```

To force the newline conventions, use these values: `force-dos`, `force-unix`, and `force-mac`. These settings force the newline mode irrespective of what the remote SSH server suggests to the SFTP client.

```
sftp> ascii
 File transfer mode is now ascii.
sftp> ascii force-unix force-dos
 Newline conventions updated.
```

You can also set either one of the options to `ask`, which will cause **sftpg3** to prompt you for the newline convention when needed.

`auto`

File transfer mode will be selected automatically from the file extension.

`binary`

Files will be transferred in binary mode.

`break`

Interrupts batch file execution. Batch file execution can be continued with the **continue** command.

`bye`

Quits the application.

`cd` *directory*

Changes the current remote working directory.

`chmod` [`-R`] [`-f`] [`-v`] *`OCTAL-MODE`* [*`file`*...]

,

`chmod` [`-R`] [`-f`] [`-v`] [`ugoa`] [`+-=`] [`rwxs`] [*`file`*...]

With Unix files, sets file permissions of the specified file or files to the bit pattern *`OCTAL-MODE`* or changes the file permissions according to the symbolic mode `[ugoa][+-=][rwxs]`.

Options:

`-R`

Recursively changes files and directories.

`-f`

Uses silent mode (error messages are suppressed).

`-v`

Uses verbose mode (lists every file processed).

`close`

Closes the remote connection.

`continue`

Continues interrupted batch file execution.

`debug` [`disable` | `no` | *`debuglevel`*]

Disables or enables debug. With `disable` or `no`, debugging is disabled. Otherwise, sets *`debuglevel`* as debug level string, as per command-line option `-D`.

`delete` [`-H, --hash`] [`-o, --offset`] [`-l, --length`] *`file`*

Tries to delete a file or directory specified in *`file`*. The options are the same as for **rm**.

`digest` [`-H, --hash`] [`-o, --offset`] [`-l, --length`] *`file`*

Calculates MD5 or SHA-1 digest over file data. The digest is calculated over the data on the disk. If any code or line delimiter conversion attributes are in effect, they are ignored when calculating the digest.

Options:

`-H, --hash=` [`md5` | `sha1`]

Use `md5` or `sha1` hash algorithm (default: `md5`).

`-o, --offset=`*`OFFSET`*

Start reading from file offset *`OFFSET`*.

`-l, --length=`*`LENGTH`*

Read *`LENGTH`* bytes of file data.

`echo` *`Text to be echoed.`*

Echo the text. This command can be used for example in batch mode to print text into batch logs.

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`exit`

Quits the application.

`get [-p, --preserve-attributes] [-u, --unlink-source] [-I, --interactive] [--overwrite] [--checksum] [-W, --whole-file] [--checkpoint] [--streaming] [--force-lower-case] [--prefix] [--suffix] [--statistics] [--summary-display] [--summary-format] [--progress-display] [--progress-line-format] [--progress-line-interval] [--max-depth=] [--retry] file...`

Transfers the specified files from the remote end to the local end. By default, directories are recursively copied with their contents, but this is configurable in the Connection Broker configuration with the SFTP compatibility mode setting (`sftpg3-mode` in `ssh-broker-config.xml`). To view the currently set SFTP compatibility mode, run command:

```
sftp> help get
```

The currently set compatibility mode is shown in the beginning of the help for command **get**.

The SFTP compatibility mode options are:

`tectia`

The **sftpg3** client transfers files recursively from the current directory and all its subdirectories.

`ftp`

The **get** command is executed as **sget** meaning that it transfers a single file, and no subdirectories are copied.

`openssh`

Only regular files and symbolic links from the specified directory are copied, and no subdirectories are copied. Otherwise the semantics of the **get** command are unchanged.

Options:

`-p, --preserve-attributes`

Preserves the file permissions and the timestamps when both the source and the destination are on Unix file systems (including z/OS USS). Preserves the timestamps but not the file permissions, if either one, the source or the destination is on Windows. If the destination is on z/OS MVS, none will be preserved.

`-u, --unlink-source`

Removes the source file after file transfer. Also directories are removed, if they become empty (move mode).

`-I, --interactive`

Prompts whether to overwrite an existing destination file (does not work with batch mode).

`--overwrite [ =yes | no ]`

Decides whether to overwrite existing destination file(s) (default: `yes`).

`--checksum` [`=yes` | `no` | `md5` | `sha1` | `md5-force` | `sha1-force` | `checkpoint`]

Uses MD5 or SHA-1 checksums or a separate checkpoint database to determine the point in the file where file transfer can be resumed. Files smaller than *`buffer_size_bytes`* are not checked. Use `md5-force` or `sha1-force` with small files (default: `yes`, i.e. use MD5 checksums). Use checkpointing when transferring large files one by one.

`-W, --whole-file`

Does not try incremental checks. By default (if this option is not given), incremental checks are tried. This option can only be used together with the `--checksum` option.

`--checkpoint=s<`*`seconds`*`>`

Time interval between checkpoint updates (default: *`10`* seconds). This option can only be used when `--checksum=checkpoint`.

`--checkpoint=b<`*`bytes`*`>`

Byte interval between checkpoint updates (default: 10 MB). This option can only be used when `--checksum=checkpoint`.

`--streaming` [`=yes` | `no` | `force` | `ext`]

Uses streaming in file transfer if the server supports it. Files smaller than *`buffer_size_bytes`* are not transferred using streaming. Use `force` with small files. Default: `yes`

Use `ext` with z/OS hosts to enable direct MVS data set access. Use this option only when the file transfer is mainly used for mainframe data set transfers, as it can slow down the transfer of small files in other environments.

The `--streaming=ext` option requires also the `--checksum=no` option, because if checksums are calculated, the file transfer uses staging, which excludes streaming.

An alternative way to activate extended streaming is to define `SSH_SFTP_STREAMING_MODE=ext` and `SSH_SFTP_CHECKSUM_MODE=no` as environment variables.

`--force-lower-case`

Destination file name will be converted to lower case characters.

`--max-depth=`*`VALUE`*

Defines whether directories are copied recursively. The value can be:

`0` - unlimited recursion, directories are recursively copied with their contents

`1` - copies files from the specified directory only, not from subdirectories

`2-n` - copies files recursively from the specified number of directory levels. Here `n` means the system-specific maximum.

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This command line option overrides the recursion depth set in the Connection Broker configuration with element `sftpg3-mode` and/or the setting made using environment variable `SSH_SFTP_CMD_GETPUT_MODE`.

`--retry`

Complete file transfer. To be used in situations where a file was only partially transferred. For retry to succeed, the target must contain some part of the source (may be a zero-sized part).

For example, if the partially-failed file-transfer command was:

```
$ sput source target
```

Then to complete the transfer, you would give the command:

```
$ sput --retry source target
```

`--prefix=`*`PREFIX`*

Adds prefix `PREFIX` to filename during the file transfer. The prefix is removed after the file has been successfully transferred.

On z/OS, when applied to MVS data set names, the prefix will be inserted after the High Level Qualifier (HLQ) by default. In case you want the prefix to be a separate qualifier, include a dot at the end of the prefix:

```
--prefix=PREFIX.
```

`--suffix=`*`SUFFIX`*

Adds suffix SUFFIX to a filename during the file transfer. The prefix is removed after the file has been successfully transferred.

On z/OS, when applied to MVS data set names, the suffix will be appended to the last dataset name qualifier by default. In case you want the suffix to be a separate qualifier, include a dot at the beginning of the suffix:

```
--suffix=.SUFFIX
```

`--statistics` [`=no` | `yes` | `simple`]

Note

In release 6.1.5, the behavior of the `--statistics` option has changed and the `--statistics-format` option has been removed. Instead of them, use the new `--summary-display` and `--summary-format` options.

The `--statistics` option chooses the style of the statistics to be shown after a file transfer operation. Note that `--statistics` and `--summary-display` must not be used together.

The `--statistics` option takes the following values:

`no` - no statistics will be created.

`yes` - shows a progress bar during the file transfer. This is the default. An example of the output:

```
sftp> get --statistics="yes" sourcefile
sourcefile               |  127MB |  42.9MiB/s | TOC: 00:00:03 | 100%
```

`simple` - simple one-line statistics will be displayed after the file transfer has ended. For example:

```
sftp> get --statistics=simple testfile
sourcefile   | 127MB | 151.3MiB/s | TOC: 00:00:00 | 100%
```

`--summary-display` [`=no` | `yes` | `simple` | `bytes`]

Chooses the style of the file transfer summary data to be displayed after a file transfer operation. With the summary display, the progress bar data is also displayed by default.

Note that `--summary-display` and `--statistics` must not be used together.

The `--summary-display` option takes the following values:

`no` - no summary data will be created. This is the default.

`yes` - detailed summary data will be created. You can configure the contents with the `summary-format` option. By default, the following contents are displayed in the summary:

```
Default settings:                    Render for example this:
"Source: %c:%g\n"                    user@host1#22:/path/to/source/file
"Source parameters: %e\n"            X=TEXT, C=ISO8859-1,D=IBM.1047
"Destination: %C:%G\n"               user@host2#22:/path/to/destination/file
"Destination parameters: %E\n"       NONE
"File size: %s bytes\n"              123456 bytes
"Transferred: %t bytes\n"            123456 bytes
"Rate: %RB/s\n"                      345kiB/s
"Start: %x(%Y-%m-%d %H:%M:%S)\n"     2010-01-26 13:10:56
"Stop: %X(%Y-%m-%d %H:%M:%S)\n"      2010-01-26 13:23:30
"Time: %y\n"                         00:12:34
```

`simple` - simple one-line summary will be displayed. For example:

```
sftp> get --summary-display=simple sourcefile
sourcefile  | 127MB | 151.3MiB/s | TOC: 00:00:00 | 100%
```

`bytes` - basic statistics reporting the transferred bytes will be displayed. For example:

```
sftp> get --summary-display=bytes sourcefile
Transferred 12915145984 bytes, file: 'sourcefile' -> 'destinationfile'
```

`--summary-format=`*`FORMAT_STRING`*

Chooses the format and the contents of the summary. You can use this option when `--summary-display=yes`. Do not use this option with `--statistics`.

Select the contents for the summary using the following definitions:

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```
%c  - source connection: user@host#port or profile
%C  - destination connection: user@host#port or profile
%D* - current date
%e  - source parameters (file transfer and data set parameters)
%E  - destination parameters (file transfer and data set parameters)
%f  - source file name
%F  - destination file name
%g  - /path/to/source/file
%G  - /path/to/destination/file
%k  - compression done ("zlib" or "none")
%p  - transfer percentage
%q  - transfer rate in bit/s
%Q  - transfer rate as "XXyb/s" (b/s, kib/s, Mib/s, Gib/s)
%r  - transfer rate in bytes/s
%R  - transfer rate as "XXyB/s" (B/s, kiB/s, MiB/s, GiB/s)
%s  - file size in bytes
%S  - file size as "XXyB" (B, kiB, MiB or GiB)
%t  - transfer size in bytes
%T  - transfer size as "XXyB" (B, kiB, MiB or GiB)
%x* - start date
%X* - end date
%y  - elapsed time
%Y  - time remaining
%z  - ETA or TOC, if transfer has finished
%Z  - string "ETA" or "TOC", if transfer has finished

Where * is one of the following:

h - hours (00-23)
m - minutes (00-59)
s - seconds (00-59)
f - milliseconds (0-999)
d - day of the month (1-31)
t - month (1-12)
y - year (1970-)

Other special characters in format strings are:

\n - line feed
\r - carriage return
\t - horizontal tab
\\ - backslash
```

`--progress-display` [`=no` | `bar` | `line`]

Chooses the mode of displaying the progress during a file transfer operation. The default is `bar`, which shows a progress bar. Option `line` shows the progress information according to the settings made in the `--progress-line-format` option.

Do not use this option with `--statistics`.

`--progress-line-format=FORMAT_STRING`

Chooses what information will be shown on the progress line. You can use this option when `--progress-display=line`.

Do not use this option with `--statistics`.

Select the contents for the progress line using the definitions described for option `--summary-format` of the **get** command above.

`--progress-line-interval=seconds`

Defines how often the progress information is updated in the line mode. The interval is given in seconds, and the default is 60 seconds.

Do not use this option with `--statistics`.

`getext`

Displays the extensions that will be ASCII in the auto transfer mode.

`lappend [options...] srcfile [dstfile]`

The same as **append**, but appends the specified remote file to the local file.

`lcd directory`

Changes the current local working directory.

`lchmod [-R] [-f] [-v] OCTAL-MODE [file...]`

,

`lchmod [-R] [-f] [-v] [ugoa] [+-=] [rwxs] [file...]`

The same as **chmod**, but operates on local files.

`lclose`

Closes the local connection.

`ldelete [options...] file...`

The same as **delete**, but operates on local files.

`ldigest [-H, --hash] [-o, --offset] [-l, --length] file`

The same as **digest**, but operates on local files.

`lls [-R] [-l] [-S] [-r] [-p] [-z|+z] [file...]`

The same as **ls**, but operates on local files.

`llsroots`

The same as **lsroots**, but operates on local files (when the local end has been opened to a VShell server).

`lmkdir directory`

The same as **mkdir**, but operates on local files.

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`localopen` [*user@*]*hostname* [*#port*] [`-l`] [`--user=`*USERNAME*]

The same as **lopen**.

`lopen` [*user@*]*hostname* [*#port*] [`-l`] [`--user=`*USERNAME*]

Tries to connect the local end to the host *hostname*. If this is successful, **lls** and friends will operate on the file system on that host.

Options:

`-l`

Connects the local end to the file system of the SFTP client host (which does not require a server). This is also the default state when no **lopen** commands have been given.

`--user`

Defines the user in the connection to be *USERNAME*.

`locsite` [`none` | *name1=value1 name2=value2*...]

The same as **site**, but operates on local files and data sets.

`lpwd`

Prints the name of the current local working directory.

`lreadlink` *path*

The same as **readlink**, but operates on local files.

`lrename` *oldfile newfile*

The same as **rename**, but operates on local files.

`lrm` [`options`...] *file*...

The same as **rm**, but operates on local files.

`lrmdir` *directory*

The same as **rmdir**, but operates on local files.

`ls` [`-R`] [`-l`] [`-S`] [`-r`] [`-p`] [`-z`|`+z`] [*file*...]

Lists the names of files on the remote server. For directories, contents are listed. If no arguments are given, the contents of the current working directory are listed.

Options:

`-R`

Directory trees are listed recursively. By default, subdirectories of the arguments are not visited.

`-l`

Permissions, owners, sizes and modification times are also shown (long format).

`-S`

Sorting is done based on file sizes (default: alphabetical sorting).

`-r`
The sort order is reversed.

`-p`
Only one page of listing is shown at a time.

`-z`
The client generates the long output.

`+z`
The long output supplied by the server is used, if available (alias for option `-l`).

`lsite` [`none` | *`name1=value1 name2=value2`*...]
The same as **site**, but operates on local files and data sets.

`lsroots`
Dumps the virtual roots of the server. (This is a VShell extension. Without this you cannot know the file system structure of a VShell server.)

`lsymlink` *`targetpath linkpath`*
The same as **symlink**, but operates on local files.

`mget` [`options`...] *`file`*...
Synonymous to **get**.

`mkdir` *`directory`*
Tries to create the directory specified in *`directory`*.

`mput` [`options`...] *`file`*...
Transfers the specified files from the local end to the remote end. Options and semantics are the same as for **get**. Synonymous to **put**.

`open` [*`user@`*]*`hostname`* [*`#port`*] [`-l`] [`--user=`*`USERNAME`*]
Tries to connect the remote end to the host *`hostname`*.

Options:

`-l`
Connects the remote end to the file system of the SFTP client host (which does not require a server).

`--user`
Defines the user in the connection to be *`USERNAME`*.

`pause` [*`seconds`*]
Pauses batch file execution for *`seconds`* seconds, or if *`seconds`* is not given until **ENTER** is pressed.

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`put` [`options`...] *`file`*...

Transfers the specified files from the local end to the remote end. Options and semantics are the same as for **get**.

`pwd`

Prints the name of the current remote working directory.

`quit`

Quits the application.

