HP-UX Secure Shell Getting Started Guide

HP-UX 11i v1, HP-UX 11i v2, and HP-UX 11i v3

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Contents

About This Document

This document describes the HP-UX Secure Shell software. It includes information about installing, verifying, configuring, and troubleshooting HP-UX Secure Shell on HP-UX platforms. The latest version of this document is available at:

http://www.hp.com/go/hpux-security-docs

The document printing date and part number indicate the document's current edition. The printing date will change when a new edition is printed. Minor changes may be made at reprint without changing the printing date. The document part number will change when extensive changes are made.

Document updates can be issued between editions to correct errors or document product changes. To ensure that you receive the updated or new edition, subscribe to the appropriate product support service. Contact your HP sales representative for details.

There are two types of administrators, the Secure Shell administrator and the Kerberos administrator. The Secure Shell administrator and the Kerberos administrator can be different people or the same person.

Intended Audience

This document is intended for system administrators who use HP-UX Secure Shell.

Administrators must have a basic understanding of the following:

- Cryptography
- Kerberos authentication protocol

New and Changed Information in This Edition

This document is updated to include information about the support of new ECDSA key types. New client and server configuration directives are also included in this edition.

Publishing History

Table 1 describes the publishing details of this document for various HP-UX releases.

Table 1 Publishing History Details

Document Manufacturing Part Number	Operating Systems Supported	Publication Date
5900–2248	• HP-UX 11i v1 • HP-UX 11i v2 • HP-UX 11i v3	March 2012
5900–1228	• HP-UX 11i v1 • HP-UX 11i v2 • HP-UX 11i v3	September 2010
5992-4213	• HP-UX 11i v1 • HP-UX 11i v2 • HP-UX 11i v3	May 2008
T1471-90028	• HP-UX 11i v1 • HP-UX 11i v2 • HP-UX 11i v3	September 2006
T1471-90024	• HP-UX 11.0 • HP-UX 11i v1 • HP-UX 11i v2	June 2006
5991-7493	• HP-UX 11i v1 • HP-UX 11i v2 • HP-UX 11i v3	February 2007

HP-UX Release Name and Release Identifier

Each HP-UX 11i release has an associated release name and release identifier. The `uname` command with the `-r` option returns the release identifier. Table 2 shows the available HP-UX releases.

Table 2 HP-UX 11i Releases

Release Identifier	Release Name	Supported Processor Architecture
B.11.11	HP-UX 11i v1	PA-RISC
B.11.20	HP-UX 11i v1.5	Intel® Itanium®
B.11.22	HP-UX 11i v1.6	Intel Itanium
B.11.23	HP-UX 11i v2	Intel Itanium, PA-RISC
B.11.31	HP-UX 11i v3	Intel Itanium, PA-RISC

Document Organization

The *HP-UX Secure Shell Getting Started Guide* is organized as follows:

Chapter 1: Introduction — Presents an overview of the HP-UX Secure Shell software and describes its structure.

Chapter 2: Installing HP-UX Secure Shell — Describes how to install HP-UX Secure Shell and the required patches. It also lists the hardware and software requirements for installing HP-UX Secure Shell.

Chapter 3: HP-UX Secure Shell Authentication Methods	Describes the different authentication methods used by HP-UX Secure Shell.
Chapter 4: Configuring HP-UX Secure Shell Authentication Methods	Describes how to configure HP-UX Secure Shell to use different authentication methods, and to optimize performance.
Chapter 5: Configuring HP-UX Secure Shell as a SOCKS Proxy	Describes how to configure proxy server support with HP-UX Secure Shell.
Chapter 6: Enabling HP-UX Secure Shell to Take Advantage of High Speed Networks	Describes how to enable HP-UX Secure Shell to take advantage of high-performance networks.
Chapter 7: Troubleshooting HP-UX Secure Shell	Describes the HP-UX Secure Shell server and client debugging options.
Appendix A: Configuration Files and Directives	Describes the HP-UX Secure Shell server and client configuration directives.
Appendix B: Sample /etc/krb5.conf File	Provides a sample `/etc/pam.conf` file.

Typographic Conventions

This document uses the following conventions:

audit(5)	An HP-UX manpage. In this example, *audit* is the name and 5 is the section in the *HP-UX Reference*. On the Web and on the Instant Information CD, it may be a link to the manpage itself. From the HP-UX command line, you can enter `man audit` or `man 5 audit` to view the manpage. See *man*(1).
Book Title	The title of a book. On the Web and on the Instant Information CD, it may be a link to the book itself.
KeyCap	The name of a keyboard key. Note that **Return** and **Enter** both refer to the same key.
Emphasis	Text that is emphasized.
Bold	The defined use of an important word or phrase.
`ComputerOut`	Text displayed or generated by the system.
`UserInput`	Commands and other text that you type.
`Command`	A command name or qualified command phrase.
`Variable`	The name of a variable that you can replace in a command or function or information in a display that represents several possible values.
|	Separates list items in a list of choices.
[ ]	The contents are optional in formats and command descriptions. If the contents are a list separated by |, you can choose one of the items.
{ }	The contents are required in formats and command descriptions. If the contents are a list separated by |, you must choose one of the items.
...	The preceding element can be repeated an arbitrary number of times.

Related Documents

Following are the additional documentation available for HP-UX Secure Shell:

- HP-UX Secure Shell Release Notes on the Internet and Security Solutions page at: http://www.hp.com/go/hpux-security-docs
- The README file at `/opt/ssh/README.hp`. You must install HP-UX Secure Shell to access this file.

- HP-UX Secure Shell Manpages
- For more information on cryptography, see: http://www.ssh.com/support/cryptography/
- For more information on Kerberos, see to the Kerberos white paper available at: http://www.hp.com/go/hpux-security-docs

You can obtain general information about Secure Shell technology from the following Web sites:

- Features and FAQ at the OpenSource SSH Web site at: http://www.openssh.org
- Barrett, Daniel J. and Richard E. Silverman, 2001. *SSH, The Secure Shell: The Definitive Guide*. California: O'Reilly and Associates Inc., This book is also available at: http://www.oreilly.com
- SSH Secure Shell FAQs at: http://www.employees.org/~satch/ssh/faq/ssh-faq.html

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Include the document title, manufacturing part number, and any comments, errors found, in this document. Also, please include what we did right, so we can incorporate it into other documents.

1 Introduction

This chapter provides an overview of HP-UX Secure Shell. HP-UX Secure Shell is a program that enables users to securely access various network services.

This chapter addresses the following topics:

Overview

HP-UX Secure Shell enables you to securely log into another system over a network, to execute commands on a remote system, and to move files from one system to another. HP-UX Secure Shell provides a set of commands that replace insecure commands such as `rlogin`, `rsh`, `rcp`, `ftp`, and `telnet`. HP-UX Secure Shell also protects a network from the following security hazards:

IP Spoofing	A technique used to gain unauthorized access to computers. An intruder sends messages to a computer with an IP address indicating that the message is coming from a trusted host.
Eavesdropping	Searching a system for passwords, credit card numbers, or business secrets.
Hijacking	A technique used to take over network communication in such a way that the attacker can inspect and modify data transmitted between the communicating parties.

HP-UX Secure Shell is based on the open source Secure Shell (OpenSSH) product. OpenSSH is available in two versions: SSH Protocol Version 1 (SSH-1) and SSH Protocol Version 2 (SSH-2). HP-UX Secure Shell supports both versions of OpenSSH. However, HP recommends SSH-2, because it is more secure than SSH-1.

HP-UX Secure Shell establishes a secure connection between a client and a remote server over an insecure network. The key attributes of this secure connection are the following:

- Strong authentication for both client and the remote system
- Strong encryption and public-key cryptography for communication between a client and the remote system
- Secure channel that the client uses to execute commands on the remote system

Secure access to the remote host enables you to perform the following actions:

- Execute commands safely on a remote system
- Move files from one system to another over a secure channel
- Securely copy remote files

NOTE: All references to server and client in this document refer to HP-UX Secure Shell server and HP-UX Secure Shell client, respectively.

Key Features

Following are the key features of HP-UX Secure Shell:

Strong Encryption	All communication between the client and the server is encrypted using patent-free encryption algorithms such as Blowfish, Data Encryption Standard (DES), 3DES, Advanced Encryption Standard (AES), and arcfour. Authentication information (for example, passwords) is never sent in clear text over the network. Encryption in conjunction with strong public-key cryptography also provides protection against a number of potential security attacks.
Strong Authentication	HP-UX Secure Shell supports a strong set of authentication methods between client and server. HP-UX Secure Shell supports two-way authentication: the server authenticates the client and the client authenticates the server. This protects the session against a variety of security hazards.
Port Forwarding	HP-UX Secure Shell supports the redirection of TCP/IP connections between a client and a remote host. For example, you can use port forwarding to redirect file transfer protocol (FTP) traffic between a client and a server. Instead of the client directly communicating with the server, you can redirect the traffic to an HP-UX Secure Shell server over a secure channel. The HP-UX Secure Shell server forwards the traffic to a designated port on the FTP server.
X11 Forwarding	X11 forwarding provides secure X traffic between client and server. It automatically sets the `DISPLAY` variable on the remote system where the `sshd` daemon is running.
Agent Forwarding	HP-UX Secure Shell facilitates and secures key-based authentication using an authentication agent. This agent typically runs in the client environment and holds all key information. The only place in the network where the key information is stored is the local system. Keys are never disclosed to any other component of the network.
Integration with HP-UX Security Features and Services	HP-UX Secure Shell is well integrated with the following features and services offered by HP-UX: • The `/etc/utmp`, `/var/adm/wtmp`, and `/var/adm/btmp` files (similar to the `telnet` and `remsh` sessions) • PAM modules • The `/etc/default/security` file • Shadow passwords • Trusted HP-UX features • The `/var/adm/syslog/syslog.log` file • Audit Logging

Architecture

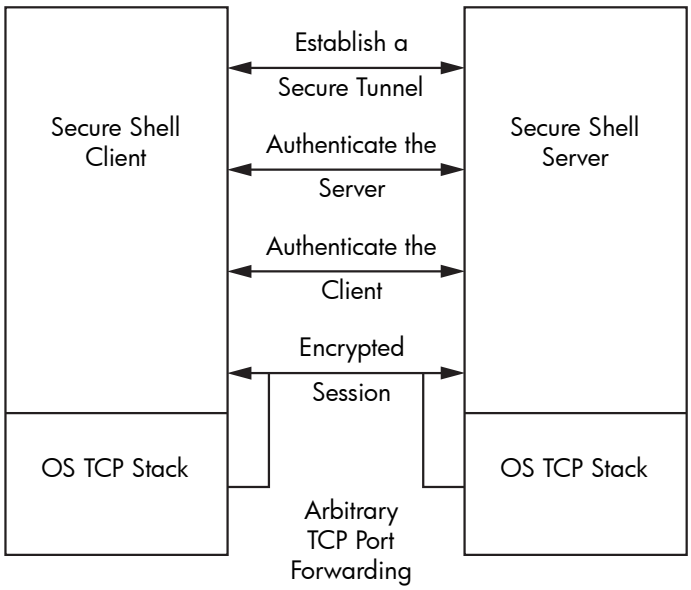
HP-UX Secure Shell is based on client-server architecture. An HP-UX Secure Shell daemon (`sshd`) runs on a UNIX system and waits for connections from clients. The HP-UX Secure Shell environment consists of the following distinct components:

Server	A program running as a daemon (`sshd`) that listens for HP-UX Secure Shell connections.
Client	A program that connects a system to the HP-UX Secure Shell server.
Session	An ongoing connection between an HP-UX Secure Shell client and a server.