`readlink` *`path`*

Provided that *`path`* is a symbolic link, shows where the link is pointing to.

`rename` *`oldfile`* *`newfile`*

Tries to rename the *`oldfile`* to *`newfile`*. If *`newfile`* already exists, the files are left intact.

`rm` [`-I, --interactive`][`-r, --recursive`] *`file`*...

Tries to delete a file or directory specified in *`file`*.

Options:

`-I, --interactive`

Prompts whether to remove a file or directory (does not work with batch mode).

`-r, --recursive`

Directories are removed recursively.

`rmdir` *`directory`*

Tries to delete the directory specified in *`directory`*. This command removes the directory only if it is empty and has no subdirectories.

`set` [`defaults` | [`--commands=`*`name1,name2,`*... `exit-value=`*`VALUE`*] | *`option1=value1 option2=value2`*...]

Sets the default values for various parameters. The `set` command takes the following options:

`defaults`

Sets the parameters to be system defaults.

`checksum` [`=yes` | `no` | `md5` | `sha1` | `md5-force` | `sha1-force` | `checkpoint`]

Uses MD5 or SHA-1 checksums or a separate checkpoint database to determine the point in the file where file transfer can be resumed. Files smaller than *`buffer_size_bytes`* are not checked. Use `md5-force` or `sha1-force` with small files. The default is `md5` (in z/OS the default is `no`). Use checkpointing when transferring large files one by one.

`compatibility-mode` [`=tectia` | `ftp` | `openssh`]

Defines what mode of recursiveness is used in the file transfer:

`tectia`
: The **sftpg3** client transfers files recursively from the current directory and all its subdirectories. This is the default mode.

`ftp`
: A single file is transferred, and no subdirectories are copied.

`openssh`
: Only regular files and symbolic links from the specified directory are copied, and no subdirectories are copied.

`compressions` [`=none` | `zlib`]
: Defines whether compression is used in file transfer:

`none`
: Compression is not used. This is the default.

`zlib`
: Enables zlib compression in file transfer.

`exit-value=`*`VALUE`*
: Defines the exit value of **sftpg3** in batch mode in case of an error. The value must be between 0 and 255. If `exit-value` is set to something else than 0 and the `--commands` parameter is not used, batch execution terminates when the first error occurs.

Example 1: If the rename command in this batch job fails, **sftpg3** will stop and return exit value "6":

```
open user@host
set exit-value=6
rename file file2
<next command in batch job>
quit
```

Example 2: If you want to ignore a possible failure of a specific command and return exit value "0" independent of the actual result of the operation, use `set exit-value=0` after the command. This example batch job ignores possible failure in renaming a file:

```
open user@host
rename file file2
set exit-value=0
<next command in batch job>
quit
```

`--commands=`*`name1,name2,...`* `exit-value=`*`VALUE`*
: This option makes an **sftpg3** batch job abort when any of the specified commands fail. When a command that is *not* specified with this option fails, the batch job execution continues, and the

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exit value of the batch job is set to the one defined with `exit-value`. Note that if `exit-value=0`, the exit value of the failed command will be returned.

Example 3: When **sftpg3** is running in batch mode, it will abort execution if a **put**, **get**, or **ls** command fails. If any other command (with the exceptions mentioned below) fails, execution will continue until the end of the batch file. In both cases value "3" will be returned:

```
set --commands=put,get,ls exit-value=3
```

Example 4: When **sftpg3** is running in batch mode, it will abort execution when a **put** or **get** command fails. If any other command (with the exceptions mentioned below) fails, execution will continue. In any case the original exit value of the last failed command will be returned:

```
set --commands=put,get exit-value=0
```

Exceptions: When `exit-value` is set for specific commands with the `--commands` option, also the following situations will cause the batch job execution to abort:

- A **cd** command resulting in an error
- Any invalid command
- `Authentication failed` error
- `Unable to connect to server` error
- `Connection aborted` error

By default (`set defaults`), in case of errors, **sftpg3** does not stop but instead will continue executing and return the last error message.

Invalid commands added in `--commands` will be ignored.

`overwrite` [`=yes` | `no`]
: Decides whether to overwrite existing destination file(s) (default: `yes`).

`progress-display` [`=bar` | `line` | `no`]
: Chooses the mode of displaying the progress during a file transfer operation. The default is `bar`, which shows a progress bar. Option `line` shows the progress information according to the settings made with the `progress-line-format` option. Option `no` disables progress display.

`progress-line-format=`*`FORMAT_STRING`*
: Chooses what information will be shown on the progress line. Use this option when `--progress-display=line`. See the definitions of contents options in command: `get --progress-line-format`.

`progress-line-interval=`*`seconds`*
: Defines how often the progress information is updated in line mode. The interval is given in seconds, and the default is 60 seconds.

`summary-display` [`=no` | `yes` | `simple` | `bytes`]

Chooses the style of the file transfer summary data to be displayed after a file transfer operation. With the summary display, the progress bar data is also displayed by default. Do not use this option with `--statistics`.

See the options described for command: `get --summary-display`

`summary-format=`*`FORMAT_STRING`*

Chooses the format and the contents of the summary. You can use this option when `--summary-display=yes`. Do not use this option with `--statistics`.

See the definitions of contents options in command: `get --summary-format`

`streaming` [`=yes` | `no` | `force` | `ext`]

Uses streaming in file transfer if the server supports it. Files smaller than *`buffer_size_bytes`* are not transferred using streaming. Use `force` with small files. Default: `yes`

Use `ext` with z/OS hosts to enable direct MVS data set access. Use this option only when the file transfer is mainly used for mainframe data set transfers, as it can slow down the transfer of small files in other environments.

The `streaming=ext` option requires also the `checksum=no` option, because if checksums are calculated, the file transfer uses staging, which excludes streaming.

`setext` [*`extension`*...]

Sets the file extensions that will be ASCII in the auto transfer mode. Normal zsh-fileglob regexps can be used in the file extensions.

`sget` [`options`...] *`srcfile`* [*`dstfile`*]

Transfers a single specified file from the remote end to the local end under the filename defined with *`dstfile`*. Directories are not copied. No wildcards can be used. Options are the same as for **get**.

`site` [`none` | *`name1=value1 name2=value2`*...]

Sets the file and data set parameters for the remote host. Parameters can be entered either one by one, or several parameters can be delimited by spaces or commas. Both long parameters and abbreviations can be used. When run without arguments, the **site** command outputs the list of entered parameters. Setting `none` resets all parameters.

The available parameters are:

- `AUTOMOUNT=YES|NO|IMMED`
- `[NO]AUTOMOUNT|[NO]AUTOM`
- `AUTORECALL=YES|NO`
- `[NO]AUTORECALL|[NO]AUTOR`

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- BLKSIZE|B|BLOCKSI=*size*
- BLOCKS|BL
- CONDDISP|CO=CATLG|UNCATLG|KEEP|DELETE
- CYLINDERS|CY
- DATACLAS|DA=*class*
- DATASET_SEQUENCE_NUMBER|SEQNUM=*number*
- DEFER|DE=YES|NO
- [NO]DEFER|DE
- DIRECTORY_SIZE|M|DI|DIRSZ=*size*
- EXPIRY_DATE|EXPDT=*yyddd*|*yyyyddd*
- FILE_STATUS|STATUS=NEW|MOD|SHR|OLD
- FILETYPE|FILET|FT=SEQ|JES|IDCAMS|IDC|PDS|IEBCOPY|IBC|ADRDSSU|DSS|SORT
- FIXRECFM|FI=*length*
- JOB_ID|JESID=*ID*
- JOB_OWNER|JESO=*name*
- JOBNAME|JESJOB=*name*
- KEYLEN|KEYL=*length*
- KEYOFF|KEYO=*offset*
- LABEL_TYPE|LABEL=NL|SL|NSL|SUL|BLP|LTM|AL|AUL
- LIKE=*like*
- LRECL|R|LR=*length*
- MGMTCLAS|MG=*class*
- NORMDISP|NOR=CATLG|UNCATLG|KEEP|DELETE
- PRIMARY_SPACE|PRI=*space*
- PDSEXTENS|PDEX=*extensions*
- PDSGENS|PDGS=*YES*|*NO*

- PDSMASK|PDMA=*mask*
- PDSNOTE|PDNT=*YES*|*NO*
- PDSRDW|PDDW=*YES*|*NO*
- PDSUDATA|PDUD=*YES*|*NO*
- PROFILE|P|PROF=*profile*
- RECFM|O|REC=*recfm*
- RECORD_TRUNCATE|U|TRUN=YES|NO
- [NO]TRUNCATE|[NO]TRU|[NO]TRUN
- RETENTION_PERIOD|RET=*days*
- SECONDARY_SPACE|SE|SEC=*space*
- SIZE|L=*size*
- SPACE_RELEASE|RLSE=YES|NO
- SPACE_UNIT|SU=BLKS|TRKS|CYLS|AVGRECLEN
- SPACE_UNIT_LENGTH|SUL=*length*
- STAGING|S|STAGE=YES|NO
- STORCLAS|ST=*class*
- SVC99_TEXT_UNITS|SVC99=*string*
- TRACKS|TR
- TRAILING_BLANKS|TRAIL=YES|NO
- [NO]TRAILINGBLANKS|[NO]TRAI|[NO]TRAIL
- TRANSFER_CODESET|C|CODESET=*codeset*
- TRANSFER_FILE_CODESET|D|FCODESET=*codeset*
- TRANSFER_FILE_LINE_DELIMITER|J|FLDELIM=UNIX|MVS|MVS-FTP|DOS|MAC|NEL
- TRANSFER_FORMAT|F|FORMAT=LINE|STREAM|RECORD
- TRANSFER_LINE_DELIMITER|I|LDELIM=UNIX|MVS|MVS-FTP|DOS|MAC|NEL
- TRANSFER_MODE|X|MODE=BIN|TEXT

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- `TRANSFER_TRANSLATE_DSN_TEMPLATES|A|XDSNT=`*`templates`*
- `TRANSFER_TRANSLATE_TABLE|E|XTBL=`*`table`*
- `TYPE|T=PS|PO|PDS|POE|PDSE|GDG|HFS|VSAM|ESDS|KSDS|RRN|PIPE`
- `UNIT|UN=`*`unit`*
- `UNIT_COUNT|UC|UNC=`*`number`*
- `UNIT_PARALLEL|UNP=YES|NO`
- `VOLUME_COUNT|VC|VOLCNT=`*`number`*
- `VOLUMES|VO|VOL=`*`vol1+vol2+...`*

For a detailed description of the parameters, see Section 6.4.1.

`sput` [`options...`] *`srcfile`* [*`dstfile`*]

Transfers a single specified file from the local end to the remote end under the filename defined with *`dstfile`*. Directories are not copied. No wildcards can be used. Options are the same as for **get**.

`sunique` [`on`] [`off`]

Stores files with unique names. If no option is specified, the command toggles the state of 'sunique'.

In case more than one of the transferred data sets have the same name, this feature adds a sequential number to the end of the repeated data set name, for example: `DS.version`, `DS.version1`, and `DS.version2`.

`symlink` *`targetpath linkpath`*

Creates symbolic link *`linkpath`*, which will point to *`targetpath`*.

`type` [`ascii` | `auto` | `binary` | `default`]

Sets file transfer type. If type is not specified, the current file transfer type is displayed.

`ascii`

Transfer file in ascii mode. See **ascii** for more information.

`auto`

Transfer file in auto mode. See **auto** for more information.

`binary`

Transfer file in binary mode. See **binary** for more information.

`default`

Transfer file in binary mode. This mode is identical to `binary` except that when the server is Tectia Server for IBM z/OS, no extra parameters are specified for the server. See **binary** for more information.

`verbose`
: Enables verbose mode (identical to the **debug 2** command). You may later disable verbose mode by **debug disable**.

`help` [*`topic`*]
: If *`topic`* is not given, lists the available topics. If *`topic`* is given, outputs available online help about the topic.

`helpall`
: Outputs available online help about all topics.

Command Interpretation

sftpg3 understands both backslashes (\) and quotation marks (`""`) on the command line. A backslash can be used for ignoring the special meaning of any character in the command-line interpretation. It will be removed even if the character it precedes has no special meaning.

When specifying filenames that contain spaces, enclose them in quotation marks.

Note

Commands **get .** and **put .** will get or put every file in the current directory and possibly they overwrite files in your current directory.

sftpg3 supports wildcard characters (also known as glob patterns) given to commands **chmod**, **lchmod**, **ls**, **lls**, **rm**, **lrm**, **get**, and **put**.

Command-Line Editing

The following key sequences can be used for command-line editing:

Ctrl-Space
: Set mark.

Ctrl-A
: Go to the beginning of the line.

Ctrl-B
: Move the cursor one character to the left.

Ctrl-D
: Erase the character to the right of the cursor, or exit the program if the command line is empty.

Ctrl-E
: Go to the end of the line.

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Ctrl-F
Move the cursor one character to the right.

Ctrl-H
Backspace.

Ctrl-I
Tab.

Ctrl-J
Enter.

Ctrl-K
Delete the rest of the line.

Ctrl-L
Redraw the line.

Ctrl-M
Enter.

Ctrl-N
Move to the next line.

Ctrl-P
Move to the previous line.

Ctrl-T
Toggle two characters.

Ctrl-U
Delete the line.

Ctrl-W
Delete a region (the region's other end is marked with Ctrl-Space).

Ctrl-X
Begin an extended command.

Ctrl-Y
Yank deleted line.

Ctrl-_
Undo.

Ctrl-X Ctrl-L
Lower case region.

Ctrl-X Ctrl-U
Upper case region.

Ctrl-X Ctrl-X
Exchange cursor and mark.

Ctrl-X H
Mark the whole buffer.

Ctrl-X U
Undo.

Esc Ctrl-H
Backwards word delete.

Esc Delete
Backwards word delete.

Esc Space
Delete extra spaces (leaves only one space).

Esc <
Go to the beginning of the line.

Esc >
Go to the end of the line.

Esc @
Mark current word.

Esc A
Go back one sentence.

Esc B
Go back one word.

Esc C
Capitalize current word.

Esc D
Delete current word.

Esc E
Go forward one sentence.

Esc F
Go forward one word.

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Esc K
Delete current sentence.

Esc L
Change current word to lower case.

Esc T
Transpose words.

Esc U
Change current word to upper case.

Delete
Backspace.

Filename Support

Different operating systems allow different character sets in filenames. On Unix, some of the special characters are allowed in filenames, but on Windows, the following characters are not allowed:

```
\/ : * ? " < > |
```

The **sftpg3** command-line tool (both as an interactive and in a batch file) follows the syntax and semantics of Unix shell command-line also on the Windows platform, except that the escape character is ~ (tilde).

When you transfer files that have special characters in the filename (for example `unixfilename*?".txt`) from a Unix server to Windows, you need to provide the files with new names that are acceptable on Windows.

The **sftpg3** command-line client includes two versions of the **get** command:

The **get** command can be used to transfer several files at the same time, but it is not possible to define target filenames. Note that if there are special characters in the filenames, you need to rename the files already on Unix so that the names are acceptable also on Windows.

The **sget** command is used to transfer one file at a time, and it allows you to define a new name for the destination file. Use it to make the name acceptable on Windows. The command sequence is as follows:

```
$ sftpg3
```

```
sftp> open user@server
```

```
sftp> sget "file*name.txt" windowsfilename.txt
```

Escaping special characters

In the **sftpg3** command, the following characters have a special meaning, and they need to be escaped in commands that take filenames as arguments:

***** asterisk is a wildcard character for any number of any characters

? question mark is a wildcard for any single character

`""` quotation marks are placed around strings that are to be taken 'as is'

\ backslash is an escape character on Unix

~ tilde is an escape character on Windows

The escape character tells the **sftpg3** command to treat the next character "as is" and not to assume any special meaning for it. The escape character is selected according to the operating system of the local machine.

Note that the \ and ~ characters are special characters themselves, and if they are present in the filename, an escape character must be placed in front of them,too. Therefore, if you need to enter a filename containing \ in Unix or ~ in Windows to any of the **sftpg3** commands, add the relevant escape character to it:

\\ on Unix

~~ on Windows

When a filename or part of a filename is placed within the quotation marks `""`, the **sftpg3** command interprets the quoted part 'as is', and none of the characters within the quote are interpreted as wildcards or as any other special characters.

However, on Unix a quotation mark `"` can also be part of a filename. If you need to enter the `"` character in a filename, you must add the escape character in front of it both on Unix and on Windows.

For example, to enter a file named `file-"name".txt` into a command on Windows, enter the following command:

```
sftp> sget "file-~"name~".txt" filename.txt
```

See the examples below to learn how the escape characters are used in the Tectia **sftpg3** commands, and how to enter filenames with special characters in different operating systems.

Examples of filenames in the **sftpg3** commands:

The following filenames are valid in Unix, but they need escape characters in the commands:

```
file|name.txt
file-"name".txt
file?name.txt
file*name.txt
file\name.txt
file - name.txt
file~name.txt
```

When using the **sftpg3** command-line tool on Unix, enter the above mentioned filenames in the following formats:

```
file\|name.txt     or  "file|name.txt"
file-\"name\".txt  or  "file-\"name\".txt"
```

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```
file\?name.txt     or  "file?name.txt"
file\*name.txt     or  "file*name.txt"
file\\name.txt     or  "file\\name.txt"
file\ -\ name.txt  or  "file - name.txt"
file~name.txt      or  "file~name.txt"
```

Example commands on Unix:

```
sftp> get "file*name.txt"
```

```
sftp> sget "file*name.txt" newfilename.txt
```

Environment Variables

In order to run **sftpg3** the following environment variables must be set:

_BPXK_AUTOCVT=`ON`
: If this variable is not set correctly **sftpg3** fails to start.

_BPX_BATCH_UMASK=`0022`
: This variable defines the permissions for newly created files, and this umask value will be used if the server configuration file does not have a umask defined for the **sft-server-g3** subsystem.

_BPXK_SHAREAS=`NO`
: This variable defines that **ssh-broker-g3** and **sftpg3** processes are run in separate address spaces.

sftpg3 uses the following environment variables:

SSH_DEBUG_FMT
: This environment variable can be used to specify the format of the debug messages.

The default variable used is:

```
SSH_DEBUG_FMT="%Dd/%Dt/%Dy %Dh:%Dm:%Ds:%Df %m/%s:%n:%f %M"
```

It will produce an output similar to the following example:

```
debug: 21/08/2007 16:17:25:883 BrokerRun/broker_run.c:158: broker_start returning.
```

The format of the debug message is composed of flags that are percent signs (`%`) followed by one or more characters. If no `%` is used, the character will be literally printed to the debug message. The value of the flags will be shown only if the information is available.

The different flags that can be used are:

`%u`
: Prints the uid.

`%e`
: Prints the euid.

`%p`
: Prints the pid.

`%t`
: Prints the thread id.

`%h`
: Prints the hostname.

`%l`
: Prints the debug level.

`%m`
: Prints the module.

`%n`
: Prints the line.

`%f`
: Prints the function name.

`%s`
: Prints the filename.

`%M`
: Prints the message.

`%o`
: Prints the ordinal or the number of messages printed so far.

`%N`
: Prints the new line.

`%E(var)`
: Expands to the value of the environment variable *`var`*.

`%Dx`
: Formats a piece of the current date, where *x* is one of the following

```
f -- milliseconds
s -- seconds
m -- minutes
h -- hours
d -- day
t -- month
y -- year
```

`%Rx`
: Reports resource usage, where *x* is one of the following

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```
u -- user time used by current process
U -- user time used by children that have terminated and have been waited for
s -- system time used by current process
S -- system time used by children that have terminated and have been waited for
```

`%W(m)(i)`
: Enables word-wrapping of debug messages. No line of output will be longer than *m* characters, and every line after the first one in a message will be indented by *i* spaces. This does not actually output anything.

`%c(n)`
: Just writes the character *n* in verbatim to the output, and it is assumed to take zero width.

`%s(n)`
: Causes the debug module to sleep *n* milliseconds after the debug message has been printed. The value of *n* must lie between 0 and 60,000 (one minute).

`%<(n)x`
: Gives field maximum width *n* to the option *x*.

`%>(n)x`
: Gives field minimum width *n* to the option *x*.

`%$x`
: Specifies alignment to right.

SSH_SFTP_BATCH_FILE=*startup_batch_file*

Defines the path to the **sftpg3** startup batch file. The file is run and the **sftpg3** commands defined in the file are executed each time **sftpg3** is started.

If this variable is not defined, **sftpg3** looks for a startup batch file named `ssh_sftp_batch_file` in the user-specific directory `$HOME/.ssh2/` on Unix or `%APPDATA%\SSH\` on Windows.

Note that if this variable is defined but the file is missing or cannot be accessed, **sftpg3** fails to start.

SSH_SFTP_CHECKSUM_MODE=`yes|no|md5|sha1|md5-force|sha1-force|checkpoint`
Defines the setting for comparing checksums. For more information on the available values, see **checksum**.

SSH_SFTP_HOME_MVS=`yes|no`
If this variable is set to `yes`, the **sftpg3** local directory is set to USER prefix in the MVS side. If it is set to `no` (default), local directory is the current directory. For more information, see the section called "Setting the File Transfer Home Location"

SSH_SFTP_SHOW_BYTE_COUNT=`yes|no`
If this variable is set to `yes`, the number of transferred bytes is shown after successful file transfer. Also the names of source and destination files are shown. The default is `no`.

SSH_SFTP_SMF_TYPE=`TYPE119|none`

If this variable is set to `TYPE119`, file transfers create SMF records of type 119.

SSH_SFTP_STATISTICS=`yes|no|simple`

If this variable is set to `yes` (default), normal progress bar is shown while transferring the file. If it is set to `no`, progress bar is not shown. If it is set to `simple`, file transfer statistics are shown after the file has been transferred.

Files

In addition to the files used by **ssh-broker-g3**, **sftpg3** uses the following files:

`$HOME/.ssh2/ssh_ftadv_config`

This is the user-specific file that contains a list of file transfer profiles, which furnish file transfer attributes to be used when processing local files. For more information, see Section 10.4.2.

`/opt/tectia/etc/ssh_ftadv_config`

This is the global (system-wide) file that contains a list of file transfer profiles, which furnish file transfer attributes to be used when processing local files. For more information, see Section 10.4.2.

Exit Values

sftpg3 returns the following values based on the result of the operation:

```
0     Operation was successful.
1     Internal error.
2     Connection aborted by the user.
3     Destination is not a directory, but a directory was specified by the user.
4     Connecting to the host failed.
5     Connection lost.
6     File does not exist.
7     No permission to access file.
8     Undetermined error from sshfilexfer.
11    Some non-fatal errors occured during a directory operation.
101   Wrong command-line arguments specified by the user.
```

Note

When the command is run from JCL using BPXBATCH, the exit values are multiplied by 256.

In batch mode, **sftpg3** returns the value 0 only if no errors occurred during the execution. A failure to change the current working directory, a failure to establish a connection, or a connection loss during batch operation cause **sftpg3** to abort. Other errors are reported to stderr and the last error value is returned as the exit value of the **sftpg3** process.

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Note

When the command is run from JCL using BPXBATCH, the exit values are multiplied by 256.

Examples

Open a **sftpg3** session with the remote end connected to the server defined in the connection profile *profile1* in the `ssh-broker-config.xml` file (the local end is initially connected to the file system of the SFTP client host):

```
$ sftpg3 profile1
```

Run **sftpg3** to connect to remote server using user private key object stored in ICSF PKCS11 token:

```
$ sftpg3 -i pkcs11:ssz.tstusr.ssh2/00000001 ruser@rserver
```

Run **sftpg3** in batch mode:

```
$ sftpg3 -B batch.txt
```

Example contents of the batch file *batch.txt* are shown below. Non-interactive authentication methods are used and the server host keys have been stored beforehand:

```
lopen user@unixserver.example.com
open user@winserver.example.com
binary
lcd backup
cd c:/temp
get --force-lower-case Testfile-X.bin
lchmod 700 testfile-x.bin
quit
```

The example batch file opens the local end of the connection to a Unix server and the remote end to a Windows server, and sets the transfer mode to binary. It changes to local directory *backup* and remote directory *C:\Temp*, and copies a file from the remote directory to the local directory. The filename is changed to lower-case characters (*testfile-x.bin*). After transfer, the file permissions are changed to allow the user full rights and others no rights.

ssh-translation-table

ssh-translation-table -- Secure Shell Translation Table

Synopsis

`ssh-translation-table` [`options`...]
[`filename`]

Description

ssh-translation-table is a utility program that generates translation tables for coded character set (CCS) conversions. **ssh-translation-table** stores the translation table in *`filename`*. If *`filename`* is not given, **ssh-translation-table** writes the translation table to standard output.

Options

The following options are available:

`-b, --binary`
: Use the z/OS-specific binary file format.

`-f, --from=`*`CODESET`*
: Specify the source code set of the inbound conversion, which is also the target code set of the outbound conversion. The default value is *`ISO8859-1`*. For example:

```
--from ISO8859-15
```

`-t, --to=`*`CODESET`*
: Specify the target code set of the inbound conversion, which is also the source code set of the outbound conversion. The default value is *`IBM-1047`*. For example:

```
--to IBM-037
```

`-l, --list-charsets`
: List available character sets. Note that all character sets are not single byte character sets. Only single byte character sets can be used.

`-D, --debug=`*`LEVEL`*
: Sets the debug level. *`LEVEL`* is a number from 0 to 99, where 99 specifies that all debug information should be displayed. This should be the first argument on the command line.

`-h, --help`
: Displays a short summary of command-line options and exits.

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Translation Table

A translation table is a file containing two tables describing the character conversion, the inbound table and the outbound table. Each table consists of 256 target values.

In Tectia File Transfer, the inbound table is used when converting data from the line to the data set. The outbound table is used when converting data from a file and sending the data out on the line.

The binary format, which is z/OS specific, consists of three 256 byte fields. The first is a comment in EBCDIC, which is ignored in the conversion software, the second is the inbound table and the third is the outbound table.

The text format can have interspersed comments. The target values are in hexadecimal.

A table is a list of 256 values represented as two hexadecimal characters (from 00 to FF). The position of the value is the index for conversion. The first position, i.e. position 00, represents the converted value for byte value of 0.

The hexadecimal values in the tables are case-insensitive. So values 0a and 0A are the same. Also, it is possible to add comments into the file. The comment starts with character '#'. Everything after that until end of line is treated as comment and ignored. Also all white spaces are ignored.

Note

Only single byte translations are supported with translation tables.

By default, **ssh-translation-table** generates output suitable for ASCII platforms. To generate output for z/OS platforms, also add the following options:

```
-f IBM-1047 -t ISO8859-1
```

Here is an example translation table generated with command **ssh-translation-table**:

```
## SSH TRANSLATION TABLE FILE FORMAT VERSION 1.0
#####################################################################
#
# This file is an example translation table that can be used to
# translate data from 'ISO8859-1' to 'IBM-1047' while reading
# from a file or from 'IBM-1047' to 'ISO8859-1' while writing
# to a file.
#
# The format of translation table file is following:
#
# - White spaces are ignored.
# - Everything after '#' character until end of line is a comment
#   that is ignored.
# - The first table is used when writing data to a file.
```

```
# - The second table is used when reading data from a file.
# - Both tables must exist.
# - Table is a simple hexadecimal representation of the
#   translation. Each value is represented as two hexadecimal
#   characters. The first line gives the values in table
#   positions 0-15 (00-0F), the second line 16-31 (10-1F)
#   and so on.
#
# Note: Only single byte translations are supported.
#
#################################################################

# Inbound (network to file) translation table:
# IBM-1047 -> ISO8859-1

#0-1-2-3-4-5-6-7-8-9-A-B-C-D-E-F
000102039C09867F978D8E0B0C0D0E0F #0
101112139D0A08871819928F1C1D1E1F #1
808182838485171B88898A8B8C050607 #2
909116939495960498999A9B14159E1A #3
20A0E2E4E0E1E3E5E7F1A22E3C282B7C #4
26E9EAEBE8EDEEEFECDF21242A293B5E #5
2D2FC2C4C0C1C3C5C7D1A62C255F3E3F #6
F8C9CACBC8CDCECFCC603A2340273D22 #7
D8616263646566676869ABBBF0FDFEB1 #8
B06A6B6C6D6E6F707172AABAE6B8C6A4 #9
B57E737475767778797AA1BFD05BDEAE #A
ACA3A5B7A9A7B6BCBDBEDDA8AF5DB4D7 #B
7B41424344454647484 9ADF4F6F2F3F5 #C
7D4A4B4C4D4E4F505152B9FBFCF9FAFF #D
5CF7535455565758595AB2D4D6D2D3D5 #E
30313233343536373839B3DBDCD9DA9F #F

# Outbound (file to network) translation table:
# ISO8859-1 -> IBM-1047
#
#0-1-2-3-4-5-6-7-8-9-A-B-C-D-E-F
00010203372D2E2F1605150B0C0D0E0F #0
101112133C3D322618193F271C1D1E1F #1
405A7F7B5B6C507D4D5D5C4E6B604B61 #2
F0F1F2F3F4F5F6F7F8F97A5E4C7E6E6F #3
7CC1C2C3C4C5C6C7C8C9D1D2D3D4D5D6 #4
D7D8D9E2E3E4E5E6E7E8E9ADE0BD5F6D #5
798182838485868788889919293949596 #6
979899A2A3A4A5A6A7A8A9C04FD0A107 #7
202122232425061728292A2B2C090A1B #8
30311A333435360838393A3B04143EFF #9
41AA4AB19FB26AB5BBB49A8AB0CAAFBC #A
908FEAFABEA0B6B39DDA9B8BB7B8B9AB #B
6465626663679E687471727378757677 #C
AC69EDEEEBEFECBF80FDFEFBFCBAAE59 #D
```

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```
4445424643479C485451525358555657 #E
8C49CDCECBCFCCE170DDDEDBDC8D8EDF #F

# EOF
```

In order to create a custom translation table, first create a translation table with **ssh-translation-table** and then edit it with any text editor.

Note

The use of the `i18n_iconv.so` conversion library was deprecated in version 6.6.11 of Tectia for z/OS. Additionally, the `SSH_CHARSET_CONV` environment variable, which points to the conversion library, is no longer necessary and may be safely removed from all environment settings.

ssh-sft-stage

ssh-sft-stage -- stage and destage MVS data sets and HFS files

Synopsis

`ssh-sft-stage` [`-i, --input-file=`*`FILE`*] [`-s, --stage-file=`*`FILE`*] [`-o, --output-file=`*`FILE`*] [`-I, --input-file-ccs=`*`CCS`*] [`-S, --stage-file-ccs=`*`CCS`*] [`-O, --output-file-ccs=`*`CCS`*] [`-f, --stage-format=`*`FORMAT`*] [`-p, --profile`] [`-b, --buffer-size=`*`BUFFER_SIZE`*] [`-d|-D, --debug=`*`STRING`*] [`-v`] [`-V`] [`-h`]

Description

ssh-sft-stage stages a file or data set, that is, converts it into transfer format, or destages a stage file, that is, converts it into a file or data set. File transfer advice strings and profiles can be used to control staging.

The Secure File Transfer Protocol (SFTP), and the way in which it is used in common Secure Shell implementations, requires that a file to be transferred is an octet sequence, that the file size is known, and that it is possible to seek to any position in the file. Staging transforms structured MVS data sets into such a format. On z/OS Unix such files are known as Hierarchical File System (HFS) files.

There are three transfer formats:

- Line format is character-based and uses the newline character as a record delimiter.
- Record format includes record length fields in the stored or transferred data.
- Stream format stores records end-to-end and does not include any structural information.

Input files and output files may be HFS files or MVS data sets. Output MVS data sets must be pre-allocated with complete DCB parameters.

ssh-sft-stage performs coded character set (CCS) conversion when a CCS option is specified for both the stage file and the MVS data set. All the character sets known by the **iconv()** function are available. To see a list of the available character sets, run