Key	A relatively small amount of data used as a parameter for cryptographic algorithms, such as encryption or message authentication.
User Key	An asymmetric key used by the client to provide a user identity.
Host Key	An asymmetric key used by the server to provide a server identity.
Session Key	A symmetric key that encrypts the communication between the client and server.
Key Generator	A program that creates persistent keys, such as user keys and host keys.
Agent	A program that caches user keys in memory so that users need not retype their passphrases.

Figure 1 shows how the major HP-UX Secure Shell components interact with one another.

Figure 1 HP-UX Secure Shell Components



How Secure Shell Establishes a Secure Connection

The client and server must establish a secure connection before any interaction can take place. The secure connection enables you to share keys, passwords, and data. Establishing a secure connection between a client and the server includes the following steps:

1. The client contacts the server.
2. The client and server disclose the HP-UX Secure Shell protocol versions they support.
3. The client and server switch to a packet-based protocol.
4. The server identifies itself to the client and provides session parameters.
5. The client sends a session key to the server.
6. Both client and server enable encryption and complete server authentication.
7. The secure connection is established.

Before running the client, you must start the server daemon (`sshd`). The `sshd` daemon takes its initial configuration values from the `sshd_config` file, located in the `/opt/ssh/etc` directory on the server. The most important configuration directives in the `sshd_config` file are those that are used to set the authentication methods that `sshd` supports.

When you run the HP-UX Secure Shell client application, the following events occur:

1. The client application establishes a socket connection with the HP-UX Secure Shell server.
2. The server spawns a child `sshd` process.

3. The child `sshd` process inherits the connection socket and authenticates the client application based on the selected authentication method. A successful secure client session is established only upon successful authentication.
4. When a session is created, all subsequent communication occurs directly between the client application and the child `sshd` process. The client application can now execute remote commands on the server. Each command request from the client application causes the child `sshd` process to spawn a shell process to execute the command.

NOTE: In HP-UX Secure Shell Versions A.03.81 and earlier, every new client connection caused the `sshd` daemon to fork itself. From HP-UX Secure Shell A.03.09 onwards, every new client connection causes the `sshd` daemon to re-execute (fork and exec). This default re-execute behavior is more secure, because it ensures that the each client connection uses a new seed for key generation. You can revert to the previous behavior by using the `sshd` command with the `-r` option. HP does not recommend changing the default behavior.

A running HP-UX Secure Shell client-server session consists of the following processes:

- A single client process running on the client system.
- The following processes running on the server system:
  - One parent `sshd` process and many child `sshd` processes.
  - A shell process for each command execution request from the client. This shell process is spawned to execute the command, and terminates when the command successfully completes execution. All communication between the child `sshd` process and the shell process is carried out through a UNIX pipe.

Protocol Support

HP-UX Secure Shell supports the SSH-1 and SSH-2 protocols. Table 3 compares the features of the SSH-1 and SSH-2 protocols.

Table 3 Comparative Analysis of SSH-1 and SSH-2 Protocols

SSH-1	SSH-2
Original version of Secure Shell protocol.	Enhanced SSH protocol. Offers better security, portability, and performance.
Uses server keys and host keys to authenticate systems.	Uses only host keys to authenticate systems.
Uses only one session key.	Uses several session keys.
Supports the RSA algorithm only.	Supports RSA, DSA, and ECDSA algorithms.
Does not support SOCKS (SOCKetS) and secure FTP (`sftp`).	Supports both SOCKS and `sftp`.

HP-UX Secure Shell Commands

HP-UX Secure Shell includes a set of commands used to securely access remote systems. For more information, see the manpages for each command.

Table 4 lists the commands that enable you to securely access remote systems.

Table 4 HP-UX Secure Shell Commands

Command	Description	Runs On	Equivalent Non-Secure Components
`ssh`	Secure Shell client	Client	`remsh`,`telnet`
`slogin`	Symbolic link to `ssh`	Client	`remsh`, `telnet`

Table 4 HP-UX Secure Shell Commands *(continued)*

Command	Description	Runs On	Equivalent Non-Secure Components
`sshd`	Secure Shell daemon	Server	`remshd`, `telnetd`
`scp`	Secure file copy for client and server	Client and Server	`rcp`
`sftp`	Secure FTP program	Client	`ftp`
`sftp-server`	The `sftp` server subsystem automatically initiated by the `sshd` daemon.	Server	`ftpd`
`prngd`	Random number generator used when the `sshd` daemon is unable to find the `/dev/random` or `/dev/urandom` file on the server	Server	Not applicable
`ssh-keygen`	Generates key pairs used in public-key authentication. Both client and server are required to generate key pairs. The server key pair is required for all HP-UX Secure Shell client operations regardless of the authentication method used. The client key pair is used for public-key authentication only.	Client and Server	Not applicable
`ssh-agent`	Tool for automatic public-key login from client to server. The `ssh-agent` binary stores information about the private-key passcodes for different client users on the system. During public-key authentication, the client prompts the user for the private-key passcode. However, if `ssh-agent` is running at the same time, the client retrieves the passcode from the `ssh-agent` binary.	Client	Not applicable
`ssh-add`	Makes the client key pairs known to `ssh-agent`. Useful during public-key authentication if the client's private keys are generated with passcodes.	Client	Not applicable
`ssh-keyscan`	Gathers public keys for a set of systems running the `sshd` daemon.	Client	Not applicable
`ssh-keysign`	The client uses this command to read the server's private key. The `ssh-keysign` binary runs as a superuser and is not visible to end users.	Client	Not applicable

Keys and Configuration Files

A run-time HP-UX Secure Shell environment uses the following files for authentication:

- Configuration files
- Host file lists
- Key files

Table 5 lists the client keys and configuration files for the HP-UX Secure Shell client.

Table 5 Client Keys and Configuration Files

Name	Description	Location
ssh_config	Specifies the client configuration file. The client uses this file to determine the required run-time parameters. For more information on the configuration directives in the ssh_config file, see Appendix A (page 62).	/opt/ssh/etc/ssh_config
known_hosts	Lists public keys for all sshd daemons on the client subnet. This file is required for all HP-UX Secure Shell operations, regardless of the authentication method used. Multiple client users using the same client system for HP-UX Secure Shell connections must make individual known_hosts files, and place them in their home directories.	$HOME/.ssh/known_hosts
Client user key files	The public and private keys for client users. The client uses these keys for public-key authentication only. You can generate a key pair with RSA-1, RSA, DSA, and ECDSA algorithms. The client user can choose the key type.	• RSA-1 keys: ◦ $HOME/.ssh/identity ◦ $HOME/.ssh/identity.pub • RSA keys: ◦ $HOME/.ssh/id_rsa ◦ $HOME/.ssh/id_rsa.pub • DSA keys ◦ $HOME/.ssh/id_dsa ◦ $HOME/.ssh/id_dsa.pub • ECDSA keys ◦ $HOME/.ssh/id_ecdsa ◦ $HOME/.ssh/id_ecdsa.pub
Client host key files	The public and private keys for every client system from which client users connect to an sshd instance using host-based authentication. These key pairs are generated with RSA-1, RSA, DSA, or ECDSA.	• RSA-1 keys: ◦ /opt/ssh/etc/ssh_host_key ◦ /opt/ssh/etc/ssh_host_key.pub • RSA keys: ◦ /opt/ssh/etc/ssh_host_rsa ◦ /opt/ssh/etc/ssh_host_rsa.pub • DSA keys: ◦ /opt/ssh/etc/ssh_host_dsa ◦ /opt/ssh/etc/ssh_host_dsa.pub • ECDSA keys: ◦ /opt/ssh/etc/ssh_host_ecdsa ◦ /opt/ssh/etc/ssh_host_ecdsa.pub

Table 6 lists the keys and configuration files for the HP-UX Secure Shell server.

Table 6 Server Keys and Configuration Files

Name	Description	Location
`sshd_config`	Configuration file for the `sshd` daemon. The `sshd` daemon uses this file to determine the required run-time parameters. For more information on the `sshd_config` file directives, see Appendix A (page 62).	`/opt/ssh/etc/sshd_config`
`known_hosts` and related files	List of public keys for all `ssh` client hosts that connect to the `sshd` daemon using host-based authentication.	• `/opt/ssh/etc/ssh_known_hosts` • `/etc/rhosts.equiv` • `/etc/shosts.equiv`
`authorized_keys`	List of public keys for all client users who connect to an instance of the `sshd` daemon using public-key authentication. This file is necessary only if you are using public-key authentication. One file is created per client user.	`$HOME/.ssh/authorized_keys`
Host key files	The public and private keys for every `sshd` instance. These files are required for all HP-UX Secure Shell operations regardless of authentication type. Host key files can be created with RSA-1, RSA, DSA, or ECDSA.	• RSA-1 keys: ◦ `/opt/ssh/etc/ssh_host_key` ◦ `/opt/ssh/etc/ssh_host_key.pub` • RSA keys: ◦ `/opt/ssh/etc/ssh_host_rsa` ◦ `/opt/ssh/etc/ssh_host_rsa.pub` • DSA keys: ◦ `/opt/ssh/etc/ssh_host_dsa` ◦ `/opt/ssh/etc/ssh_host_dsa.pub` • ECDSA keys: ◦ `/opt/ssh/etc/ssh_host_ecdsa` ◦ `/opt/ssh/etc/ssh_host_ecdsa.pub`

Table 7 lists the configuration files that are common to both the HP-UX Secure Shell client and server.

Table 7 Common Client and Server Configuration Files

Name	Description	Location
Kerberos files	Required for client users who connect to the server using GSS-API authentication. The client user requires the following files: • `krb5.conf` file – Required for both the client and server. • A ticket file specific to each user.	On the client system: • `/etc/krb5.conf` • `/tmp/krb5CC_uid` On the server system: • `/etc/krb5.conf` • `/opt/krb5/v5srvtab` (default location of the ticket file)

2 Installing HP-UX Secure Shell

This chapter describes how to install HP-UX Secure Shell. This chapter also lists the prerequisites for installing HP-UX Secure Shell.

The chapter addresses the following topics:

- "Prerequisites" (page 19)
- "Installation and Verification" (page 20)

Prerequisites

This section lists the prerequisites for installing HP-UX Secure Shell.

System Requirements

Table 8 lists the minimum system requirements for installing HP-UX Secure Shell.

Table 8 System Requirements for Installing HP-UX Secure Shell

Component	Requirement
Operating System	• HP-UX 11i v1 • HP-UX 11i v2 • HP-UX 11i v3
Hardware	• HP/9000 servers and workstations • HP Integrity servers
Disk Space	22 MB for HP-UX 11i v1 31 MB for HP-UX 11i v2 18 MB for HP-UX 11i v3
Memory	Memory usage depends on the number of users. The memory used by HP-UX Secure Shell for a single user is: • 21 MB on an HP-UX 11i v1 system • 33 MB on an HP-UX 11i v2 system • 18 MB on an HP-UX 11i v3 system

If you are using HP-UX Secure Shell as a SOCKS proxy, you need to download and install the following additional products:

- DanteSOCKS- DanteSOCKS is a part of the Internet Express suite of products. It is available for download at: www.software.hp.com
- SOCKS Client product- The SOCKS client product (connect.c) is a simple relaying command that makes network connections using SOCKS and https proxy. It is available for download at: http://zippo.taiyo.co.jp/~gotoh/ssh/connect.html

For information on configuring HP-UX Secure Shell as a SOCKS proxy, see Chapter 5 (page 48)

Patch Requirement

The appropriate patches for installing HP-UX Secure Shell can be obtained in the following ways:

- HP-UX 11i v1

  The HP-UX 11i v1 (B.11.11) Support Plus release media contains the standard HP-UX patch bundles. The patch bundles are also available on the HP Support Center (HPSC) website. If you do not have access to the media, follow these steps:

1. Go to the HPSC website at: http://www.hp.com/go/hpsc
2. Select the appropriate site, for example, **Americas/Asia-Pacific** or **European**.
3. Select **maintenance and support for hp products** in the left navigation bar. The **maintenance and support for hp products** page is displayed.
4. Select **standard patch bundles - find patch bundles** in the patching section. The **find bundles** page is displayed.
5. Select **HP-UX patch bundles** in the **Bundles for HP-UX** section. The **standard HP-UX patch bundles** index page is displayed. This page lists the release dates for the current patch bundles in the release name section.
6. Select the appropriate patch bundle in the release name section to download the bundle.

NOTE: The standard HP-UX patch bundles are cumulative. If you do not find an older bundle, such as the patch bundle on the September 05 Support Plus 11.11 media, select the latest 11.11 release and use the latest version of the patch bundle.

- HP-UX 11i v2

  The latest patches are available as part of the latest HP-UX 11i v2 operating environment (OE) media.

- HP-UX 11i v3

  No patches are required for installing HP-UX Secure Shell on HP-UX 11i v3.

Installation and Verification

This section describes how to install HP-UX Secure Shell and verify the installation. You can install HP-UX Secure Shell from either the Application Release (AR) media or the Web.

Installing HP-UX Secure Shell from the Media

To install HP-UX Secure Shell from the AR media, follow these steps:

1. Insert the AR media into the drive.
2. To log in as a superuser, run the following command at the HP-UX prompt:

   ```
   $ su root
   ```

3. To create a directory in which to mount the media, run the following command at the HP-UX prompt:

   ```
   # mkdir -p /tmp
   ```

   Where:

   `tmp` denotes the directory in which the media is mounted.

4. To mount the AR media, run the following command at the HP-UX prompt:

   ```
   # mount <absolute device-path> /tmp
   ```

   Where:

   <absolute device-path> specifies the device path for the AR media.

5. To verify whether the media is mounted, run the following command at the HP-UX prompt:

   ```
   # mount
   ```

6. Complete Steps 11 – 17 described in "Installing HP-UX Secure Shell from the Web" (page 20) to install the HP-UX Secure Shell software on your system.

Installing HP-UX Secure Shell from the Web

To install HP-UX Secure Shell from the Web, follow these steps:

1. Go to the HP Software Depot Web page at: www.software.hp.com

2. Use the **Search** button to browse for the product number **T1471AA**. The product catalog page is displayed.
3. Select **HP-UX Secure Shell** in the product catalog. The HP-UX Secure Shell page is displayed.
4. Select the **Receive for Free>>** option at the bottom right of the page.
5. Select the appropriate release of HP-UX operating system.
6. Enter the registration information. Read and accept the terms and conditions statements.
7. Click **Next>>**. The Electronic Delivery Receipt page is displayed.
8. Select the HP-UX Secure Shell depot under Download Software.
9. Save the HP-UX Secure Shell depot in a local directory, for example, `/tmp`.
10. To verify that the HP-UX Secure Shell depot is saved properly in the local directory, run the following HP-UX MD5 Secure Checksum command:

    ```
    $ md5sum <depot_name>
    ```

    The result of this command must match the fingerprint provided in the Electronic Delivery Receipt. If the result does not match, download the HP-UX Secure Shell depot again.

    NOTE: The HP-UX MD5 Secure Checksum software is not installed by default on the system. It is available at: http://h20293.www2.hp.com/

11. To install the HP-UX Secure Shell depot, run the following command:

    ```
    # swinstall -s <fully_qualified_depot_source_path>
    ```

    The **swinstall** window is displayed.
12. Press the space bar to select the depot name.
13. Select **Install** in the **Action** menu. The Install Analysis window is displayed.
14. Select **OK** when the Status field displays a Ready message. The Install window is displayed.
15. The HP-UX Secure Shell software installation starts. The `swinstall` command loads the HP-UX Secure Shell files on to the system in approximately three to five minutes.
16. Select **Done** when the Status field displays a Completed message.
17. Select **File→Exit** to exit from the `swinstall` window.

The `sshd` daemon is preconfigured and starts after installation. The `swinstall` command installs HP-UX Secure Shell in the`/opt/ssh/etc` directory.

The `/opt/ssh/etc` directory contains the following files:

- `moduli`
- `ssh_host_key`
- `ssh_config`
- `ssh_host_key.pub`
- `sshd_config`
- `ssh_host_dsa_key`
- `ssh_host_ecdsa_key`
- `ssh_host_rsa_key`
- `ssh_host_dsa_key.pub`
- `ssh_host_ecdsa_key.pub`
- `ssh_host_rsa_key.pub`

Verifying HP-UX Secure Shell Installation

To verify that the installation was successful, take the following actions:

- To verify whether the HP-UX Secure Shell software is successfully installed on your system, run the following command at the HP-UX prompt:

  ```
  # swlist | grep T1471AA (HP-UX 11i v1 and HP-UX 11i v2)
  # swlist | grep SecureShell (HP-UX 11i v3)
  ```

  The following output is displayed if the HP-UX Secure Shell software is installed successfully on your system:

  ```
  T1471AA     A.50.09.001     HP-UX Secure Shell (on HP-UX 11i v1 and HP-UX 11i v2)
  SecureShell  A.05.90.003  HP-UX Secure Shell (on HP-UX 11i v3)
  ```

  NOTE: The version number displayed in the output varies according to the version of HP-UX Secure Shell you installed.

- To verify whether the `sshd` daemon is running, run the following command:

  ```
  # ps -ef | grep sshd
  ```

  The following output is displayed if the `sshd` daemon is running on the system:

  ```
  root  743   1 0 Sep 28 ?     0:00 /opt/ssh/sbin/sshd
  root   14909 14800 0  20:39:05  pts/0 0:00  grep sshd
  ```

- To verify whether the host keys have been generated, run the following command:

  ```
  # ls /opt/ssh/etc
  ```

  If host keys were generated, the `/opt/ssh/etc` directory contains the following files:

  - `moduli`
  - `ssh_host_key`
  - `ssh_config`
  - `ssh_host_key.pub`
  - `sshd_config`
  - `ssh_host_dsa_key`
  - `ssh_host_ecdsa_key`
  - `ssh_host_rsa_key`
  - `ssh_host_dsa_key.pub`
  - `ssh_host_ecdsa_key.pub`
  - `ssh_host_rsa_key.pub`

If the HP-UX Secure Shell software is not installed successfully on your system, run the following command at the HP-UX prompt to view the log file for errors:

```
# grep -i error /var/adm/sw/swagent.log
```

For more information on troubleshooting HP-UX Secure Shell, see "Troubleshooting HP-UX Secure Shell" (page 54).

3 HP-UX Secure Shell Authentication Methods

This chapter describes the authentication methods supported by HP-UX Secure Shell.

This chapter addresses the following topics:

Overview

Authentication is a means of verifying the identity of a server or client using certain parameters such as user name, password, and passphrase.

Every HP-UX Secure Shell connection includes server authentication, where the server verifies the identity of the user requesting access, and client authentication, where the client verifies the identity of the server.

Server authentication ensures that the HP-UX Secure Shell server is genuine and not an imposter. Server authentication also guards against a hacker redirecting your network connection to a different system.

A server authenticates itself to the client using the public-key authentication method. The server requires the passphrase from the client in order to establish a successful connection.

When a client attempts to connect to a server, the client selects an authentication method and either presents the appropriate credentials as part of the connection request, or responds to a prompt sent back by the server. All authentication methods work this way.

HP-UX Secure Shell supports the following authentication methods:

Table 9 describes the advantages and disadvantages of the authentication methods supported by HP-UX Secure Shell.