```
> iconv -l
```

in the environment where you intend to run **ssh-sft-stage**.

The Tectia Server for IBM z/OS server program, **sshd2**, uses temporary memory files as stage files. This mechanism can be verified with **ssh-sft-stage** by omitting the `-s` option and using `-i` only or both the `-i` and `-o` options.

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Options

ssh-sft-stage has both a long and short form for the options. Both are shown below – use either of the forms.

`-i, --input-file=`*`FILE`*
: Specifes the name of the input file to be staged.

`-s, --stage-file=`*`FILE`*
: Specifies the stage file name.

`-o, --output-file=`*`FILE`*
: Specifies the file name resulting from destaging the stage file.

`-I, --input-file-ccs=`*`CCS`*
: Specifies the CCS of the input file.

`-S, --stage-file-ccs=`*`CCS`*
: Specifies the CCS of the stage file.

`-O, --output-file-ccs=`*`CCS`*
: Specifies the CCS of the output file.

`-f, --stage-format=`*`FORMAT`*
: Specifies the format of the stage file: stream, line, or record.

`-b, --buffer-size=`*`BUFFER_SIZE`*
: Specifies the size of file buffer (in bytes).

`-p, --profile`
: Enables file transfer advice profiles.

`-d|-D, --debug=`*`STRING`*
: Enables debugging.

`-v, --verbose`
: Generates verbose output.

`-V, --version`
: Displays program version and exits.

`-h, --help`
: Displays a short summary of command-line options and exits.

Files

Data Set Names

Write MVS data set names with leading slashes, e.g. `//HANDY.PROGRAM`.

HFS file names must include at least one slash, but not two at the start of the name.

Use single quotes for data set names that should not be prefixed with the user's prefix: `"//'SYS3.HANDY.PROGRAM'"`

Input and output files may also be members in PDS and PDSE libraries. Write the member name in parentheses. Use quoting to prevent the shell from trying to interpret the parentheses: `"//'SYS3.CODE(HANDY)'"`

Output Data Sets

MVS output data sets must be pre-allocated. Any content will be overwritten.

When destaging, overrunning the data set record length (or block size for the `U` data set organization) will cause the run to fail. Overrun can be caused by excessive record lengths when the stage file format is record or missing or improperly placed newline characters when the stage file format is line.

For the line format, the stage file must be encoded in EBCDIC or must be converted to EBCDIC with CCS options. The newline character must be NL (`0x15` in hexadecimal and `025` in octal).

When the stage file format is line, fixed length records are padded with blanks. When the stage file format is record, fixed length records are padded with binary zeros. For the stream format, the last record may be padded with binary zeros.

Environment Variables

You must set this environment variable:

_BPXK_AUTOCVT`=ON`
: If this variable is not set correctly, **ssh-sft-stage** fails to start.

See the IBM *z/OS C/C++ Run-Time Library Reference* manual for these two variables, which influence how **ssh-sft-stage** performs character set conversions:

- **_ICONV_UCS2**
- **_ICONV_UCS2_PREFIX**

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ssh-keygen-g3

ssh-keygen-g3 -- authentication key pair generator

Synopsis

`ssh-keygen-g3` [`options` ...]
[*`key1 key2`* ...]

Description

ssh-keygen-g3 is a tool that generates and manages authentication keys for Secure Shell. Each user wishing to use a Secure Shell client with public-key authentication can run this tool to create authentication keys. Additionally, the system administrator can use this to generate host keys for the Secure Shell server. This tool can also convert openSSH public or private keys to the Tectia key format, or, from Tectia key format to openSSH format. Tectia public keys use The Secure Shell (SSH) Public Key File Format (RFC 4716).

By default, if no path for the key files is specified, the key pair is generated under the user's home directory (`$HOME/.ssh2` on Unix, "`%APPDATA%\SSH\UserKeys`" on Windows). If no file name is specified, the key pair is likewise stored under the user's home directory with such file names as `id_rsa_2048_a` and `id_rsa_2048_a.pub`.

When specifying file paths or other strings that contain spaces, enclose them in quotation marks ("").

Options

The following options are available:

`-1` *`file`*
: Converts a key file from the SSH1 format to the SSH2 format. Note: "`1`" is number one (not letter L).

`-7` *`file`*
: Extracts certificates from a PKCS #7 file.

`-b` *`bits`*
: Specifies the length of the generated key in bits. The allowed and default lengths for different key types are:

- RSA/DSA: allowed 512 to 65536 bits, default 2048 bits
- ECDSA: allowed 256, 384 and 521 bits, default 256 bits

`-B` *`num`*
: Specifies the number base for displaying key information (default: *`10`*).

`-c` *`comment`*

Specifies a comment string for the generated key.

`-D` *`file`*

Derives the public key from the private key *`file`*.

`-e` *`file`*

Edits the specified key. Makes **ssh-keygen-g3** interactive. You can change the key's passphrase or comment.

`-F, --fingerprint` *`file`*

Dumps the fingerprint and type (RSA, DSA or ECDSA) of the given public key. By default, the fingerprint is given in the SSH Babble format, which makes the fingerprint look like a string of "real" words (making it easier to pronounce). The output format can be changed with the `--fingerprint-type` option.

The following options can be also used to modify the behavior of this option: `--fingerprint-type` `--hash`, `--hostkeys-directory`, `--known-hosts`, `--rfc4716`.

`-F, --fingerprint` *`host_ID`*

Dumps the location, fingerprint and type (RSA, DSA or ECDSA) of the locally stored host key(s) identified with the given *`host_ID`*. The *`host_ID`* is a host name or string "*`host#port`*".

The following options can be used to modify the behavior of this option: `--fingerprint-type`, `--hash`, `--hostkeys-directory`, `--known-hosts`, `--rfc4716`.

`-H, --hostkey`

Stores the generated key pair in the default host key directory (`/opt/tectia/etc`). Specify the `-P` option to store the private key with an empty passphrase.

`-i` *`file`*

Loads and displays information on the key *`file`*.

`-k` *`file`*

Converts a PKCS #12 file to an SSH2-format certificate and private key.

`-m, --generate-moduli-file`

Generates moduli file `secsh_dh_gex_moduli` for Diffie-Hellman group exchange.

`-p` *`passphrase`*

Specifies the passphrase for the generated key.

`-P`

Specifies that the generated key will be saved with an empty passphrase.

`-q, --quiet`

Hides the progress indicator during key generation.

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`-r file`

Adds entropy from *file* to the random pool. If *file* contains 'relatively random' data (i.e. data unpredictable by a potential attacker), the randomness of the pool is increased. Good randomness is essential for the security of the generated keys.

`-t dsa | rsa | ecdsa | ed25519`

Selects the type of the key. Valid values are `rsa` (default), `dsa`, `ecdsa` and `ed25519`.

`-x file`

Converts a private key from the X.509 format to the SSH2 format.

`--append [ =yes | no ]`

Appends the keys. Optional values are `yes` and `no`. The default is `yes` to append.

`--copy-host-id host_ID destination`

Copies the host identity to the specified destination directory.

The following options can be used to modify the behavior of this option: `--append`, `--hostkeys-directory`, `--known-hosts`, `--overwrite`.

If `--hostkey-file` is given, the file is treated as a normal host identity file used by the Connection Broker, and its contents will be copied to the destination directory.

`--delete-host-id host_ID`

Deletes the host key of the specified host ID. The *host_ID* is a host name or string "*host#port*".

The following options can be used to modify the behavior of this option: `--host-key-file`, `--hostkeys-directory`, `--known-hosts`.

`--fingerprint-type babble | babble-upper | pgp-2 | pgp-5 | hex | hex-upper`

Specifies the output format of the fingerprint. If this option is given, the `-F` option and the key file name must precede it. The default format is `babble`.

See the section called “Examples” for examples of using this option.

`--hash md5 | sha1 | sha256`

Specifies the digest algorithm for fingerprint generation. Valid options are `md5` and `sha1`.

`--hostkey-file file`

When copying, uses the given file as the source host key, instead of autodetecting the location. When deleting, only deletes from the given location. If the specified file does not contain identities for the specified host, does nothing.

`--hostkeys-directory directory`

Specifies the directory for known host keys to be used instead of the default location.

`--import-public-key` *`infile`* [*`outfile`*]

Attempts to import a public key from *`infile`* and store it to *`outfile`* in the format specified by --key-format parameter. If *`outfile`* is not given, it will be requested. The default output format is SSH2 native format.

`--import-private-key` *`infile`* [*`outfile`*]

Attempts to import a private key from *`infile`* and store it to *`outfile`* in the format specified by --key-format parameter. If *`outfile`* is not given, it will be requested. The default output format is SSH2 native private key format.

`--import-ssh1-authorized-keys` *`infile outfile`*

Imports an SSH1-style authorized_keys file *`infile`* and generates an SSH2-style authorization file *`outfile`*, and stores the keys from *`infile`* to generated files into the same directory with *`outfile`*.

`--key-format` *`format`*

Output key format: secsh2, pkcs1, pkcs8, pkcs12, openssh2, or openssh2-aes.

`--key-hash` *`hash`*

This option can be used for other than Tectia key formats. Specifies the hash algorithm to be used in passphrase-based private key derivation. The default value is `sha1`. Other supported algorithms are `sha224`, `sha256`, `sha384`, and `sha512`. Note that all key formats do not support all hash algorithms.

`--known-hosts` *`file`*

Uses the specified known hosts file. Enables fetching fingerprints for hosts defined in an OpenSSH-style known-hosts file. Using this option overrides the default locations of `known_hosts` files (`/etc/ssh/ssh_known_hosts` and `$HOME/.ssh/known_hosts`). Giving an empty string will disable known-hosts usage altogether.

`--moduli-file-name` *`file`*

Writes the moduli generated for Diffie-Hellman group exchange to *`file`*. (The default file name for option `-m` is `secsh_dh_gex_moduli`.)

`--overwrite` [`=yes` | `no`]

Overwrite files with the same file names. The default is to overwrite.

`--rfc4716`

Displays the fingerprint in the format specified in *RFC4716*. The digest algorithm (hash) is md5, and the output format is the 16-bytes output in lowercase HEX separated with colons (:).

`-V`

Displays version string and exits.

`-h, --help, -?`

Displays a short summary of command-line options and exits.

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Environment Variables

In order to run **ssh-keygen-g3** the following environment variables must be set:

_BPXK_AUTOCVT `=ON`
: If this variable is not set correctly **ssh-keygen-g3** fails to start.

Examples

Create a 3072-bit RSA key pair and store the key pair in the default user key directory with file names *newkey* and *newkey.pub*:

```
$ ssh-keygen-g3 -t rsa -b 3072 newkey
```

Create a 4096-bit RSA key pair and store the private key in ICSF PKCS11 token *pkcs11:ssz.tstusr.ssh2*:

```
$ ssh-keygen-g3 -t rsa -b 4096 pkcs11:ssz.tstusr.ssh2
Generating 4096-bit rsa key pair

Key generated.
4096-bit rsa, TSTUSR@SYS1, Fri Jan 30 2026 11:46:16 +0800
Private key saved to PKCS11:SSZ.TSTUSR.SSH2/000000B5
```

Create a 521-bit ECDSA key pair and store the private key in ICSF PKCS11 token *pkcs11:ssz.sshd2.hostkey*:

```
$ ssh-keygen-g3 -t ecdsa -b 521 pkcs11:ssz.sshd2.hostkey
Generating 521 bit ECDSA key on nistp521 curve

Key generated.
521-bit ecdsa, TSTUSR@SYS1, Fri Jan 30 2026 11:48:16 +0800
Private key saved to PKCS11:SSZ.SSHD2.HOSTKEY/00000088
```

Derive a private key object in ICSF PKCS11 token and store the public key in the default user key directory:

```
$ ssh-keygen-g3 -D pkcs11:ssz.tstusr.ssh2/000000B5
Public key saved to /u/tstusr/.ssh2/PKCS11-SSZ_TSTUSER_SSH2-000000B5.pub
```

Convert an SSH1 key *oldkey* to SSH2 format:

```
$ ssh-keygen-g3 -1 oldkey
```

Display the fingerprint of a server host public key in SSH babble (default) format:

```
$ ssh-keygen-g3 -F hostkey.pub
Fingerprint for key:
xeneh-fyvam-sotaf-gutuv-rahih-kipod-poten-byfam-hufeh-tydym-syxex
```

Display the fingerprint of a server host public key in hex format:

```
$ ssh-keygen-g3 -F hostkey.pub --fingerprint-type=hex
Fingerprint for key:
25533b8c7734f6eb1556ea2ab4900d854d5d088c
```

Convert a private key into openSSH2-AES format:

```
$ ssh-keygen-g3 -p <password> --key-format openssh2-aes \
  --import-private-key <source_key_file> <destination_key_file>
```

Note: if the private key file that is being converted is encrypted with a passphrase, the passphrase must be provided with the '-p' option.

Convert a Tectia public key `tectiakey.pub` to an OpenSSH public key `opensshkey.pub`:

```
$ ssh-keygen-g3 --key-format openssh2 --import-public-key \
  tectiakey.pub opensshkey.pub
```

Generate moduli file `dhgex-moduli` for Diffie-Hellman group exchange:

```
$ ssh-keygen-g3 -m --moduli-file-name dhgex-moduli
```

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ssh-keydist-g3

ssh-keydist-g3 -- Key distribution tool

Synopsis

`ssh-keydist-g3` [`options`...] *`host`* [[`options`...] [*`host`*] ...]

Description

The **ssh-keydist-g3** key distribution tool can be used for storing multiple remote host keys to a common key store and setting up public-key authentication to multiple hosts.

The tool uses sub-script **ssh-keyfetch** for fetching remote host keys.

The tool calls **ssh-keygen-g3** when creating new key pairs.

Options

ssh-keydist-g3 accepts the following options:

`-A, --accepted-host-key-log FILE`
: Specifies a log file listing the accepted new host keys. The default is *`ssh_host_keys.log`* in the user home directory.

`-b, --key-bits NUMBER`
: Specifies the length of the generated key in bits (default `2048`).

`-d, --allow-keygen-overwrite`
: Allows **ssh-keygen-g3** to overwrite an existing key pair.

`-D, --debug LEVEL`
: Sets the debug level, where *`LEVEL`* is number from 1 to 99.

`-f, --pubkey-file FILE`
: Disables key pair generation, and distributes the given key file instead.

`-F, --accepted-host-key-filename-format plain|hashed`
: The accepted host keys are stored in the specified filename format. The default is `hashed`. See Section Section 4.2.1 for more information.

`-g, --accept-hostkeys-globally`
: The accepted host keys are copied to the system-wide store for trusted host keys (`/opt/tectia/etc/hostkeys`). This causes all users to trust the host key. Giving this option requires administrator privileges.

`-H, --hostlist-file FILE`

Specify a host list file that contains hostnames or username/hostname pairs.

The format of the host list file is as follows:

```
userid1/host1.example.com,passwordfile1
userid2/host2.example.com,passwordfile2
userid3/host3.example.com,passwordfile3
```

If the user name is omitted from the entry, the user name given with the `-u` option is used for the connection. If `-u` has not been given, the local user name is used.

If the password file is omitted from the entry, the password file given with the `-p` option is used for the connection. If `-p` has not been given, the password is prompted interactively from the user.

`-i, --accept-host-keys-also-by-ip`

Stores the accepted host keys also by their IP address. This option must be specified if the host will be accessed with Transparent FTP tunneling.

`-I, --dont-accept-host-keys-also-by-ip`

Does not store the accepted host keys also by their IP address (default).

`-k, --continue-after-error`

Do not exit if an operation for one host fails but continue with other hosts.

`-l, --accept-hostkeys-locally`

The accepted host keys are copied to the user specific store for accepted keys. This is the default.

`-M, --destination-home-directory`

Absolute path of the user home directory in the remote system. Default is to access the remote home directory with relative filepaths. Used when SSH_SFTP_HOME_MVS is set to "yes" in SSH environment variables.

`-n, --do-not-execute`

Prints the commands but does not execute them.

`-N, --accept-host-keys`

Accepts new host keys. Does not generate or distribute user keys.

`-O, --openssh-unix`

The remote host is running Unix and its Secure Shell server is OpenSSH. The public key is appended to the user's `$HOME/.ssh/authorized_keys` file.

`-p, --password-file FILE`

Specify a file or a data set containing the password for authenticating to remote server(s) during public key setup. Use with care!

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`-P, --empty-passphrase`
Generate the key pair with an empty passphrase.

`-S, --ssh2-unix`
The remote host is running Unix and its Secure Shell server is Tectia. The public key is uploaded to the user's `$HOME/.ssh2` directory and the `$HOME/.ssh2/authorization` file is updated.

`-t, --key-type dsa|rsa|ecdsa|ed25519`
Selects the algorithm used in key generation. `rsa` (default), `dsa`, `ecdsa` and `ed25519` are supported.

`-u, --remote-user USER`
Specify remote user name. The default is the local user name.

`-U, --user-key-log FILE`
Specifies a log file listing the generated and distributed user keys. The default is *`ssh_user_keys.log`* in the user home directory.

`-v, --verbose`
Enables verbose mode. Information on the progress of the program is displayed in standard output.

`-W, --ssh2-windows`
The remote host is running Windows and its Secure Shell server is Tectia. The public key is uploaded to the user's `%USERPROFILE%\.ssh2` directory and the `%USERPROFILE%\.ssh2\authorization` file is updated.

`-Z, --ssh2-zos`
The remote host is running z/OS and its Secure Shell server is Tectia. The public key is uploaded to the user's USS `$HOME/.ssh2` directory and the `$HOME/.ssh2/authorization` file is updated.

Caution

When **ssh-keydist-g3** is run with the `-N` option, it accepts the received host keys automatically without prompting the user. You should verify the validity of keys by verifying the key fingerprints after receiving them or you risk being subject to a man-in-the-middle attack.

To validate the host key, obtain the host key fingerprint from a trusted source (for example by calling the server administrator) and verify it against the output from command:

```
ssh-keygen-g3 --fingerprint <hostname>
```

Examples

Example 1: Connect to multiple hosts, fetch their host keys in hashed (default) format, and save them under the user's `$HOME/.ssh2/hostkeys` directory. Save the host key hash values with both the specified hostname and the IP address of the host. Store a log of the accepted new host keys under `/tmp`.