Table 9 Advantages and Disadvantages of HP-UX Secure Shell Authentication Methods

Authentication Method	Advantages	Disadvantages
Password	Requires little or no setup. Convenient for users who travel a lot and do not like to carry private keys.	Users must type passwords every time they connect to the server. Less secure because the password is transmitted from the client to the server over the network in clear text. The password is protected from snooping while on the network; however, it

Table 9 Advantages and Disadvantages of HP-UX Secure Shell Authentication Methods *(continued)*

Authentication Method	Advantages	Disadvantages
		becomes vulnerable if server security is compromised.
Public-key	Secure authentication method that does not require a password for authentication. Convenient for users who run remote test scripts, secured automated file transfers, and run test suite from remote systems.	Large management overhead, such as creating key pairs and sharing public-key information with clients.
Host-based	Simple and easy to manage. Convenient for managing a trusted network, because this method checks only the hosts. It does not check individual user logins.	Less secure authentication method because multiple users can establish connections from the same client using the host key pair.
Generic Security Service Application Programming Interface (GSS-API) authentication using Kerberos	Uses a centrally managed third party Key Distribution Center (KDC) server that manages tickets for all clients. Secure authentication method. Convenient for systems that are accessed by many users and systems that need centralized user authentication.	Large management overhead, including creating and maintaining tickets.
Keyboard Interactive	Simple and easy to manage. Convenient for remote administrators and secure personal use.	Not as secure as GSS-API or public-key authentication.

You can combine the authentication methods described in Table 9 or use them separately, depending on the level of security that you need.

Password Authentication

Password authentication is a simple, convenient method of authentication, because the server and client do not require any additional setup.

During password authentication, the server takes the following steps to authenticate a client:

1. The user logs in using the user ID and password.
2. The client transmits the password to the server over the network in clear text.
3. The server checks whether the given password matches the target account, and allows the client to connect to the server.

You can use one of the following files for password authentication:

- "Using the /etc/passwd File" (page 24)
- "Using the /etc/pam.conf File" (page 25)

Using the /etc/passwd File

This authentication method is based on the user login details specified in the `/etc/passwd` file. You must use the user ID and password configured in this file when you log into the HP-UX Secure Shell server. Each entry in the `/etc/passwd` file contains the following attributes, separated by a colon (:):

- Login name
- Encrypted password
- Numerical user ID

- Numerical group ID
- Reserved gecos ID
- Initial working directory
- Program to user as shell

Following is a sample entry in the `/etc/passwd` file:

```
user1:3Km/o4Cyq84Xc:10:15:System Administrator:/home/user1:/sbin/sh
```

HP-UX Secure Shell verifies the password that you enter against the password in the `/etc/passwd` file and allows access only if the passwords match.

For more information on the attributes in an entry in the `/etc/passwd` file, see *passwd*(4)

The `/etc/passwd` file gets default values such as `ABORT_LOGIN_ON_MISSING_HOMEDIR` and `BOOT_AUTH`, `BOOT_USERS` from the `/etc/default/security` file. For more information on different default values, see *security*(4).

Using the /etc/pam.conf File

Pluggable Authentication Module (PAM) is a generic framework for authentication, authorization, and accounting. HP-UX Secure Shell supports the following PAM modules:

- `PAM_UNIX`
- `PAM_LDAP`
- `PAM_KERBEROS`

NOTE: HP-UX Secure Shell supports, but is not tested with PAM modules, such as `PAM_DCE` and `PAM_NTLM`.

A PAM module provides functionality for one or more of the following services:

- Authentication
- Account management
- Session management
- Password management

The `/etc/pam.conf` PAM configuration file contains a list of these services. Each service is paired with a corresponding service module. When an application requests a service, the application invokes the module associated with the service.

Each entry in the `/etc/pam.conf` file has the following format:

```
service_name  module_type control_flag  module_path options
```

Following is a sample entry in the `/etc/pam.conf` file for authentication:

```
login  auth   required    libpam_unix.so.1    debug
```

For more information on the PAM configuration file, see *pam.conf*(4). For information about a PAM module, see *pam_unix*(5) and *pam_hpsec*(5).

The HP-UX Secure Shell server configuration file, `/opt/ssh/etc/sshd_config`, contains the `UsePAM` directive that enables PAM authentication. If you set this directive to `yes`, HP-UX Secure Shell looks at the PAM configuration file for password authentication requests from the client. HP-UX Secure Shell also attempts password authentication through the configured PAM modules in sequence, until a connection is established. The details of the authentication method employed by PAM is transparent to HP-UX Secure Shell. The PAM library informs HP-UX Secure Shell whether the authentication was successful. The default value for the `UsePAM` directive is `yes`.

You can set the `UsePAM` directive to `no`. With this setting, any password authentication request from the client causes HP-UX Secure Shell to ignore the PAM configuration settings on the server.

Instead, the server directly reads the user ID and password from the `/etc/passwd` file. For more information on the `UsePAM` directive, see Appendix A (page 62).

Public-Key Authentication

HP-UX Secure Shell uses public-key authentication for strong and secure authentication. Public-key authentication enables users to connect to a remote server without sending their password over the network. In this type of authentication, a client system needs a private key and a passphrase to authenticate itself to the server.

Public-key authentication uses the following types of keys (referred to as a key pair or an asymmetric key pair):

- Private key – A private key can be used only by its owner and must not be revealed to others. It can be encrypted with a passphrase to give it an extra layer of security.
- Public key – The public key is placed on the remote server to which users attempt to access.

Following are the important features of a key pair:

- The key pair is asymmetric. Messages encrypted with a public key can be decrypted only by the matching private key of the pair. Similarly, messages encrypted with a private key can be decrypted only by the matching public key of the pair.
- It is impossible to derive the private key using the matching public key.

To send a secure message to the server, the client must encrypt the message using the public key and send the encrypted message over the network. The encrypted message can be decrypted only by the owner of the matching private key. This enables the client to prove its identity to the server. Public-key authentication is more secure than password-based authentication.

Following are the steps used in public-key authentication when the server authenticates the client:

1. The server generates a key pair, which includes the public key and the private key.
2. The server shares the public key with the client by copying the public key into the appropriate directory on the client.
3. The client encrypts a message with the server's public key.
4. The client sends the encrypted message to the server.

Following are the steps used in public-key authentication when the client authenticates the server:

1. The server encrypts a message using its private key.
2. The server sends the encrypted message and the clear-text message to the client. A clear text message is a unencrypted message.
3. The client decrypts the encrypted message with the server's public key and matches the decrypted message with the clear-text message. If the keys match, the client accepts the server's identity.

Table 10 lists the default public key and private key file names generated for different key formats, and their default locations on the client.

Table 10 Key File Name for RSA and DSA Key Format

Key Format	Private Key	Public Key
RSA-1	`$HOME/.ssh/identity`	`$HOME/.ssh/identity.pub`
RSA	`$HOME/.ssh/id_rsa`	`$HOME/.ssh/id_rsa.pub`
DSA	`$HOME/.ssh/id_dsa`	`$HOME/.ssh/id_dsa.pub`
ECDSA	`$HOME/.ssh/id_ecdsa`	`$HOME/.ssh/id_ecdsa.pub`

The SSH-1 protocol supports only the RSA-1 algorithm. The SSH-2 protocol supports RSA, RSA1, DSA, and ECDSA algorithms. You can generate an RSA key pair, a DSA key pair, and an ECDSA

key pair and store all the key pairs in the `$HOME/.ssh` directory. If you have DSA, ECDSA, and RSA keys, you can use the `HostKeyAlgorithms` client configuration directive to set an order of preference. The HP-UX Secure Shell client selects the keys in the order you set for public-key authentication.

NOTE: The client cannot pick the correct key pair if there are multiple key pairs of the same type in the `$HOME/.ssh` directory, for instance, three RSA key pairs. HP-UX Secure Shell does not have a configuration directive that can inform the client about multiple key pairs. However, you can specify a key file name in the HP-UX Secure Shell client using the option. For more information on the `-i` option, see *ssh*(1).

Kerberos Authentication

Kerberos is a network authentication protocol based on RFC 1510, Kerberos Network Authentication Service (V5). RFC 1510 is designed to provide strong authentication for client and server applications using shared secret key cryptography. For more information on Kerberos, see the Kerberos documentation set available at: http://www.hp.com/go/hpux-security-docs

The main component of the Kerberos security is the Key Distribution Center (KDC), which is a network service that supplies tickets and temporary session keys to clients and servers. The KDC maintains a database of principal names (users and services) and their associated secret keys.

When the HP-UX Secure Shell server authenticates the client, both the system running the HP-UX Secure Shell client and the system running the HP-UX Secure Shell server interact with the KDC.

Kerberos is a third party custodian of user (client) and service information. A user is a client application. A service is a process running on a server that the user is trying to connect to. The service must authenticate the user.

The following actions take place when the service authenticates the user:

1. The user contacts the Kerberos server to obtain information about itself (client information) and the service.
2. The user generates information about itself.
3. The user contacts the required service with the Kerberos-generated client information and the self-generated client information.
4. The service compares its client information with the self-generated client information. If these two pieces of data match, the service allows the client to access the service.

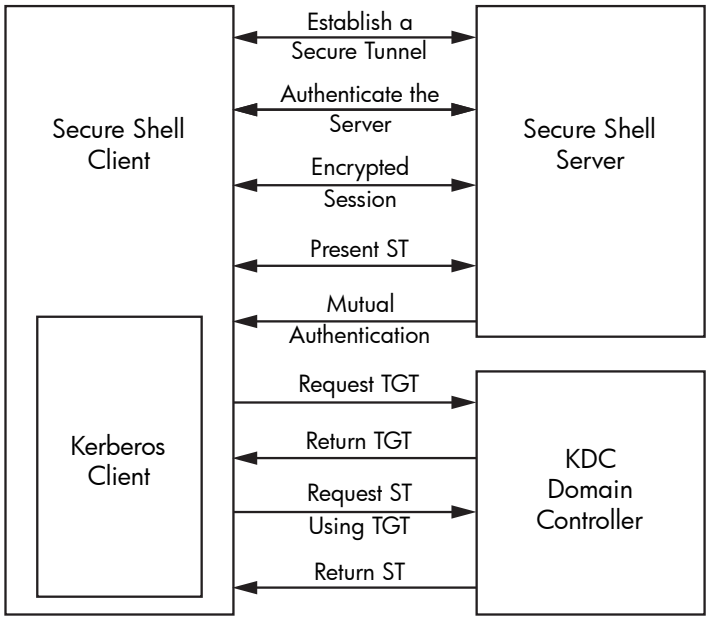
Using Kerberos with HP-UX Secure Shell offers the following benefits:

- Proven security of Kerberos authentication
- Simplicity and flexibility of HP-UX Secure Shell

How Kerberos Works with HP-UX Secure Shell

Figure 2 illustrates how Kerberos works with HP-UX Secure Shell.

Figure 2 Using Kerberos with HP-UX Secure Shell



The following events occur when HP-UX Secure Shell uses Kerberos for authentication:

1. A secure tunnel is established between the HP-UX Secure Shell client and HP-UX Secure Shell server.
2. The HP-UX Secure Shell server authenticates itself to the client.
3. The Kerberos client on the HP-UX Secure Shell client system sends a message to the KDC and requests a ticket granting ticket (TGT).
4. If the KDC decrypts the message successfully, it issues a TGT to the client.
5. The Kerberos client uses the TGT to request a session ticket (ST) from the KDC.
6. If the TGT is valid, the KDC issues an ST.
7. The HP-UX Secure Shell client presents the ST to the HP-UX Secure Shell server.
8. If the credentials in the ST are valid, the HP-UX Secure Shell client is authenticated and a secure session is initiated.

Kerberos Authentication Methods

Following are methods to authenticate HP-UX Secure Shell using Kerberos:

- "Password Authentication Using Kerberos" (page 28)
- "GSS-API Authentication Using Kerberos" (page 28)

Password Authentication Using Kerberos

HP-UX Secure Shell uses the PAM Kerberos module in the `/etc/pam.conf` file for password authentication. If the authentication management of PAM is pointed to the shared, dynamically loadable PAM Kerberos library `/usr/lib/security/libpam_krb5.1`, HP-UX Secure Shell uses PAM Kerberos for user authentication.

GSS-API Authentication Using Kerberos

HP-UX Secure Shell offers GSS-API-based authentication using Kerberos as the underlying security service. GSS-API is an API used by applications to access a set of security services such as Kerberos and Windows NT LAN Manager (NTLM).

For GSS-API authentication to work properly, the client must obtain Kerberos credentials in advance and must also have a Kerberos configuration file present in the appropriate client directory. When an HP-UX Secure Shell client connects to an `sshd` daemon, the HP-UX Secure Shell client presents

its credentials. The HP-UX Secure Shell server matches these credentials against its copy of credentials for a specific user. The user is also identified with a password. The server can also optionally establish the legitimacy of the client host environment.

Keyboard-Interactive Authentication

Keyboard-Interactive Authentication, also known as challenge-response authentication, is a generic authentication method that can be used to implement authentication methods. This authentication method is similar to the password authentication method, with some key differences. The Password authentication also uses the Keyboard-Interactive method to show the response when the users are logged on to the host.

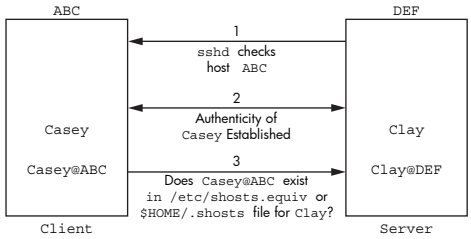
Most PAM modules deal with a single user name and password. The PAM modules prompt the HP-UX Secure Shell client for a password, and allow or deny the connection based on the response. However, certain authentication methods require a longer dialogue with the HP-UX Secure Shell client. Therefore, HP-UX Secure Shell implements the Keyboard-Interactive Authentication method, which provides a higher degree of security.

Host-Based Authentication

Host-based authentication is different from the other authentication methods. The HP-UX Secure Shell server does not directly authenticate users based on passwords or private keys. Instead, it authenticates the client host and trusts the client host system, which trusts the user of that system. The HP-UX Secure Shell server uses the `/etc/shosts.equiv` or `$HOME/.shosts` file in the server to determine the account names of the client host that are allowed access to the server.

Figure 3 illustrates how a user Casey on host ABC is authenticated by the user Clay on host DEF using host-based authentication.

Figure 3 Authenticating a Host Using Host-Based Authentication



Following are the steps HP-UX Secure Shell follows when Clay authenticates Casey using host-based authentication:

1. The `sshd` server checks the identity of host ABC, ensuring that ABC is a trusted host. It does not check the identity of Casey directly.
2. The `sshd` server on host DEF checks whether the connection is coming from a trusted program on ABC, installed by the system administrator that cannot lie about the identity of Casey.

   If the connection passes both tests, the authenticity of Casey is established.
3. The `sshd` daemon checks whether the Casey@ABC account exists in the `/etc/shosts.equiv` or `$HOME/.shosts` configuration file for Clay. If the account exists, Casey@ABC is allowed access to the accounts of Clay.

This method also uses client and server keys for authentication. While public-key authentication requires individual client users to generate their own key pairs, host-based authentication requires only the client host system have a key pair.

The server has knowledge of all the public keys for all client host systems from which users can attempt host-based authentication. In addition, the server can restrict host-based authentication to specific user accounts in specific client systems.

When an HP-UX Secure Shell user attempts host-based authentication with an HP-UX Secure Shell server, the following events occur:

1. The server checks whether the user and host combination is allowed for host-based authentication in the `/etc/shosts.equiv` or `$HOME/.shosts` file.
2. If the user and host combination is allowed, the HP-UX Secure Shell server creates a challenge string, encrypts it with the public key of the client, and sends it to the client.
3. The client uses its private key to decrypt the challenge string, and sends the decrypted message back to the server.
4. The server matches the decrypted string with the original challenge string. If both strings match, the client is authenticated.

This method is convenient for client users, because they do not need to generate their own individual key pairs.

You can configure host-based authentication for both superusers and regular users.

NOTE: You can use host-based authentication in environments that require non-interactive authentication. If you use only one trusted host, an attacker can get access to all accounts on other hosts. You can use this method in scripts and automated processes, such as cron jobs.

HP recommends that you do not enable host-based authentication, because it is insecure.

---

4 Configuring HP-UX Secure Shell Authentication Methods

This chapter describes how to configure HP-UX Secure Shell authentication methods.

This chapter addresses the following topics:

Overview

HP-UX Secure Shell supports the following authentication methods:

- Password authentication
- Public-key authentication
- Kerberos authentication
- Keyboard Interactive authentication
- Host-based authentication

Although this is the complete list of supported authentication methods, you can set up `sshd` to support only a subset of these methods, based on your requirements.

When a client connects to the server, the server responds with its list of supported authentication methods. This list represents the authentication methods supported by the server and the order of preference. The client can omit one or more of the authentication methods and can also change the sequence in which the methods are attempted. The client makes changes using a configuration directive in the `/opt/ssh/etc/ssh_config` client configuration file. The preferred authentication method is one of the most important configuration parameters of the client.

Configuring Password Authentication

The password authentication method relies on the existence of a user ID and password. You can configure password authentication using either of the following files:

- `/etc/passwd`
- `/etc/pam.conf`

The following sections discuss how to configure password authentication using these files.

Configuring Password Authentication Using the `/etc/passwd` File

To configure password authentication in HP-UX Secure Shell using the `/etc/passwd` file, follow these steps:

1. To ensure that HP-UX Secure Shell is installed on the server and client, run the following command on the server and client:

   ```
   $ swlist | grep T1471AA (HP-UX 11i v1 and HP-UX 11i v2)
   $ swlist | grep SecureShell (HP-UX 11i v3)
   ```

   The following output is displayed if HP-UX Secure Shell is installed:

   ```
   T1471AA     A.05.90.001   HP-UX Secure Shell (on HP-UX 11i v1 and HP-UX 11i v2)
   SecureShell  A.05.90.003  HP-UX Secure Shell (on HP-UX 11i v3)
   ```

   If HP-UX Secure Shell is not installed on your system, see "Installing HP-UX Secure Shell" (page 19) for instructions on installing HP-UX Secure Shell on your system.
2. Create a user name in the HP-UX Secure Shell server that the HP-UX Secure Shell client can use to connect to the HP-UX Secure Shell server.
3. To ensure that the `sshd` daemon is running, run the following command on the server system:

   ```
   $ ps -ef | grep sshd
   ```
4. To connect to the server, run the following command on the client system:

   ```
   $ ssh -o "PreferredAuthenticationspassword" user@remotehost
   ```

   Where:

   user Specifies the user name that you will use to connect to the HP-UX Secure Shell server.

   remotehost Specifies the name of the server to which you want to connect.

   The server prompts for the password for *user*.

   NOTE: Ensure that the HP-UX Secure Shell server contains the user name (*user*) you will use to connect to the HP-UX Secure Shell server.
5. Enter the password for the *user*.

   The server checks whether the given password matches with the password for user1 in the `/etc/passwd` file. If the passwords match, the server allows the client to connect to the server.

Configuring Password Authentication Using the `/etc/pam.conf` File

To configure password authentication in HP-UX Secure Shell using the `/etc/pam.conf` file, follow these steps:

1. In the `/opt/ssh/etc/sshd_config` file in the server, set the following directives:

   ```
   UsePAM yes
   PasswordAuthentication yes
   ```
2. In the `/etc/pam.conf` file, set the authentication method to any PAM module listed in Table 11.

   You must select the PAM module depending on the authentication method that you want to use with PAM.

   Table 11 summarizes the PAM modules and the corresponding library names.

Table 11 PAM Modules and Library Names

PAM Module	Library
PAM_UNIX	/usr/lib/security/libpam_unix.1
PAM_LDAP	/usr/lib/security/libpam_ldap.1
PAM_KERBEROS	/usr/lib/security/libpam_krb5.1
PAM_DCE	/usr/lib/security/libpam_dce.1
PAM_NTLM	/usr/lib/security/libpam_ntlm.1

NOTE: The PAM library for the PA-RISC architecture has a suffix of `.1`. For the Itanium architecture, the PAM library has a suffix of `.so.1`. For example, the `PAM_NTLM` library for PA-RISC is `libpam_ntlm.1` and for Itanium is `libpam_ntlm.so.1`.

3. In the `/opt/ssh/etc/sshd_config` file on the server and the client, set the following directive:

   ```
   PasswordAuthentication yes
   ```

4. Run the following command on the client system:

   ```
   $ ssh Clay
   ```

Depending on the authentication method that you configure in the `/etc/pam.conf` file, you are prompted for the relevant information.