```
$ ssh-keydist-g3 -N -i -A /tmp/newhosts.log host1 host2 host3
```

Example 2: Connect to multiple hosts defined in the *`hostlist.txt`* file, fetch their host keys in plain format, and save them under the system-wide `/opt/tectia/etc/hostkeys` directory. Running the command requires administrator privileges.

```
# ssh-keydist-g3 -N -F plain -g -H /home/userid/hostlist.txt
```

The keys are stored with the names specified in the host list file. For example, the following list would specify storing the keys with FQDN and also connecting to port 222 on host1.example.com:

```
host1.example.com
host1.example.com#222
host2.example.com
host3.example.com
```

Example 3: Create a 2048-bit DSA key with an empty passphrase, and upload it to a Unix server running OpenSSH, including the necessary conversions. Public-key upload uses password-from-file for authentication.

```
$ ssh-keydist-g3 -t dsa -b 2048 -P -d -p /home/userid/passwd_file \
   -u user1 -O open_server.example.com
```

Example 4: Create a 2048-bit RSA key with an empty passphrase, and upload it to multiple servers, including the necessary conversions. Public-key upload uses password-from-file for authentication. *`passwd_file1`* is used for the Unix, Windows, and z/OS hosts running Tectia and *`passwd_file2`* is used for the host running OpenSSH.

```
$ ssh-keydist-g3 -t -P -d \
   -p /home/userid/passwd_file1 \
   -S -u user1 tectia_unix.example.com \
   -W -u user2 tectia_win.example.com \
   -Z -u user3 tectia_zos.example.com \
   -p /home/userid/passwd_file2 \
   -O -u user1 open_server.example.com \
```

Example 5: Distribute an existing RSA public key to several hosts using host lists. Store the log of distributed keys under `/tmp`.

The host lists need to be grouped so that all Tectia Unix, Tectia Windows, Tectia z/OS, and OpenSSH hosts are in different host files, for example *`tectiaunix_hostlist.txt`*, *`tectiazos_hostlist.txt`*, *`openssh_hostlist.txt`*, each host list defined in the following way:

```
userid1/host1.example.com
userid2/host2.example.com
userid3/host3.example.com
```

The command is as follows:

```
$ ssh-keydist-g3 -f /home/userid/.ssh2/id_rsa_2048_a.pub \
   -p /home/userid/common_passwd_file -F plain -U /tmp/userkeys.log \
   -S -H tectiaunix_hostlist.txt \
   -Z -H tectiazos_hostlist.txt \
   -O -H openssh_hostlist.txt
```

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ssh-keyfetch

ssh-keyfetch -- Host key tool for the Secure Shell client

Synopsis

`ssh-keyfetch` [`options`...]
[*`host`*]

Description

ssh-keyfetch is a tool that downloads server host keys and optionally sets them as known host keys for the Secure Shell client. It is typically used by the system administrator during the initial setup phase.

By default the host key is fetched from the server and saved in file `key_`*`host_port`*`.suffix` in the current directory.

Options

The following options are available:

`-a, --set-trusted`
: Instead of writing the public key to a file, add the public key as a known host key to the user-specific directory: `$HOME/.ssh2/hostkeys`. This option cannot be combined with `-C` or `-K`.

Caution

When **ssh-keyfetch** is run with the `-a` option, it accepts the received host keys automatically without prompting the user. You should verify the validity of keys by verifying the key fingerprints after receiving them or you risk being subject to a man-in-the-middle attack.

To validate the host key, obtain the host key fingerprint from a trusted source (for example by calling the server administrator) and verify it against the output from command:

```
ssh-keygen-g3 --fingerprint <hostname>
```

`-A, --fetch-any`
: Probe for and fetch either server public key or certificate.

`-C, --fetch-certificate`
: Probe for and fetch the server certificate only.

`-d, --debug` *`debug-level`*
: Enable debugging.

`-D, --debug-default`
Enable debugging with default level.

`-f, --filename-format` *`nameformat`*
Filename format for known host keys. Accepted values are *`plain`* and *`hashed`*. The default is *`plain`*.

`-F, --fingerprint-type` [`=babble` | `babble-upper` | `pgp-2` | `pgp-5` | `hex` | `hex-upper`]
Public key fingerprint type for fingerprints displayed in messages and log. Most popular types are *`babble`* (the SSH babble format) and *`hex`*. The default is *`babble`*. See also the option `--rfc4716`.

`-H, --hash` [`=md5` | `sha1`]
Specifies the digest algorithm for fingerprint generation. Valid options are `md5` and `sha1`.

`-K, --kex-key-formats` *`typelist`*

Explicitly specify the host-key types accepted in protocol key exchange. For experts only. See RFC 4253 for details.

`-k, --kex-key-family` *`rsa|dss|ecdsa|ed25519`*
Accept only one family of server host keys.

`-l, --log`
Report successfully received keys in log format. The log format consists of one line per key, six fields per line. The fields are:

- accept|save
- replace|append
- hostname
- ip-port
- user-id
- key-file-path
- fingerprint

`-o, --output-file` *`output-file`*
Write result to *`output-file`*. A minus sign ("`-`") denotes standard output.

`-O, --output-directory` *`output-dir`*
Write result to *`output-dir`*. The default is the current directory.

`-p, --port` *`port`*
Server port (default: *`22`*).

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`-P, --fetch-public-key`
Probe for and fetch the server public key only. This is the default behaviour.

`-q, --quiet`
Quiet mode, report only errors.

`-R, --rfc4716`

Displays the public key fingerprints in the format specified in RFC 4716. The digest algorithm (hash) is md5, and the output format is the 16-bytes output in lowercase HEX separated with colons (:).

`-S, --proxy-url` *`socks-url`*
Specifies the SOCKS server to use.

`-t, --timeout` *`timeout`*
Connection timeout in seconds (default: *`10`* seconds).

`--append` [`=yes` | `no`]
Instead of appending a new host key, overwrite the existing known host keys for this host. Optional values are `yes` and `no`. The default is to append.

`-V, --version`
Displays version string and exits.

Environment Variables

In order to run **ssh-keyfetch** the following environment variables must be set:

_BPXK_AUTOCVT`=ON`
If this variable is not set correctly **ssh-keyfetch** fails to start.

SSH_SOCKS_SERVER
The address of the SOCKS server used by **ssh-keyfetch**.

Examples

Connect to the server through a SOCKS proxy:

```
$ ssh-keyfetch -S socks://fw.example.com:1080/10.0.0.0/8 server.outside.example
Public key from server.outside.example:22 saved.
 File: server.outside.example.pub
 Fingerprint: xucar-bened-liryt-lumup-minad-tozuc-pesyp-vafah-mugyd-susic-guxix
```

Accept the server key as a known key for Tectia Client and report in the more rigid log format:

```
$ ssh-keyfetch -a -l  newhost
Accepted newhost 22 testuser /home/testuser/.ssh2/hostkeys/key_22_newhost.pub
xigad-hozuf-kykek-vogid-dumid-bydop-mulym-zegar-nybuv-muled-syxyx
```

Accept the server key as a known key for Tectia client tools for z/OS and store the key to global configuration `hostkeys` directory:

```
$ ssh-keyfetch -a --output-directory /etc/ssh2/hostkeys
Accepted newhost 22 testuser /etc/ssh2/hostkeys/key_22_anotherhost.pub
bydop-mulym-zegar-nybuv-muled-syxyx-xigad-hozuf-kykek-vogid-dumid
```

Accept the server key as a known key for Tectia Client and use an uninformative hash as the filename for the stored known key:

```
$ ssh-keyfetch -f hashed -a  newhost
Public key from newhost:22 accepted as trusted hostkey.
 File:
 /home/testuser/.ssh2/hostkeys/keys_420b23ca959ab165e52e117a90baa89d92ffc535
 Fingerprint:
 xigad-hozuf-kykek-vogid-dumid-bydop-mulym-zegar-nybuv-muled-syxyx
```

Accept RSA and ECDSA server keys as a known key for Tectia Client:

```
$ for t in ecdsa rsa; do
  ssh-keyfetch --set-trusted -k $t newhost
done
Public key from newhost accepted as trusted hostkey.
 File: /home/testuser/.ssh2/hostkeys/key_22_newhost.pub
 Fingerprint:
 xecok-rebop-cufar-hotod-geses-dusim-deluv-deren-dyviv-bapad-moxex
Public key from newhost:22 accepted as trusted hostkey.
 File: /home/testuser/.ssh2/hostkeys/key_22_newhost.pub
 Fingerprint:
 xuzib-sehat-pemys-zulor-foran-tizur-repyh-boryd-nogeb-refip-raxax
Public key from newhost:22 accepted as trusted hostkey.
 File: /home/testuser/.ssh2/hostkeys/key_22_newhost.pub
 Fingerprint:
 xifon-sorer-pysys-vumab-mosuz-pefor-pevab-givaz-feguc-nyven-lexux
```

Fetch the X.509 certificate of the server running in port 222 and display the content with **ssh-certview**:

```
$ ssh-keyfetch -C -p 222 -o - newhost | ssh-certview -
Certificate =
  SubjectName = <C=FI, O=SSH, OU=DEV, CN=newhost.ssh.com>
  IssuerName = <C=FI, O=SSH, CN=Sickle CA>
  SerialNumber= 24593438
  Validity =
    NotBefore = 2007 Sep 13th, 15:10:00 GMT
    NotAfter  = 2008 Sep 12th, 15:10:00 GMT
  PublicKeyInfo =
    PublicKey =
      Algorithm = RSA
      Modulus n  (1024 bits) :
...
  Fingerprints =
    MD5 = 3c:71:17:9b:c2:12:26:cf:96:27:fb:d7:a8:19:37:89
```

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```
    SHA-1 =
    14:72:f3:0f:20:5e:75:ed:d2:c3:86:4b:69:45:00:47:ae:fe:31:64
```

This explicit key exchange type list is equivalent to specifying option `-A`:

```
$ ssh-keyfetch -K \
ssh-rsa-sha512@ssh.com,ssh-rsa-sha384@ssh.com,ssh-rsa-sha256@ssh.com, \
ssh-rsa-sha224@ssh.com,ssh-rsa,ssh-dss-sha512@ssh.com,ssh-dss-sha384@ssh.com, \
ssh-dss-sha256@ssh.com,ssh-dss-sha224@ssh.com,ssh-dss,ecdsa-sha2-nistp256, \
ecdsa-sha2-nistp384,ecdsa-sha2-nistp521 newhost
Public key from newhost:22 saved.
 File: key_newhost_22.pub
 Fingerprint:
 xigad-hozuf-kykek-vogid-dumid-bydop-mulym-zegar-nybuv-muled-syxyx
```

ssh-cmpclient-g3

ssh-cmpclient-g3 -- CMP enrollment client

Synopsis

```
ssh-cmpclient-g3 command [options] access [name]

Where command is one of the following:

     INITIALIZE psk|racerts keypair template
     ENROLL certs|racerts keypair template
     UPDATE certs [keypair]
     POLL psk|certs|racerts id

     RECOVER psk|certs|racerts template
     REVOKE psk|certs|racerts template

     TUNNEL racerts template

Most commands can accept the following options:
     -B            Perform key backup for subject keys.
     -o prefix     Save result into files with given prefix.
     -O filename   Save the result into the specified file.
                   If there is more than one result file,
                   the remaining results are rejected.
     -C file       CA certificate from this file.
     -S url        Use this SOCKS server to access the CA.
     -H url        Use this HTTP proxy to access the CA.
     -E            PoP by encryption (CA certificate needed).
     -v num        Protocol version 1|2 of the CA platform. Default is 2.
     -y            Non-interactive mode. All questions answered with 'y'.
     -N file       Specifies a file to stir to the random pool.
     -d level      Set debug level.
     -Z provspec   Specifies external key provider for the private key.
                   The format of provspec is "providername:initstring".


The following identifiers are used to specify options:
     psk      -p refnum:key (reference number and pre-shared key)
              -p file (containing refnum:key)
              -i number (iteration count, default 1024)
     certs    -c file (certificate file) -k url (private-key URL)
     racerts  -R file (RA certificate file) -k url (RA private-key URL)
     keypair  -P url (private-key URL)
     id       -I number (polling ID)
     template -T file (certificate template)
              -s subject-ldap[;type=value]
              -u key-usage-name[;key-usage-name]
              -U extended-key-usage-name[;extended-key-usage-name]
```

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```
     access   URL where the CA listens for requests.
     name     LDAP name for the issuing CA (if -C is not given).