Configuring Public-Key Authentication

To configure public-key authentication, follow these steps:

1. To generate RSA key pairs, run the following command on the client:

   ```
   # ssh-keygen -t [rsa dsa ecdsa]
   ```

   The following output is displayed:

   ```
   Generating public/private rsa key pair.
   Enter file in which to save the key (//.ssh/id_rsa): <file name>
   Enter passphrase (empty for no passphrase):
   Enter same passphrase again:
   Your identification has been saved in /tmp/hi.
   Your public key has been saved in /tmp/hi.pub.
   The key fingerprint is:
   84:7d:f5:dd:88:f7:53:88:8a:6e:f7:85:04:28:6e:ed root@<hostname>
   ```

   HP-UX Secure Shell generates the key pairs `id_rsa` and `id_rsa.pub` and stores them in the `$HOME/.ssh` directory on the client system.

2. Set the following configuration directive in the `/opt/ssh/etc/sshd_config` configuration file on the client system:

   ```
   PubkeyAuthentication yes
   ```

   NOTE: For backward compatibility purposes, HP-UX Secure Shell supports the `RSAAuthentication` configuration directive in both the client and server configurations. This directive also enables public-key authentication for the client, but only for the SSH-1 protocol.

3. To ensure that the permissions of the home directory of the client, the `$HOME/.ssh` directories, and all files under the `$HOME/.ssh` directory match the permissions listed in Table 12, run the following commands:

   ```
   # ll -d $HOME
   # ll -d $HOME/.ssh
   #ll $HOME/.ssh/
   ```

   Table 12 lists the specific permissions for these files and directories.

Table 12 Permissions for the Client Files and Directories

File/Directory	Permissions
`$HOME` (home directory)	`drwx------` or `drwxr--r--`
`$HOME/.ssh`	`drwx------` or `drwxr--r--`
`$HOME/.ssh/id_rsa` and `id_dsa`	`-rw-r--r--` or `-rw------`

Table 12 Permissions for the Client Files and Directories *(continued)*

File/Directory	Permissions
`$HOME/.ssh/id_rsa.pub` and `id_dsa.pub`	`-rw-r--r--` or `-rw------`
`$HOME/.ssh/config`	`-rwx------`

4. Copy the public key in the client system to the home directory of the server using the following command:

   ```
   # cat $HOME/.ssh/id_dsa.pub | ssh remoteuser@remotehost
   'cat - >> $HOME/.ssh/authorized_keys'
   ```

   The following output is displayed:

   ```
   The authenticity of host 'remoteuser.remotehost (15.70.189.130)' can't be established
   ECDSA key fingerprint is 2a:c9:77:ad:d5:d3:ef:c3:1e:12:12:9e:3a:9f:c0:38.
   Are you sure you want to continue connecting (yes/no)?
   ```

5. Enter **`yes`** to continue with the connection. The following message is displayed:

   ```
   Warning: Permanently added 'itanika2.india.hp.com' (ECDSA) to the list of known hosts.
   ```

   Enter **`no`** if you do not want to continue with the connection.

6. To enable public-key authentication, set the following directive in the server configuration file `/opt/ssh/etc/sshd_config`:

   ```
   PubkeyAuthentication yes
   ```

7. Set the directory and file permissions on the server as specified in Table 13.

   Table 13 Permissions for the Server Files and Directories

File/Directory	File Permission
`$HOME` (home directory)	`drwx------` or `drwxr--r--`
`$HOME/.ssh`	`drwx------` or `drwxr--r--`
`$HOME/.ssh/authorized_keys` and `$HOME/.ssh/authorized_keys2`	`-rw-r--r--` or `-rw------`

NOTE: The `$HOME` and `$HOME/.ssh` directories, and all the files in the `$HOME/.ssh` directories must be owned by the respective users whose home directories they are.

8. To connect to the server, run the following command:

   ```
   $ ssh Clay
   ```

   Where:

   Clay is the name of the server to which you want to connect.

   The server does not prompt for the password. The secure connection is established between the server and the client.

Configuring Kerberos Authentication

Kerberos authentication contains the following entities:

- Application client
- Application server daemon
- Kerberos server

Before you can use HP-UX Secure Shell with Kerberos, you must set up and configure these entities. These entities must also communicate the Kerberos password to the client and copy the key file from one system to the other.

To use HP-UX Secure Shell with Kerberos authentication, follow these steps:

1. Ensure that the Kerberos server is installed and configured correctly. For more information about installing and configuring the Kerberos server, see the *Kerberos Server Version 3.1 Administrator's Guide* available at: http://www.hp.com/go/hpux-security-docs
2. Ensure that your name can be authenticated by the Kerberos server.
3. Ensure that the Kerberos client is installed and configured on the HP-UX Secure Shell client system.
4. To obtain a local ticket, run the following command:

   ```
   # kinit <user@realm>
   ```

5. To connect to the remote server, run the following command from the client system:

   ```
   # ssh <server_name>
   ```

   Where:

   `<server_name>` specifies the name of the remote system to which you want to connect.

The default setting in the `/opt/ssh/etc/ssh_config` and `/opt/ssh/etc/sshd_config` files is set to enable Kerberos authentication. Unless you change the `/opt/ssh/etc/ssh_conf` and `/opt/ssh/etc/sshd_conf` files to deny Kerberos authentication, you can log in remotely without being prompted for passwords.

You can use the following methods to configure HP-UX Secure Shell to use Kerberos authentication:

- Password authentication using PAM_KERBEROS. For more information, see "Configuring Password Authentication Using PAM Kerberos" (page 35).
- GSS-API authentication using Kerberos. For more information, see "Configuring GSS-API Authentication" (page 36).

Configuring Password Authentication Using PAM Kerberos

To enable password authentication using Kerberos, follow these steps:

1. On the HP-UX Secure Shell server and client systems, set the following directives in the `/opt/ssh/etc/sshd_config` file:
   - `PasswordAuthentication yes`
   - `UsePAM yes`
2. To configure the `/etc/pam.conf` file for PAM Kerberos in the HP-UX Secure Shell server, use the `/usr/lib/security/libpam_krb5.1` or `/usr/lib/security/libpam_krb5.so.1` library for the `login` service in the `/etc/pam.conf` file.

   Following is a sample entry for PAM Kerberos in the `/etc/pam.conf` file for the HP-UX 11.0 and 11i v1 systems (PA-RISC architecture) :

   ```
   sshd auth required /usr/lib/security/libpam_krb5.1
   ```

   Following is a sample entry for PAM Kerberos in the `/etc/pam.conf` file for the HP-UX 11i v2 system (Itanium architecture) :

   ```
   sshd auth required /usr/lib/security/$ISA/libpam_krb5.so.1
   ```

3. To ensure that the host service principle and the host service key are available in the `/etc/krb5.keytab` file, run the following command on the HP-UX Secure Shell server:

   ```
   # kinit -k
   ```

   If the host service principle and host service key are not available in the `/etc/krb5.keytab` file, run the following command to extract the host service principle:

   ```
   # /opt/krb5/admin/kadminl
   ```

   For information on extracting the host service principle, see Step 4 in "Configuring GSS-API Authentication" (page 36).

4. Identify a system where you must install the Kerberos server, and install the Kerberos server software in that system. If you are installing the Kerberos server on an HP-UX system, see the latest version of the Kerberos server software is available at: http://www.software.hp.com

   Follow these steps to configure the Kerberos server:

   a. Configure the Kerberos server. You can configure the Kerberos server either manually or by using the `/opt/krb5/sbin/krbsetup` tool. For information about configuring the Kerberos server, see the chapter "Auto-Configuration of the Security Server" and "Manual Configuration Of The Kerberos Server" in *Kerberos Server Version 3.12 Administrator's Guide* available at: http://www.hp.com/go/hpux-security-docs

   The following Kerberos server daemons are automatically started when you use the `/opt/krb5/sbin/krbsetup` tool to configure the Kerberos server:

   - `/opt/krb5/sbin/kadmind`
   - `/opt/krb5/sbin/kdcd`

   b. If you manually configured the Kerberos server, and if you have modified the Kerberos configuration files, or if you have stopped the Kerberos server daemons, run the following command to start or restart the Kerberos server daemons:

   ```
   # /sbin/init.d/krbsrv start
   ```

   To verify that these daemons are running, run the following commands in the Kerberos Server:

   ```
   # ps -ef   grep kadmind
   #ps -ef   grep kdcd
   ```

   The following output is displayed if the `/opt/krb5/sbin/kadmind` daemon is running:

   ```
   root  769   1 0 Mar 17 ?     0:50 /opt/krb5/sbin/kadmind
   root 4725 4708 1 12:44:20 pts/0   0:00 grep kadmind
   ```

   The following output is displayed if the `/opt/krb5/sbin/kdcd` daemon is running:

   ```
   root   477     1  0  Apr 27  ?         0:00 /opt/krb5/sbin/kdcd
   root 26237 26219  2 15:36:39 pts/1     0:00 grep kdcd
   ```

   c. The Kerberos administrator must create the user information (user ID and password) for users. The Kerberos server contains the user ID and key created using the user's password. The Kerberos administrator must communicate the user information to individual users. Users must know their Kerberos user ID and password. Based on the security policies of your organization, the Kerberos administrator can choose any method to communicate the user IDs and passwords, to users.

   For more information about configuring the Kerberos server, see the *Kerberos Server V 3.12 Administrator's Guide* available at: http://www.hp.com/go/hpux-security-docs

5. To connect to the HP-UX Secure Shell server, run the following command on the HP-UX Secure Shell client:

   ```
   # ssh <server_name> -l user_name
   ```

   Where:

   user_name specifies the name of the user in the HP-UX Secure Shell client system.

   The HP-UX Secure Shell prompts for the Kerberos password.

6. Enter the Kerberos password at the `password:` prompt. If you enter the correct password, the HP-UX Secure Shell client connects to the HP-UX Secure Shell server.

Configuring GSS-API Authentication

To configure GSS-API authentication, follow these steps:

1. On the Kerberos server, ensure that the following Kerberos daemons are running:
   - `/opt/krb5/sbin/kadmind`
   - `/opt/krb5/sbin/kdcd`
2. The Kerberos administrator must create user (client) information (user ID and key) for users using the Kerberos service. The user information is stored on the KDC server and the Kerberos administrator must communicate the user information to individual users. Users must know their user ID and password. Kerberos Administrators must use a communication method that complies with security policies of their organization.

   NOTE: The Kerberos administrator can use the following administrative tools to create user information:

   - `/opt/krb5/admin/kadminl` or `/opt/krb5/admin/kadminl_ui` if the Kerberos administrator is local.
   - `/opt/krb5/admin/kadmin` or `/opt/krb5/admin/kadmin_ui` if the Kerberos administrator is remote.

   For more information about these administrative tools, see the *Kerberos Server Version 3.12 Administrator's Guide* available at: http://www.hp.com/go/hpux-security-docs
3. The Kerberos administrator must generate service principals for every service (for example, `/opt/ssh/sbin/sshd`) that supports Kerberos authentication. A service principal consists of a service name, the fully qualified domain name of the host name, and the Kerberos realm name. By default, the service principals are stored in the `/opt/krb5/v5srvtab` file on the Kerberos server.
4. The Kerberos administrator must extract the required service principal.

   If you are the Kerberos administrator, use the following command to extract the service principal:

   ```
   # /opt/krb5/admin/kadminl
   ```

   The following output is displayed:

   ```
   Connecting as: K/M

   Connected to krb5v01 in realm casy.india.hp.com.

   Command:
   ```

   Enter the `ext` command to extract the host service principal.

   The `/opt/krb5/adm/kadmin` command prompts for the service key table file name, as follows:

   ```
   Service Key Table File Name (/opt/krb5/v5srvtab):
   ```

   The default service key table file name is `/opt/krb5/v5srvtab`. You can specify a different file name (for example `/etc/krb5.keytab`) for the service key table because the `/opt/krb5/v5srvtab` file is not accessible by services (for example, `sshd`). The Kerberos administrator must communicate the location of the service key table file name to the users.
5. Copy the `/etc/krb5.keytab` file from the Kerberos server to the `/etc` directory on the HP-UX Secure Shell server.
6. To ensure that the service principal is copied properly, run the following command on the HP-UX Secure Shell server:

   ```
   # klist -k
   ```

   The following output is displayed:

   ```
   Keytab name: FILE:/etc/krb5.keytab
   KVNO Principal
   ```

```
------------------------------------------------------------
1 host/pluto.mydomain.com@MYDOMAIN.COM
```

7. The HP-UX Secure Shell client and server must contain the Kerberos configuration file (`/etc/krb5.conf`) that points to the KDC service. The `/etc/krb5.conf` file is a network configuration file and does not contain any security-specific information. For a sample `/etc/krb5.conf` configuration file, see Appendix B (page 99).
8. In the HP-UX Secure Shell client system, run the following command to invoke the KDC service to obtain a ticket granting ticket (TGT).

   `# kinit <user_ID>`

   The Kerberos client prompts the Kerberos administrator for the Kerberos password:

   `Password for <user_ID>@krb_mc.realm:`

   Where:

   `<user_ID>` specifies the user name.

   If you enter the correct password, the Kerberos server provides the TGT to the client. By default, the `/usr/bin/kinit` utility stores the TGT in the `/tmp/krb5cc_<uid>` file, which is the default credentials cache. The *`<uid>`* specifies the decimal UID of the user. For more information on the `/usr/bin/kinit` utility, see *kinit*(1).

   If you have obtained the ticket, you can view the ticket by running the following command in the client system:

   ```
   # klist

   Ticket cache: /tmp/krb5cc_01
   Default principal: root@KRB_MC.REALM

   Valid starting   Expires      Service principal
   01/31/06 17:54:40 02/01/06 03:54:40 krbtgt/KRB_MC.REALM
   ```

9. To enable GSS API authentication, set the following directive in the `/opt/ssh/etc/sshd_config` file in the HP-UX Secure Shell server and `/opt/ssh/etc/ssh_config` in the HP-UX Secure Shell client:

   `GSSAPIauthentication yes`

   Set the following directive to `yes` to automatically destroy the credentials of the user on logout:

   `GSSAPICleanUpCredentials yes`

10. To connect to the HP-UX Secure Shell client, run the following command from the HP-UX Secure Shell server:

    `$ ssh user@remotehost -l <user_name> -o "GSSAPIauthentication yes"`

    Where:

`remotehost`	Specifies the name of the server to which you want to connect.
`user`	Specifies the user name using which you want to connect to the HP-UX Secure Shell server.

    The HP-UX Secure Shell client connects to the HP-UX Secure Shell server.

11. To verify the connection, run the following `/usr/bin/klist` command in the HP-UX Secure Shell client system:

    ```
    # klist
    ```

    The following output is displayed:

    ```
    Ticket cache: /tmp/krb5cc_01
    Default principal: root@KRB_MC.REALM
    Valid starting   Expires      Service principal
    01/31/06 17:54:40 02/01/06 03:54:40 krbtgt/KRB_MC.REALM
    1/31/06 18:20:40 02/01/06 03:54:40 host/sshd_mc.appserverdomain.com@KRB_MC.REALM
    ```

    This output is different from the previous `/usr/bin/klist` output. This output shows the ticket information of the client (`1/31/06 18:20:40 02/01/06 03:54:40 host/sshd_mc.appserverdomain.com@KRB_MC.REALM`) and indicates that the HP-UX Secure Shell server has accepted the ticket.

Configuring Keyboard-Interactive Authentication

To configure the Keyboard-Interactive authentication, set either of the following directives in the `/opt/ssh/etc/ssh_config` configuration file:

```
ChallengeResponseAuthentication yes
UsePAM yes
```

NOTE: If the HP-UX Secure Shell client requests the Keyboard-Interactive authentication method and the underlying PAM module is a simple one-password function, Keyboard-Interactive authentication works the same way as password authentication.

Configuring Host-Based Authentication

This section describes how to configure host-based authentication.

Configuring Host-Based Authentication for Non-Superusers

Non-superusers can configure host-based authentication using systemwide configuration or the user-specific configuration.

Using Systemwide Configuration

To configure host-based authentication for non-superusers using systemwide configuration, follow these steps:

1. On the client system, set the following directives in the `/opt/ssh/etc/ssh_config` file:

   ```
   RhostsRSAAuthentication yes (For SSH-1)
   HostbasedAuthentication yes (For SSH-2)
   ```

2. On the client system, set the following directive in the `/opt/ssh/etc/ssh_config` file:

   ```
   EnableSSHKeysign yes
   ```

3. On the server system, set the following directives in the `/opt/ssh/etc/sshd_config` file:

   ```
   RhostsRSAAuthentication yes      (For SSH-1)
   HostBasedAuthentication yes     (For SSH-2)
   ```

4. Ensure that the `/opt/ssh/etc/shosts.equiv` file or the `/etc/hosts.equiv` file on the server contains an entry for the fully qualified client host name and the user ID of the client, as shown in the following example:

   ```
   client.abc.com            localuser
   ```

   Where:

localuser	Specifies the user on the client system who is logging into the remote system.
client	Specifies the name of the client system.
abc.com	Specifies the client domain.

NOTE: HP-UX Secure Shell uses the `/etc/hosts.equiv` file if the directives `RhostsRSAAuthentication` and `HostbasedAuthentication` are configured in the HP-UX Secure Shell configuration files. This file is used for host-based authentication with remotely executed commands (r-commands). The `/opt/ssh/etc/shosts.equiv` file is preferred over the `/etc/hosts.equiv` file, because the `/opt/ssh/etc/shosts.equiv` file is used by HP-UX Secure Shell only.

5. To add the public host key of the client to the `/opt/ssh/etc/ssh_known_hosts` file, which is the known hosts file of the server, run one of the following commands from the client system as a superuser for SSH-2:

   ```
   # cat /opt/ssh/etc/ssh_host_dsa_key.pub | ssh
   root@RemoteMachine 'cat >> /opt/ssh/etc/ssh_known_hosts'
   ```

   Or

   ```
   # cat /opt/ssh/etc/ssh_host_rsa_key.pub | ssh
   root@RemoteMachine 'cat >> /opt/ssh/etc/ssh_known_hosts'
   ```

   Or

   ```
   # cat /opt/ssh/etc/ssh_host_ecdsa_key.pub | ssh
   root@RemoteMachine 'cat >> /opt/ssh/etc/ssh_known_hosts'
   ```

   For SSH-1:

   ```
   # cat /opt/ssh/etc/ssh_host_key.pub | ssh root@RemoteMachine
   'cat >> /opt/ssh/etc/ssh_known_hosts'
   ```

   You can view the `/opt/ssh/etc/ssh_known_hosts` file on the server and verify that the public host key of the client is added to this file.

6. In the server system, add the fully qualified host name of the client at the beginning of the key in the `/opt/ssh/etc/ssh_known_hosts` file, as shown in the following example:

   ```
   client.abc.com ssh-dss ssh-dss AAAAB3NzaC1kc3MAAACBAKCJJv/D2
   Jo3Qejlhp2Z3OAvWjcQRa0c4e3gwEvYjXGECe/upvromDyNA4ou5n5rkPKBD
   e37l3U+PYkKQ3KYQyb7b2+kZ3EkzHOGB0X57hrX0e3kAeHJhSpwdY6KpGQO7
   CmVwHbn3R0NFY9c0sPw1rSADY6BsJ4IJXdi5dgakIGLAAAAFQDjKdniF5llT
   NwSJZzdjqBDSJvaHwAAAIEAlbtE9eMzjVPSfo/peqerKm2qY/gfBL80kQKcA
   wc81kzxdHO8Qisn823KtAlYfQOHCt/UVV6VIvNwD5fbLmhrzFCM39+YLPJre
   09CQ41Nxuu+ttqGCIPVggzjp/AwOeuedmkqKyQ7PuErGHTb0UYsXqzv9Nj7s
   h+UfRMdIjiVdKQAAACACQE0NxmxqTdFyDZaGnqLmzLcgMqMjr0UlzDGaPGyg
   ds2LZ1uotvI4wBGIGteZxvlNiwxMXMvKc5Ej55oiefXCRLqHOp4JWo8sVQdh
   VKxa1gpCVNYuGCmN5DGVDhT0bYV3GBs2/PAh1ky2hCCLd6sMAIhVLwIcqtOQ
   bK6Hobu2qI= root@client
   ```

   In this example, client.abc.com is the fully qualified host name of the client that is appended to the key in the `/opt/ssh/etc/ssh_known_hosts` file.