Key URLs are either valid external key paths or in the format:
     "generate://savetype:passphrase@keytype:size/save-file-prefix"
     "file://passphrase/relative-key-file-path"
     "file:relative-key-file-path"
     "any-key-file-path"

The key generation "savetype" can be:
 - ssh2, secsh2, secsh (Secure Shell 2 key type)
 - ssh1, secsh1 (legacy Secure Shell 1 key type)
 - pkcs1 (PKCS #1 format)
 - pkcs8s (passphrase-protected PKCS #8, "shrouded PKCS #8")
 - pkcs8 (plain-text PKCS #8)
 - x509 (Tectia-proprietary X.509 library key type)

     -h Prints usage message.
     -F Prints key usage extension and keytype instructions.
     -e Prints command-line examples.
```

Description

The **ssh-cmpclient-g3** command-line tool is a certificate enrollment client that uses the CMP protocol. It can generate an RSA or DSA public-key pair and get certificates for their public components. CMP is specified by the IETF PKIX Working Group for certificate life-cycle management, and is supported by some CA platforms, such as RSA Keon.

Commands

The **ssh-cmpclient-g3** command-line command keywords are listed below. Shorthands longer than three letters can be used to identify the command. The commands are case-insensitive. The user must specify the CA address URL for each command. Here the term "user" refers to a user, program, or hardware device.

`INITIALIZE`

Requests the user's initial certificate. The request is authenticated using the reference number and the corresponding key (PSK) received from the CA or RA using some out-of-band mechanism.

The user must specify the PSK, the asymmetric key pair, and a subject name.

`ENROLL`

Requests a new certificate when the user already has a valid certificate for the key. This request is similar to `initialize` except that it is authenticated using public-key methods.

`POLL`

Polls for a certificate when a request was not immediately accepted.

`UPDATE`

Requests an update of an existing certificate (replacement). The issued certificate will be similar to the existing certificate (names, flags, and other extensions). The user can change the key, and the validity times are updated by the CA. This request is authenticated by a valid existing key pair and a certificate.

`RECOVER`

Requests recovery of a backed-up key. This request is authenticated either by PSK-based or certificate-based authentication. The template describes the certificate whose private key has already been backed up and should be recovered. Users can only recover keys they have backed up themselves.

`REVOKE`

Requests revocation for a key specified in the template. Authentication of the request is made using a PSK or a certificate belonging to the same user as the subject of revocation.

`TUNNEL`

Operates in RA tunnel mode. Reads requests and optionally modifies the subject name, alternative names, and extensions based on the command line. Approves the request and sends it to the CA.

Options

The **ssh-cmpclient-g3** command-line options are listed below. Note that when a file name is specified, an existing file with the same name will be overwritten. When specifying subject names or other strings that contain spaces, enclose them in quotation marks ("").

`-B`

Requests private key backup to be performed for the initialize, enroll, and update commands.

`-o` *`prefix`*

Saves resulting certificates and CRLs into files with the given *`prefix`*. The prefix is first appended by a number, followed by the file extension `.crt` or `.crl`, depending on the type of object.

`-O` *`filename`*

Saves the result into the specified absolute filename. If there is more than one result file, the remaining results are rejected.

`-C` *`file`*

Specifies the file path that contains the CA certificate. If key backup is done, the file name must be given, but in most cases the LDAP name of the CA can be given instead.

`-S` *`url`*

Specifies the SOCKS URL if the CA is located behind a SOCKS- enabled firewall. The format of the URL is: `socks://[username@]server[:port][/network/bits[,network/bits]]`

`-H` *`url`*

Uses the given HTTP proxy server to access the CA. The format of the URL is: `http://server[:port]/`

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`-E`

Performs encryption proof of possession if the CA supports it. In this method of PoP, the request is not signed, but instead the PoP is established based on the ability to decrypt the certificates received from the CA. The CA encrypts the certificates with the user's public key before sending them to the user.

`-v` *`num`*

Selects the CMP protocol version. This is either value 1, for an RFC 2510-based protocol, or 2 (the default) for CMPv2.

`-N` *`file`*

Specifies a file to be used as an entropy source during key generation.

`-d` *`level`*

Sets the debug level string to *`level`*.

`-Z` *`provspec`*

Specifies the external key provider for the private key. Give *`provspec`* in the format *`"providername:init-string"`*.

The usage line uses the following meta commands:

`psk`

The reference number and the corresponding key value given by the CA or RA.

`-p` *`refnum:key|file`*

`refnum` and `key` are character strings shared among the CA and the user. `refnum` identifies the secret `key` used to authenticate the message. The `refnum` string must not contain colon characters.

Alternatively, a filename containing the reference number and the key can be given as the argument.

`-i` *`number`*

`number` indicates the key hashing iteration count.

`certs`

The user's existing key and certificate for authentication.

`-k` *`url`*

URL specifying the private key location. This is an external key URL whose format is specified in the section called “Synopsis”.

`-c` *`file`*

Path to the file that contains the certificate issued to the public key given in the `-k` option argument.

`racerts`

In RA mode, the RA key and certificate for authentication.

`-k` *`url`*

URL specifying the private key location. This is an external key URL whose format is specified in the section called “Synopsis”.

`-R` *`file`*

Path to the file that contains the RA certificate issued to the public key given in the `-k` option argument.

`keypair`

The subject key pair to be certified.

`-P` *`url`*

URL specifying the private key location. This is an external key URL whose format is specified in the section called “Synopsis”.

`id`

Polling ID used if the PKI action is left pending.

`-I` *`number`*

Polling transaction ID *`number`* given by the RA or CA if the action is left pending.

`template`

The subject name and flags to be certified.

`-T` *`file`*

The file containing the certificate used as the template for the operation. Values used to identify the subject are read from this, but the user can overwrite the key, key-usage flags, or subject names.

`-s` *`subject-ldap[;type=value]*`*

A subject name in reverse LDAP format, that is, the most general component first, and alternative subject names. The name `subject-ldap` will be copied into the request verbatim.

A typical choice would be a DN in the format `"C=US,O=SSH,CN=Some Body"`, but in principle this can be anything that is usable for the resulting certificate.

The possible `type` values are `ip`, `email`, `dn`, `dns`, `uri`, and `rid`.

`-u` *`key-usage-name[;key-usage-name]*`*

Requested key usage purpose code. The following codes are recognized: `digitalSignature`, `nonRepudiation`, `keyEncipherment`, `dataEncipherment`, `keyAgreement`, `keyCertSign`, `cRLSign`, `encipherOnly`, `decipherOnly`, and `help`. The special keyword help lists the supported key usages which are defined in RFC 3280.

`-U` *`extended-key-usage-name[;extended-key-usage-name]*`*

Requested extended key usage code. The following codes, in addition to user-specified dotted OID values are recognized: `serverAuth`, `clientAuth`, `codeSigning`, `emailProtection`, `timeStamping`, `ikeIntermediate`, and `smartCardLogon`.

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`access`

Specifies the CA address in URL format. Possible access methods are HTTP (`http://host:port/path`), or plain TCP (`tcp://host:port/path`). If the host address is an IPv6 address, it must be enclosed in square brackets (`http://[IPv6-address]:port/`).

`name`

Optionally specifies the destination CA name for the operation, in case a CA certificate was not given using the option `-C`.

Examples

Initial Certificate Enrollment

This example provides commands for enrolling an initial certificate for digital signature use. It generates a private key into a PKCS #8 plaintext file named `initial.prv`, and stores the enrolled certificate into file `initial-0.crt`. The user is authenticated to the CA with the key identifier (refnum) `62154` and the key `ssh`. The subject name and alternative IP address are given, as well as key-usage flags. The CA address is `pki.ssh.com`, the port `8080`, and the CA name to access `Test CA 1`.

```
$ ssh-cmpclient-g3 INITIALIZE \
   -P generate://pkcs8@rsa:1024/initial -o initial \
   -p 62154:ssh \
   -s 'C=FI,O=SSH,CN=Example/initial;IP=1.2.3.4' \
   -u digitalsignature \
   http://pki.ssh.com:8080/pkix/ \
   'C=FI, O=SSH Communications Security Corp, CN=SSH Test CA 1 No Liabilities'
```

As a response the command presents the issued certificate to the user, and the user accepts it by typing `yes` at the prompt.

```
Certificate =
  SubjectName = <C=FI, O=SSH, CN=Example/initial>
  IssuerName = <C=FI, O=SSH Communications Security Corp,
    CN=SSH Test CA 1 No Liabilities>
  SerialNumber= 8017690
  SignatureAlgorithm = rsa-pkcs1-sha1
  Validity = ...
  PublicKeyInfo = ...
  Extensions =
      Viewing specific name types = IP = 1.2.3.4
    KeyUsage = DigitalSignature
    CRLDistributionPoints = ...
    AuthorityKeyID =
      KeyID = 3d:cb:be:20:64:49:16:1d:88:b7:98:67:93:f0:5d:42:81:2e:bd:0c
    SubjectKeyID =
      KeyId = 6c:f4:0e:ba:b9:ef:44:37:db:ad:1f:fc:46:e0:25:9f:c8:ce:cb:da
  Fingerprints =
    MD5 = b7:6d:5b:4d:e0:94:d1:1f:ec:ca:c2:ed:68:ac:bf:56
    SHA-1 = 4f:de:73:db:ff:e8:7d:42:c4:7d:e1:79:1f:20:43:71:2f:81:ff:fa
```

```
Do you accept the certificate above? yes
```

Key update

Before the certificate expires, a new certificate with updated validity period should be enrolled. **ssh-cmpclient-g3** supports key update, where a new private key is generated and the key update request is authenticated with the old (still valid) certificate. The old certificate is also used as a template for issuing the new certificate, so the identity of the user will not be changed during the key update. With the following command you can update the key pair, which was enrolled in the previous example. Presenting the resulting certificate has been left out.

```
$ ssh-cmpclient-g3 UPDATE \
   -k initial.prv -c initial-0.crt -P \
   generate://pkcs8@rsa:1024/updatedcert -o updatedcert \
   http://pki.ssh.com:8080/pkix/ \
   "C=FI, O=SSH Communications Security Corp, CN=SSH Test CA 1 No Liabilities"
```

The new key pair can be found in the files with the `updatedcert` prefix. The policy of the issuing CA needs to also allow automatic key updates if **ssh-cmpclient-g3** is used in the `UPDATE` mode.

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ssh-scepclient-g3

ssh-scepclient-g3 -- SCEP enrollment client

Synopsis

```
ssh-scepclient-g3 command [options] access [name]
```

```
Where command is one of the following:
     GET-CA
     GET-CHAIN
     ENROLL psk keypair template

Most commands can accept the following options:
     -o prefix       Save result into files with prefix.
     -S url          Use this socks server to access CA.
     -H url          Use this HTTP proxy to access CA.

The following identifiers are used to specify options:
     psk      -p key (used as revocationPassword or challengePassword)
     keypair  -P url (private-key URL)
     ca       -C file (CA certificate file)
              -E file (RA encryption certificate file)
              -V file (RA validation certificate file)
     template -T file (certificate template)
              -s subject-ldap[;type=value]
              -u key-usage-name[;key-usage-name]
              -U extended-key-usage-name[;extended-key-usage-name]
     access   URL where the CA listens for requests.

GET-CA and GET-CHAIN take name argument, that is something
interpreted by the CA to specify a CA entity managed by the responder.

Key URLs are either valid external key paths or in the format:
     "generate://savetype:password@keytype:size/save-file-prefix"
     "file://savetype:password@/file-prefix"
     "file://passphrase/file-prefix"
     "file:/file-prefix"
     "key-filename"

The "keytype" for the SCEP protocol has to be "rsa".

The key generation "savetype" can be:
 - ssh2 (Secure Shell 2 key type)
 - ssh1 (Legacy Secure Shell 1 key type)
 - ssh  (Tectia proprietary crypto library format, passphrase-protected)
 - pkcs1 (PKCS#1 format)
 - pkcs8s (passphrase-protected PKCS#8, "shrouded PKCS#8")
 - pkcs8 (plain-text PKCS#8)
 - x509 (Tectia proprietary X.509 library key type)
```

Description

The **ssh-scepclient-g3** command-line tool is a certificate enrollment client that uses the SCEP protocol. It can generate an RSA public-key pair and get certificates for its public components. The SCEP protocol was developed by Cisco and Verisign to be used on Cisco routers. Nowadays most CA platforms support this protocol for client certificate enrollment.

Commands

The **ssh-scepclient-g3** command-line command keywords are listed below. Shorthands longer than three letters can be used to identify the command. The commands are case-insensitive. The user must specify the CA address URL for each command. Here the term "user" refers to a user, program, or hardware device.

`GET-CA`
: Requests CA or RA certificate download from the CA, and display the certificate fingerprint for CA validation. Fingerprints should be received from the CA using some out-of-band mechanism.

`GET-CHAIN`
: Requests certificate chain from the CA/RA to the top-level CA.

`ENROLL`
: Requests a new certificate from the CA. The CA will authorize the request using some out-of-band mechanism, or it can contain a password received from the CA.

Options

`-o` *`prefix`*
: Saves output certificates into files with the given prefix. The prefix is first appended by a number, followed by the file extension `.ca` for CA certificates or `.crt` for user certificates.

`-S` *`url`*
: Specifies the SOCKS URL if the CA is located behind a SOCKS-enabled firewall. The format of the URL is: `socks://[username@]server[:port][/network/bits[,network/bits]]`

`-H` *`url`*
: Uses the given HTTP proxy server to access the CA. The format of the URL is: `http://server[:port]/`.

The usage line uses the following meta commands:

`psk`
: The pre-shared key given by the CA or RA, or a revocation password invented by the client and provided to the CA when the user wishes to revoke the certificate issued. The type and need for this depends on the PKI platform used by the CA.

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`-p` *`key`*

An authentication password or a revocation password transferred (in encrypted format) to the CA for certification request or revocation request authorization purposes.

`keypair`

The subject key pair to be certified.

`-P` *`url`*

URL specifying the private key location. This is an external key URL whose format is specified in the section called “Synopsis”.

`ca`

The CA/RA certificates.

`-C` *`file`*

When performing enrollment, reads the CA certificate from the given file path.

`-E` *`file`*

Optionally specifies the RA encryption certificate.

`-V` *`file`*

Optionally specifies the RA signing certificate.

`template`

The subject name and flags to be certified.

`-T` *`file`*

The file containing the certificate used as the template for the operation. Values used to identify the subject are read from this, but the user may overwrite the key, key-usage flags, or subject names.

`-s` *`subject-ldap[;type=value]*`*

A subject name in reverse LDAP format, that is, the most general component first, and alternative subject names. The name `subject-ldap` will be copied into the request verbatim.

A typical choice would be a DN in the format `"C=US,O=SSH,CN=Some Body"`, but in principle this can be anything that is usable for the resulting certificate.

The possible `type` values are `ip`, `email`, `dn`, `dns`, `uri`, and `rid`.

`-u` *`key-usage-name[;key-usage-name]*`*

Requested key usage purpose code. The following codes are recognized: `digitalSignature`, `nonRepudiation`, `keyEncipherment`, `dataEncipherment`, `keyAgreement`, `keyCertSign`, `cRLSign`, `encipherOnly`, `decipherOnly`, and `help`. The special keyword help lists the supported key usages which are defined in *RFC 3280*.

`-U` *`extended-key-usage-name[;extended-key-usage-name]*`*
: Requested extended key usage code. The following codes, in addition to user-specified dotted OID values are recognized: `serverAuth`, `clientAuth`, `codeSigning`, `emailProtection`, `timeStamping`, `ikeIntermediate`, and `smartCardLogon`.

`access`
: Specifies the address of the CA in URL format. If the host address is an IPv6 address, it must be enclosed in brackets (`http://[IPv6-address]:port/`).

`name`
: Specifies the destination CA name.

Examples

In the following example we first receive the CA certificate. The CA address is `pki.ssh.com`, the port is `8080`, and the CA name is `test-ca1.ssh.com`.

```
$ ssh-scepclient-g3 GET-CA \
   -o ca http://pki.ssh.com:8080/scep/ \
   test-ca1.ssh.com

Received CA/RA certificate ca-0.ca:

fingerprint 9b:96:51:bb:29:0d:c9:e0:75:c8:03:0d:0d:92:60:6c
```

Next, we enroll an RSA certificate. The user is authenticated to the CA with the key `ssh`. The subject name and alternative IP address are given, as well as key-usage flags.

```
$ ssh-scepclient-g3 ENROLL \
    -C ca-0.ca -p ssh \
    -o subject -P generate://pkcs8:ssh@rsa:1024/subject \
    -s 'C=FI,O=SSH,CN=SCEP Example;IP=1.2.3.4' \
    -u digitalsignature \
    http://pki.ssh.com:8080/scep/

Received user certificate subject-0.crt:
fingerprint 4b:7e:d7:67:27:5e:e0:54:2f:5b:56:69:b5:01:d2:15
$ ls subject*
subject-0.crt   subject.prv
```

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ssh-certview-g3

ssh-certview-g3 -- certificate viewer

Synopsis

`ssh-certview-g3`
[`options`...] *`file`*
[`options`...] *`file ...`*

Description

The **ssh-certview-g3** program is a simple command-line application, capable of decoding and showing X.509 certificates, CRLs, and certification requests. The command output is written to the standard output.

Options

The following options are available:

`-h`
Displays a short help.

`-verbose`
Gives more diagnostic output.

`-quiet`
Gives no diagnostic output.

`-auto`
The next input file type is auto-detected (default).

`-cert`
The next input file is a certificate.

`-certpair`
The next input file is a cross-certificate pair.

`-crmf`
The next input file is a CRMF certification request.

`-req`
The next input file is a PKCS #10 certification request.

`-crl`
The next input file is a CRL.

`-prv`
The next input file is a private key.

`-pkcs12`
The next input file is a PKCS#12 package.

`-ssh2`
The next input file is an SSH2 public key.

`-spkac`
The next input file is a Netscape-generated SPKAC request.

`-noverify`
Does not check the validity of the signature on the input certificate.

`-autoenc`
Determines PEM/DER automatically (default).

`-pem`

Assumes that the input file is in PEM (ASCII base-64) format. This option allows both actual PEM (with headers and footers), and plain base-64 (without headers and footers). An example of PEM header and footer is shown below:

```
-----BEGIN CERTIFICATE-----
encoded data
-----END CERTIFICATE-----
```

`-der`
Assumes that the input file is in DER format.

`-hexl`

Assumes that the input file is in Hexl format. (Hexl is a common Unix tool for outputting binary files in a certain hexadecimal representation.)

`-skip` *`number`*
Skips *`number`* bytes from the beginning of input before trying to decode. This is useful if the file contains some garbage before the actual contents.

`-ldap`
Prints names in LDAP order.

`-utf8`
Prints names in UTF-8.

`-latin1`
Prints names in ISO-8859-1.

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`-base10`
: Outputs big numbers in base-10 (default).

`-base16`
: Outputs big numbers in base-16.

`-base64`
: Outputs big numbers in base-64.

`-width` *`number`*
: Sets output width (*`number`* characters).

Example

For example, using a certificate downloaded from `pki.ssh.com`, when the following command is given:

```
$ ssh-certview-g3 -width 70 ca-certificate.cer
```

The following output is produced:

```
Certificate =
  SubjectName = <C=FI, O=SSH Communications Security Corp, CN=Secure
    Shell Test CA>
  IssuerName = <C=FI, O=SSH Communications Security Corp, CN=Secure
    Shell Test CA>
  SerialNumber= 34679408
  SignatureAlgorithm = rsa-pkcs1-sha1
  Certificate seems to be self-signed.
      * Signature verification success.
  Validity =
    NotBefore = 2003 Dec  3rd, 08:04:27 GMT
    NotAfter  = 2005 Dec  2nd, 08:04:27 GMT
  PublicKeyInfo =
    PublicKey =
      Algorithm name (SSH) : if-modn{sign{rsa-pkcs1-md5}}
      Modulus n  (1024 bits) :
        96356809228059302634765496419579987563410225412029378652405 53
        93747409460794737674242240714708377288408393205216215183233 77
        35931023504159872523008179267699688811598969554902743686066 64
        07596441316907505326652662186964660603777993580367354759022 57
        60860985629193639634709266901627442584519831245755959268495 51
        903
      Exponent e (  17 bits) :
        65537
  Extensions =
    Available = authority key identifier, subject key identifier, key
      usage(critical), basic constraints(critical), authority
      information access
    KeyUsage = DigitalSignature KeyEncipherment KeyCertSign CRLSign
        [CRITICAL]
```

```
  BasicConstraints =
    PathLength = 0
    cA         = TRUE
      [CRITICAL]
  AuthorityKeyID =
    KeyID =
      eb:f0:4d:b5:b2:4c:be:47:35:53:a8:37:d2:8d:c8:b2:f1:19:71:79
  SubjectKeyID =
    KeyId =
      eb:f0:4d:b5:b2:4c:be:47:35:53:a8:37:d2:8d:c8:b2:f1:19:71:79
  AuthorityInfoAccess =
    AccessMethod = 1.3.6.1.5.5.7.48.1
    AccessLocation =
      Following names detected =
        URI (uniform resource indicator)
      Viewing specific name types =
        URI = http://pki.ssh.com:8090/ocsp-1/
Fingerprints =
  MD5 = c7:af:e5:3d:f6:ea:ce:da:07:93:d0:06:8d:c0:0a:f8
  SHA-1 =
  27:d7:19:47:7c:08:3e:1a:27:4b:68:8e:18:83:e8:f9:23:e8:29:85
```

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ssh-ekview-g3

ssh-ekview-g3 -- external key viewer

Synopsis

`ssh-ekview-g3` [`options`...] *`provider`*

Description

The **ssh-ekview-g3** program allows you to export certificates from external key providers. You can further study these certificates with **ssh-certview-g3**.

This is useful when you want to generate, for example, entries for allowing certificate authentication in the `ssh-server-config.xml` file. You might need to know the subject names on the certificate.

With **ssh-ekview-g3**, you can export the certificate and get the information you need from the certificates with **ssh-certview-g3**.

Options

The following options are available:

`-h`
: Displays a short help.

`-i` *`info`*
: Uses *`info`* as the initialization string for the provider.

`-k`
: Prints the key paths only.

`-e` *`keypath`*
: Exports certificates at *`keypath`* to files.

`-a`
: Exports all found certificates to files.

`-b` *`base`*
: Uses *`base`* when printing integers. For example, the decimal 10 is 'a' in base-16.

Appendix C Egrep Syntax

The Tectia tunneling and FTP-SFTP conversion filter rules can be matched to hostname or IP address patterns specified using the **egrep** syntax. In addition, regular expressions can be used in selectors when specifying ranges of values. The egrep syntax is explained in this section.

C.1 Egrep Patterns

The escape character is a backslash (\). You can use it to escape meta characters to use them in their plain character form.

In the following examples literal 'E' and 'F' denote any expression, whether a pattern or a character.

(
: Start a capturing subexpression.

)
: End a capturing subexpression.

E|F
: Disjunction, match either E or F (inclusive). E is preferred if both match.

E*
: Act as Kleene star, match E zero or more times.

E+
: Closure, match E one or more times.

E?
: Option, match E optionally once.

.
: Match any character except for newline characters (\n, \f, \r) and the `NULL` byte.

E{n}
: Match E exactly n times.

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E{n,} or E{n,0}
: Match E n or more times.

E{,n} or E{0,n}
: Match E at most n times.

E{n,m}
: Match E no less than n times and no more than m times.

[
: Start a character set, see Section C.3.

$
: Match the empty string at the end of the input or at the end of a line.

^
: Match the empty string at the start of the input or at the beginning of a line.

C.2 Escaped Tokens for Regex Syntax Egrep

\0n..n
: The literal byte with octal value n..n.

\0
: The `NULL` byte.

\[1-9]..x
: The literal byte with decimal value `[1-9]..x`.

\xn..n or \0xn..n
: The literal byte with hexadecimal value n..n.

\<
: Match the empty string at the beginning of a word.

\>
: Match the empty string at the end of a word.

\b
: Match the empty string at a word boundary.

\B
: Match the empty string provided it is not at a word boundary.

\w
: Match a word-constituent character, equivalent to [a:zA:Z0:9-].

\W
: Match a non-word-constituent character.

\a
: Literal alarm character.

\e
: Literal escape character.

\f
: Literal line feed.

\n
: Literal new line, equivalent to C's \n so it can be more than one character long.

\r
: Literal carriage return.

\t
: Literal tab.

All other escaped characters denote the literal character itself.

C.3 Character Sets For Egrep

A character set starts with '[' and ends at non-escaped ']' that is not part of a POSIX character set specifier and that does not follow immediately after '['.

The following characters have a special meaning and need to be escaped if meant literally:

- (minus sign)
: A range operator, except immediately after '[', where it loses its special meaning.

^
: If immediately after the starting '[', denotes a complement: the whole character set will be complemented. Otherwise literal '^'.

[:alnum:]
: Characters for which 'isalnum' returns true .

[:alpha:]
: Characters for which 'isalpha' returns true .

[:cntrl:]
: Characters for which 'iscntrl' returns true .

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[:digit:]
: Characters for which 'isdigit' returns true .

[:graph:]
: Characters for which 'isgraph' returns true .

[:lower:]
: Characters for which 'islower' returns true .

[:print:]
: Characters for which 'isprint' returns true .

[:punct:]
: Characters for which 'ispunct' returns true .

[:space:]
: Characters for which 'isspace' returns true .

[:upper:]
: Characters for which 'isupper' returns true .

[:xdigit:]
: Characters for which 'isxdigit' returns true .

Example: `[[:xdigit:]XY]` is typically equivalent to `[0123456789ABCDEFabcdefXY]` .

It is also possible to include the predefined escaped character sets into a newly defined one, so `[\d\s]` matches digits and whitespace characters.

Also, escape sequences resulting in literals work inside character sets.

Appendix D Audit Messages

This appendix lists the audit messages generated by the Connection Broker.

1000 KEX_failure
Level: warning
Origin: Tectia Server, Connection Broker

The key exchange failed.

Default log facility: normal

Argument	Description
Username	User's login name (not present for first KEX)
Algorithm	KEX algorithm name (not present if failure happens before choosing the algorithm)
Text	Error description
Session-Id	Session identifier

1001 Algorithm_negotiation_failure
Level: warning
Origin: Tectia Server, Connection Broker

Algorithm negotiation failed - there was no common algorithm in the client's and server's lists.

Default log facility: normal

Argument	Description
Username	User's login name (not present for first KEX)
Algorithm	Algorithm type
Client algorithms	Client's algorithm list
Server algorithms	Server's algorithm list
Session-Id	Session identifier

1002 Algorithm_negotiation_success
Level: informational
Origin: Tectia Server, Connection Broker

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Algorithm negotiation succeeded.

Default log facility: normal

Argument	Description
Username	User's login name (not present for first KEX)
Text	Negotiated algorithms
Session-Id	Session identifier

1003 KEX_success
Level: informational
Origin: Connection Broker

Key-exchange was successful.

Default log facility: normal

Argument	Description
Algorithm	Kex method name.
Session-Id	Session identifier.
Protocol-session-Id	Protocol session identifier.

1100 Certificate_validation_failure
Level: informational
Origin: Tectia Server, Connection Broker

A received certificate failed to validate correctly under any of the configured CAs.

Default log facility: normal

Argument	Description
Username	User's login name (not present for first KEX)
Text	Resulting search states for all configured CAs.
Session-Id	Session identifier

1101 Certificate_validation_success
Level: informational
Origin: Tectia Server, Connection Broker

A received certificate validated correctly under one or more configured CAs.

Default log facility: normal

Argument	Description
Username	User's login name
CA List	A list of CAs under which the user's certificate validated correctly.

Argument	Description
Session-Id	Session identifier

1110 CM_find_started
Level: informational
Origin: Tectia Server, Connection Broker

A low-level search was started in the certificate validation subsystem.

Default log facility: normal

Argument	Description
Ctx	Search context
Search constraints	Search constraints.

1111 CM_find_finished
Level: informational
Origin: Tectia Server, Connection Broker

A low-level find operation has finished in the certificate validation subsystem.

Default log facility: normal

Argument	Description
Ctx	Context pointer that identifies the search

1112 CM_cert_not_in_search_interval
Level: informational
Origin: Tectia Server, Connection Broker

The certificate is not valid during the required time period.

Default log facility: normal

Argument	Description
SubjectName	Subject name of the certificate
Text	Error description
Ctx	Search context

1113 CM_certificate_revoked
Level: informational
Origin: Tectia Server, Connection Broker

A certificate was found to be revoked.

Default log facility: normal

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Argument	Description
SubjectName	Subject name of the certificate
Ctx	The context pointer of the search

1114 CM_cert_search_constraint_mismatch
Level: informational
Origin: Tectia Server, Connection Broker

The certificate did not satisfy the constraints set for the search.

Default log facility: normal

Argument	Description
SubjectName	Subject name of the certificate
Text	Description of the mismatch
Ctx	Search context

1115 CM_ldap_search_started
Level: informational
Origin: Tectia Server, Connection Broker

An LDAP search for a CRL or a sub-CA is being started.

Default log facility: normal

Argument	Description
Text	Search details

1116 CM_ldap_search_success
Level: informational
Origin: Tectia Server, Connection Broker

An LDAP search for a CRL or a sub-CA completed successfully.

Default log facility: normal

Argument	Description
Text	Search details

1117 CM_ldap_search_failure
Level: informational
Origin: Tectia Server, Connection Broker

The attempt to contact an LDAP server was unsuccessful.

Default log facility: normal

Argument	Description
Text	Error details

1118 CM_http_search_started
Level: informational
Origin: Tectia Server, Connection Broker

The certificate validation subsystem is initiating a search for a CRL or a sub-CA through the HTTP protocol.

Default log facility: normal

Argument	Description
Text	Search target

1119 CM_http_search_success
Level: informational
Origin: Tectia Server, Connection Broker

An HTTP request for a CRL or a sub-CA completed successfully.

Default log facility: normal

Argument	Description
Text	Status message detailing what was being retrieved

1120 CM_http_search_failure
Level: informational
Origin: Tectia Server, Connection Broker

An HTTP request for a CRL or a sub-CA failed.

Default log facility: normal

Argument	Description
Text	Error details

1121 CM_crl_added
Level: informational
Origin: Tectia Server, Connection Broker

A new CRL was successfully added to the certificate validation subsystem.

Default log facility: normal

Argument	Description
Text	CRL's issuer and validity period

1122 Certificate_end_point_id_check_success

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Level: informational
Origin: Connection Broker

End point identity check succeeded.

Default log facility: normal

Argument	Description
Server	Host name
Text	Explanatory message

1123 Certificate_end_point_id_check_warning
Level: informational
Origin: Connection Broker

Certificate end point identity check warning.

Default log facility: normal

Argument	Description
Server	Host name
Text	Warning message

1124 Certificate_end_point_id_check_failure
Level: informational
Origin: Connection Broker

Certificate end point identity check failure.

Default log facility: normal

Argument	Description
Server	Host name
Text	Error message

1200 Key_store_create
Level: informational
Origin: Tectia Server, Connection Broker

Key store created.

Default log facility: normal

1201 Key_store_create_failed
Level: warning
Origin: Tectia Server, Connection Broker

Key store creation failed.

Default log facility: normal

1202 Key_store_destroy
Level: informational
Origin: Tectia Server, Connection Broker

Key store destroyed.

Default log facility: normal

1204 Key_store_add_provider
Level: informational
Origin: Tectia Server, Connection Broker

Added a provider to the key store.

Default log facility: normal

Argument	Description
Type	Provider type

1205 Key_store_add_provider_failed
Level: warning
Origin: Tectia Server, Connection Broker

Adding a provider to the key store failed.

Default log facility: normal

Argument	Description
Type	Provider type
EK error	Error message

1206 Key_store_remove_provider
Level: informational
Origin: Tectia Server, Connection Broker

Removed a provider from the key store.

Default log facility: normal

Argument	Description
Init info	Provider name

1208 Key_store_decrypt
Level: informational
Origin: Tectia Server, Connection Broker

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A key was used successfully for decryption.

Default log facility: normal

Argument	Description
Key path	Key path
Fwd path	Fwd path

1209 Key_store_decrypt_failed
Level: warning
Origin: Tectia Server, Connection Broker

A key was used unsuccessfully for decryption.

Default log facility: normal

Argument	Description
Key path	Key path
Fwd path	Fwd path
Crypto error	Error string

1210 Key_store_sign
Level: informational
Origin: Tectia Server, Connection Broker

A key was used successfully for signing.

Default log facility: normal

Argument	Description
Key path	Key path
Fwd path	Fwd path

1211 Key_store_sign_failed
Level: warning
Origin: Tectia Server, Connection Broker

A key was used unsuccessfully for signing.

Default log facility: normal

Argument	Description
Key path	Key path
Fwd path	Fwd path
Crypto error	Error string

1212 Key_store_sign_digest
Level: informational

Origin: Tectia Server, Connection Broker

A key was used successfully for signing a digest.

Default log facility: normal

Argument	Description
Key path	Key path
Fwd path	Fwd path

1213 Key_store_sign_digest_failed
Level: warning
Origin: Tectia Server, Connection Broker

A key was used unsuccessfully for signing a digest.

Default log facility: normal

Argument	Description
Key path	Key path
Fwd path	Fwd path
Crypto error	Error string

1214 Key_store_ek_provider_failure
Level: warning
Origin: Tectia Server, Connection Broker

External key provider failure.

Default log facility: normal

Argument	Description
Key path	Key path
Text	Key label
Text	Error description

1300 Channel_inbound_statistics
Level: informational
Origin: Connection Broker, Tectia Server

Statistics for the inbound side of a channel (traffic arriving from the network)

Default log facility: normal

Argument	Description
Username	User's login name
Session-Id	Session identifier
Channel Id	Local channel id

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Argument	Description
Packet count	Protocol packet count
Packet size	Average protocol packet payload size

1301 Channel_outbound_statistics
Level: informational
Origin: Connection Broker, Tectia Server

Statistics for the outbound side of a channel (traffic going to the network)

Default log facility: normal

Argument	Description
Username	User's login name
Session-Id	Session identifier
Channel Id	Local channel id
Packet count	Protocol packet count
Packet size	Average protocol packet payload size
Packet size	Final size of outbound channel buffer

3000 Sft_client_start
Level: debug
Origin: Tectia Secure File Transfer clients

File transfer client program was started.

Default log facility: user

3001 Sftc_create_file
Level: debug
Origin: Tectia Secure File Transfer clients

A new file was created.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
File	Path to target file
Text	(Optional) error message and/or additional info

3002 Sftc_truncate_file

Level: debug
Origin: Tectia Secure File Transfer clients

A file was truncated.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
File	Path to file
Text	(Optional) error message and/or additional info

3003 Sftc_modify_file_attrs
Level: informational
Origin: Tectia Secure File Transfer clients

A file attribute was modified.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
File	Path to file
Text	(Optional) error message and/or additional info

3004 Sftc_delete_file
Level: notice
Origin: Tectia Secure File Transfer clients

A file was deleted.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program

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Argument	Description
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
File	Path to file
Text	(Optional) error message and/or additional info

3005 Sftc_create_dir
Level: debug
Origin: Tectia Secure File Transfer clients

A directory was created.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
Dir	Path to directory
Text	(Optional) error message and/or additional info

3006 Sftc_remove_dir
Level: notice
Origin: Tectia Secure File Transfer clients

A directory was removed.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
Dir	Path to directory
Text	(Optional) error message and/or additional info

3007 Sftc_copy_dir_start
Level: notice

Origin: Tectia Secure File Transfer clients

Copying a directory initiated.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Source Connection	Source connection
From	Path to source directory
Target Connection	Target connection
To	Path to target directory
Text	(Optional) error message and/or addtnl info

3008 Sftc_copy_dir_finished
Level: notice
Origin: Tectia Secure File Transfer clients

Copying a directory completed.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Source Connection	Source connection
From	Path to source directory
Target Connection	Target connection
To	Path to target directory
Duration	Duration of copying the directory
Files	Number of files that were copied
Data	Amount of data copied in bytes
Speed	Copy speed in KiB/s
Text	(Optional) error message and/or additional info

3009 Sftc_move_dir_start
Level: notice
Origin: Tectia Secure File Transfer clients

Moving a directory initiated.

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Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Source Connection	Source connection
From	Path to source directory
Target Connection	Target connection
To	Path to target directory
Text	(Optional) error message and/or additional info

3010 Sftc_move_dir_finished
Level: notice
Origin: Tectia Secure File Transfer clients

Moving a directory completed.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Source Connection	Source connection
From	Path to source directory
Target Connection	Target connection
To	Path to target directory
Duration	Duration of moving the directory
Files	Number of files that were moved
Data	Amount of data transferred in bytes
Speed	Transfer speed in KiB/s
Text	(Optional) error message and/or additional info

3011 Sftc_copy_file_start
Level: informational
Origin: Tectia Secure File Transfer clients

Copying a file initiated.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Source Connection	Source connection
From	Path to source file
Target Connection	Target connection
To	Path to target file
Text	(Optional) error message and/or additional info

3012 Sftc_copy_file_finished
Level: notice
Origin: Tectia Secure File Transfer clients

Copying a file completed.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Source Connection	Source connection
From	Path to source file
Target Connection	Target connection
To	Path to target file
Duration	Duration
Data	Amount of data copied in bytes
Speed	Copy speed in KiB/s
Text	(Optional) error message and/or additional info

3013 Sftc_move_file_start
Level: informational
Origin: Tectia Secure File Transfer clients

Moving a file initiated.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program

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Argument	Description
Pid	Client process ID
OpID	Operation ID
Source Connection	Source connection
From	Path to source file
Target Connection	Target connection
To	Path to target file
Text	(Optional) error message and/or additional info

3014 Sftc_move_file_finished

Level: notice

Origin: Tectia Secure File Transfer clients

Moving a file completed.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Source Connection	Source connection
From	Path to source file
Target Connection	Target connection
To	Path to target file
Duration	Duration of moving the file
Data	Amount of data transferred in bytes
Speed	Transfer speed in KiB/s
Text	(Optional) error message and/or additional info

3015 Sftc_rename_file

Level: informational

Origin: Tectia Secure File Transfer clients

A file was renamed.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID

Argument	Description
Status	Result (SUCCESS or FAILED)
Connection	Target connection
File	Path to file
Text	(Optional) error message and/or additional info

3017 Sft_client_command
Level: debug
Origin: Tectia Secure File Transfer clients

File transfer client command.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Text	Command given on cmd line or defined in batch file

3018 Sftc_open_dir
Level: debug
Origin: Tectia Secure File Transfer clients

A directory was opened.

Default log facility: user

Argument	Description
Local username	Local user name
Program	Secure file transfer client program
Pid	Client process ID
OpID	Operation ID
Status	Result (SUCCESS or FAILED)
Connection	Target connection
Dir	Path to directory
Text	(Optional) error message and/or additional info

6000 Broker_client_connect
Level: informational
Origin: Connection Broker

A client connected to the Broker.

Default log facility: discard

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Argument	Description
Client	Client name
Pid	Process id
Local username	Local user name

6001 Broker_client_connect_failed
Level: warning
Origin: Connection Broker

A client attempted to connect unsuccessfully to the Broker.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Process id
Local username	Local user name
Text	Reason

6002 Broker_client_disconnect
Level: informational
Origin: Connection Broker

A client disconnected from the Broker.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Process id
Local username	Local user name

6004 Broker_exec_channel_open
Level: informational
Origin: Connection Broker

The Broker opened an exec channel.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Server	Server host
Server Port	Server port
Remote username	Remote user name
Local username	Local user name

Argument	Description
Command	Command
Text	Exec parameters
Channel Id	Channel ID
Session-Id	Session ID

6005 Broker_exec_channel_open_failed
Level: warning
Origin: Connection Broker

The Broker failed to open an exec channel for a client.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Server	Server host
Server Port	Server port
Remote username	Remote user name
Local username	Local user name
Command	Command
Text	Exec parameters
Channel Id	Channel ID
Text	Reason
Session-Id	Session ID

6006 Broker_tunnel_open
Level: informational
Origin: Connection Broker

The Broker opened a tunnel for a client.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Server	Server host
Server Port	Server port
Remote username	Remote user name
Local username	Local user name
Dst	Destination host
Dst Port	Destination port
Tunnel type	Tunnel type

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Argument	Description
Session-Id	Session ID

6007 Broker_tunnel_open_failed
Level: warning
Origin: Connection Broker

The Broker failed to open a tunnel for a client.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Server	Server host
Server Port	Server port
Remote username	Remote user name
Local username	Local user name
Dst	Destination host
Dst Port	Destination port
Tunnel type	Tunnel type
Text	Reason
Session-Id	Session ID

6008 Broker_tunnel_listener_open
Level: informational
Origin: Connection Broker

The Broker opened a tunnel listener for a client.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Server	Server host
Server Port	Server port
Remote username	Remote user name
Local username	Local user name
Listener	Listener host
Listener Port	Listener port
Dst	Destination host
Dst Port	Destination port
Tunnel type	Tunnel type
Text	Tunnel listener parameters

Argument	Description
Session-Id	Session ID

6009 Broker_tunnel_listener_open_failed
Level: warning
Origin: Connection Broker

The Broker failed to open a tunnel listener for a client.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Server	Server host
Server Port	Server port
Remote username	Remote user name
Local username	Local user name
Listener	Listener host
Listener Port	Listener port
Dst	Destination host
Dst Port	Destination port
Tunnel type	Tunnel type
Text	Tunnel listener parameters
Text	Reason
Session-Id	Session ID

6010 Broker_channel_fd_strip
Level: informational
Origin: Connection Broker

The Broker destroyed a channel object (and returned the underlying fd to the client).

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Text	Channel permanent?
Local username	Local user name
Session-Id	Session ID

6011 Broker_channel_fd_strip_failed
Level: warning
Origin: Connection Broker

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The Broker failed to destroy a channel object (and return the underlying fd to the client).

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Text	Channel permanent?
Local username	Local user name
Text	Reason
Session-Id	Session ID

6012 Broker_channel_control
Level: informational
Origin: Connection Broker

The Broker sent a channel control message.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Command	Command
Args	Arguments
Local username	Local user name
Session-Id	Session ID

6013 Broker_channel_control_failed
Level: warning
Origin: Connection Broker

The Broker failed to send a channel control message.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Command	Command
Args	Arguments
Local username	Local user name
Text	Reason

Argument	Description
Session-Id	Session ID

6014 Broker_channel_close
Level: informational
Origin: Connection Broker

The Broker closed a channel.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Exit Value	Exit value
Local username	Local user name
Session-Id	Session ID

6015 Broker_channel_close_failed
Level: warning
Origin: Connection Broker

The Broker failed to close a channel.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Local username	Local user name
Text	Reason

6018 Broker_server_version_request
Level: informational
Origin: Connection Broker

The Broker requested (and got) the server version.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Ver	Version

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Argument	Description
Local username	Local user name
Session-Id	Session ID

6019 Broker_server_version_request_failed
Level: warning
Origin: Connection Broker

The Broker failed to get the server version.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Channel Id	Channel ID
Local username	Local user name
Text	Reason
Session-Id	Session ID

6020 Broker_channel_process_exit
Level: informational
Origin: Connection Broker

Channel process exit request was successful.

Default log facility: discard

Argument	Description
Client	Client name
Pid	Client process ID
Local username	Local user name
Session-Id	Session ID

6021 Broker_channel_process_exit_failed
Level: warning
Origin: Connection Broker

Channel process exit request failed.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Text	Reason
Local username	Local user name

Argument	Description
Session-Id	Session ID

6025 Broker_connector_license_check_failed
Level: warning
Origin: Connection Broker

Connector license check failed.

Default log facility: normal

Argument	Description
Text	Error message
Session-Id	Session id

6026 Broker_server_rekey
Level: notice
Origin: Connection Broker

The Broker requested rekeying and it was successful.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Local username	Local user name
Session-Id	Session ID

6027 Broker_server_rekey_failed
Level: warning
Origin: Connection Broker

The Broker requested rekeying but it failed.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process ID
Local username	Local user name
Session-Id	Session ID

6035 Broker_publickey_upload
Level: informational
Origin: Connection Broker

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Public key is uploaded.

Default log facility: normal

Argument	Description
Client	Client name
Pid	Client process id
Local username	Local user name
Public key hash	Public key hash
Server	Server name
Server Port	Server port
Remote username	Remote user name
File name	Public key file name

6100 Broker_starting
Level: notice
Origin: Connection Broker

The Broker is starting.

Default log facility: normal

Argument	Description
Local username	Local user name

6101 Broker_start_failed
Level: warning
Origin: Connection Broker

Starting the Broker failed.

Default log facility: normal

Argument	Description
Local username	Local user name
Success | Error	Error code
Text	Error message

6102 Broker_running
Level: notice
Origin: Connection Broker

The Broker is running.

Default log facility: normal

Argument	Description
Local username	Local user name
Text	Message text

6104 Broker_stopping
Level: notice
Origin: Connection Broker

The Broker is stopping.

Default log facility: normal

Argument	Description
Local username	Local user name

6106 Broker_reconfig_started
Level: notice
Origin: Connection Broker

Reconfiguration started.

Default log facility: normal

Argument	Description
Local username	Local user name

6108 Broker_reconfig_finished
Level: notice
Origin: Connection Broker

Reconfiguration finished.

Default log facility: normal

Argument	Description
Local username	Local user name
Success | Error	Error code

6114 Broker_config_deprecated_element
Level: warning
Origin: Connection Broker

The Broker config contains a deprecated element.

Default log facility: normal

Argument	Description
Text	Event description.

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6200 Broker_tcp_connect
Level: informational
Origin: Connection Broker

Broker TCP connection attempt was successful.

Default log facility: discard

Argument	Description
Dst	Destination host
Dst Port	Destination port
Src Port	Source port
Local username	Local username

6201 Broker_tcp_connect_failed
Level: warning
Origin: Connection Broker

Broker TCP connection attempt failed.

Default log facility: normal

Argument	Description
Dst	Destination host
Dst Port	Destination port
Local username	Local username
NIO error	NIO error

6204 Broker_transport_connect
Level: informational
Origin: Connection Broker

A transport was connected through TCP.

Default log facility: discard

Argument	Description
Dst	Destination host
Dst Port	Destination port
Remote username	Remote username
Src Port	Source port
Local username	Local username
Session-Id	Session ID

6206 Broker_transport_gateway_connect
Level: informational
Origin: Connection Broker

A transport was connected through a gateway handle.

Default log facility: discard

Argument	Description
Dst	Destination host
Dst Port	Destination port
Remote username	Remote username
Local username	Local username
Session-Id	Session ID

6208 Broker_connection_connect
Level: informational
Origin: Connection Broker

The Broker got successfully a Secure Shell connection up.

Default log facility: discard

Argument	Description
Dst	Destination host
Dst Port	Destination port
Local username	Local user name
Remote username	Remote user name
Uses gateway?	Is this going through a gateway handle
Session-Id	Session ID

6209 Broker_connection_connect_failed
Level: warning
Origin: Connection Broker

The Broker failed to get a Secure Shell connection up.

Default log facility: normal

Argument	Description
Dst	Destination host
Dst Port	Destination port
Local username	Local user name
Remote username	Remote user name
Uses gateway?	Is this going through a gateway handle
Session-Id	Session ID
Text	Error code

6210 Broker_connection_disconnect
Level: informational

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Origin: Connection Broker

A Secure Shell connection initiated by the Broker was disconnected.

Default log facility: discard

Argument	Description
Local username	Local user
Session-Id	Session identifier
Dst	Destination host
Dst Port	Destination port
Remote username	Remote username

6211 Broker_unknown_hostkey_accepted
Level: warning
Origin: Connection Broker

* The Broker accepted an unknown hostkey without user interaction * because of configuration.

Default log facility: normal

Argument	Description
Text	Key digest
Dst	Destination host
Dst Port	Destination port
Local username	Local user name
Remote username	Remote user name
Text	SHA-256 key digest

6212 Broker_new_hostkey
Level: warning
Origin: Connection Broker

* First connection to a server or this server hostkey was never * saved before.

Default log facility: normal

Argument	Description
Text	Key digest
Dst	Destination host
Dst Port	Destination port
Local username	Local user name
Remote username	Remote user name
Text	SHA-256 key digest

6213 Broker_hostkey_changed
Level: warning

Origin: Connection Broker

* Server hostkey is different than the saved hostkey.

Default log facility: normal

Argument	Description
Text	Key digest
Dst	Destination host
Dst Port	Destination port
Local username	Local user name
Remote username	Remote user name
Text	SHA-256 key digest

6301 Broker_userauth_failure
Level: warning
Origin: Connection Broker

User authentication failed.

Default log facility: normal

Argument	Description
Text	Reason
Session-Id	Session identifier

6302 Broker_userauth_method_success
Level: informational
Origin: Connection Broker

A user authentication method succeeded.

Default log facility: discard

Argument	Description
Text	Authentication method
Session-Id	Session identifier

6303 Broker_userauth_method_failure
Level: warning
Origin: Connection Broker

A user authentication method failed.

Default log facility: discard

Argument	Description
Text	Authentication method

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Argument	Description
Text	Reason
Session-Id	Session identifier

6401 Connector_filter_rule
Level: informational
Origin: Connection Broker

SOCKS proxy not tunneling

Default log facility: discard

Argument	Description
Connector	Connector action
Dst	Address
Dst Port	Port

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