7. To connect to the remote server, run the following command from the client system:

   ```
   # ssh <server_name>
   ```

   Where:

   <server_name> specifies the name of the remote system to which you want to connect.

   The HP-UX Secure Shell client connects to the HP-UX Secure Shell server.

Using User-Specific Configuration

To configure host-based authentication for non-superusers using user-specific configuration, follow the steps specified in "Using Systemwide Configuration" (page 39). However, the host configuration files that you need to update are user-specific files, not the systemwide files.

Table 14 describes the systemwide configuration files and the corresponding user-specific configuration files.

Table 14 Host Configuration Files

User-Specific Files	Systemwide Files
`$HOME/.shosts`	`/opt/ssh/etc/shosts.equiv`
`$HOME/.rhosts`	`/etc/hosts.equiv`
`$HOME/.ssh/knownhosts`	`/opt/ssh/etc/ssh_known_hosts`

Configuring Host-Based Authentication for Superusers

To configure host-based authentication for superusers, follow the steps described in "Using Systemwide Configuration" (page 39). For the superuser, HP-UX Secure Shell uses the information specified in the `$HOME/.shosts` and `$HOME/.rhosts` files. It does not use the information specified in the systemwide configuration files `/opt/ssh/etc/shosts.equiv` or `/etc/hosts.equiv`.

Configuring User-Specific Authentication

You can configure HP-UX Secure Shell to enable different authentication methods for different users. You can also configure HP-UX Secure Shell to enable users to login as superuser only if their `ttys` are listed in the `etc/securetty` file. To enable these functionalities, HP-UX Secure Shell includes the Auth Selection patch, and a new configuration directive called `EnforceSecureTTY`. For more information on these functions, see the following sections:

- "The Auth Selection Patch."
- "The `EnforceSecureTTY` Configuration Directive" (page 44)

The Auth Selection Patch

HP-UX Secure Shell includes a third-party Auth Selection patch, which enables you to configure different authentication methods for different users. The Auth Selection patch provides a set of 12 configuration directives to implement this feature. These configuration directives can be broadly classified as Allow and Deny configuration directives. Table 15 lists the 12 configuration directives.

Table 15 Configuration Directives Provided by the Auth Selection Patch

Allow Configuration Directives	Deny Configuration Directives
`KerberosAuthAllowUsers`	`KerberosAuthDenyUsers`
`KerberosorLocalPasswdAuthAllowUsers`	`KerberosorLocalPasswdAuthDenyUsers`
`PubkeyAuthAllowUsers`	`PubkeyAuthDenyUsers`
`HostbasedAuthAllowUsers`	`HostbasedAuthDenyUsers`
`ChallRespAuthAllowUsers`	`ChallRespAuthDenyUsers`
`PasswordAuthAllowUsers`	`PasswordAuthDenyUsers`

These directives are similar to the `AllowUsers` and `DenyUsers` configuration directives. However, these new configuration directives allow or deny users permission to authenticate, using a particular authentication method. By default, all the "Allow" configuration directives enable all users to authenticate and all the "Deny" directives deny no user. The following examples show how to use these configuration directives:

Example 1 To Enable all Users to Authenticate Using Public key Authentication

Add the following line in the `sshd_config` file:

```
PubkeyAuthAllowUsers     *
```

Example 2 To Enable User U1 to Authenticate Using Kerberos Authentication

Add the following line in the `sshd_config` file:

```
 KerberosAuthAllowUsers     U1
```

You need not set the `KerberosAuthDenyUsers` configuration directive. Use the configuration directive that has fewer members.

Example 3 To Enable all Users Except User U1 to Authenticate Using Kerberos Authentication

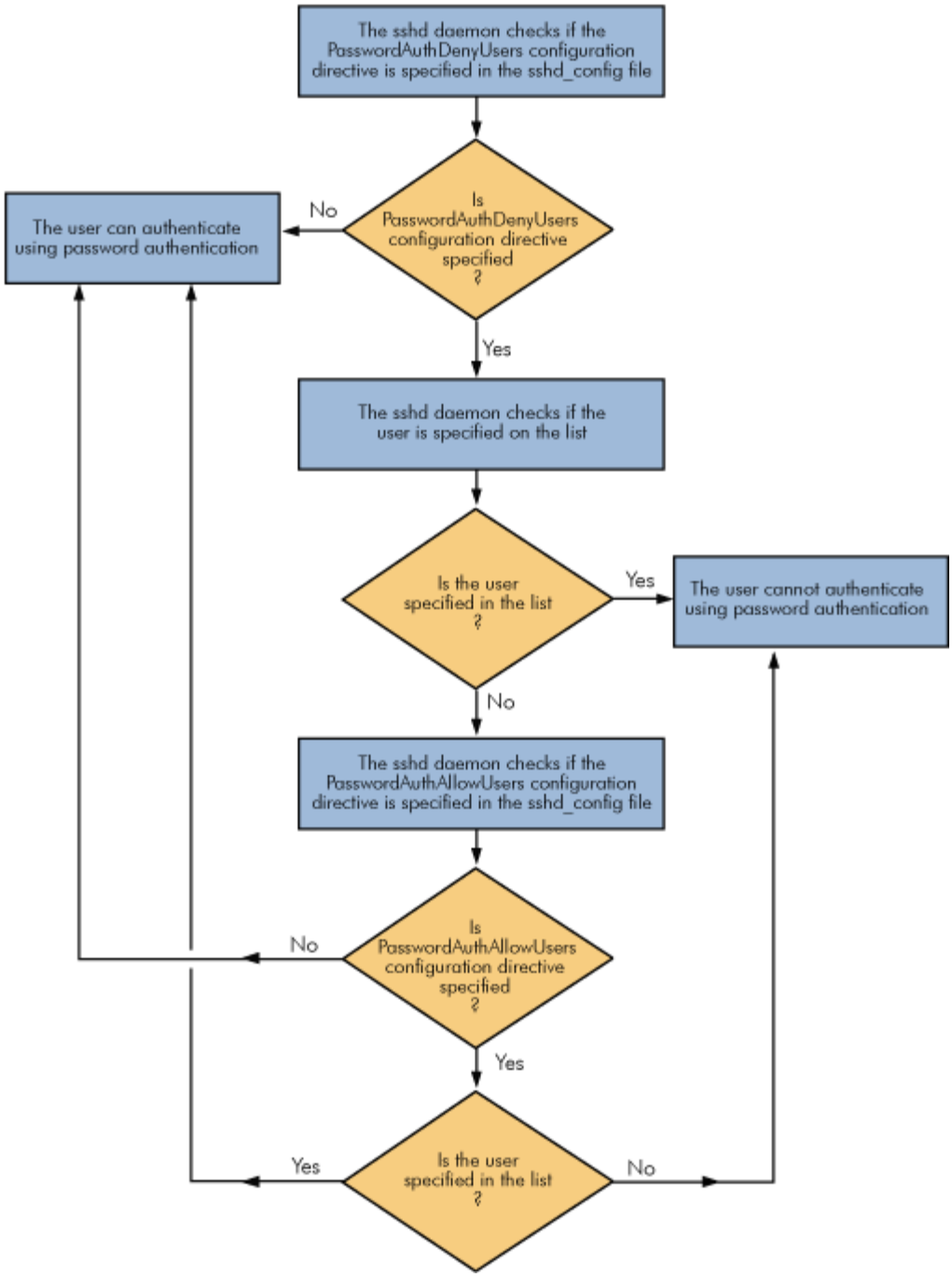
Add the following line in the `sshd_config` file:

```
KerberosAuthDenyUsers     U1
```

NOTE: These configuration directives are commented in the default `sshd_config` file. To change the default setting of these configuration directives, you must uncomment the directive in the `sshd_config` file and assign a value to it.

Figure 4 illustrates how the `sshd` daemon uses the Allow and Deny configuration directives to find out if user U1 is permitted to authenticate using password authentication.

Figure 4 Flowchart Depicting the Usage of the Allow and Deny Configuration Directives



Steps by which the `sshd` daemon uses the Configuration Directives in the Auth Selection Patch

Following is the sample process outlined in Figure 4 (page 43):

1. The `sshd` daemon checks if the `PasswordAuthDenyUsers` configuration directive is specified in the `sshd_config` file.
2. If the `PasswordAuthDenyUsers` configuration directive is specified, then the `sshd` daemon checks to see if user U1 is specified in the list. If the `PasswordAuthDenyUsers` configuration directive is not specified, the user can authenticate using password authentication.
3. If user U1 is specified in the list, the user cannot authenticate using password authentication.
4. If user U1 is not specified in the list, the `sshd` daemon checks if the `PasswordAuthAllowUsers` configuration directive is specified.

5. If the PasswordAuthAllowUsers configuration directive is not specified, user U1 can authenticate using password authentication. If the PasswordAuthAllowUsers configuration directive is specified, the sshd daemon checks if user U1 is specified in the list.
6. If user U1 is specified in the list, the user can authenticate using password authentication.
7. If user U1 is not specified in the list, then user U1 cannot authenticate using password authentication.

The EnforceSecureTTY Configuration Directive

This configuration directive honors the settings in the etc/securetty file. Use this configuration directive to specify whether the sshd daemon must restrict superuser logins to the tty (terminal types) names listed in the /etc/securetty file. When EnforceSecureTTY is set to no (the default value), HP-UX Secure Shell ignores the settings in the etc/securetty file.

You can use the EnforceSecureTTY configuration directive in conjunction with the PermitRootLogin configuration directive. Table 16 describes the behavior of the ssh, scp, and sftp commands with different combinations of EnforceSecureTTY and PermitRootLogin.

Table 16 Behavior of the ssh, scp, and sftp commands with Different Combinations of EnforceSecureTTY and PermitRootLogin

EnforceSecureTTY	PermitRootLogin	Behavior of the sshCommand	Behavior of the scp and sftp Commands
NO	NO	Host login[1] and host command[2] executions are not allowed for all users	Superusers cannot execute the scp and sftp[3] commands, regardless of the settings in the etc/securetty file.
NO	YES	Host login and host command executions are allowed for all superusers	Superusers can execute the scp and sftp commands, regardless of the settings in the etc/securetty file.
YES	NO	Host login and host command executions are not allowed for all superusers	Superusers cannot execute the scp and sftp commands, regardless of the settings in the etc/securetty file.
YES	YES	Host login is allowed only for those superusers whose ttys are listed in the etc/securetty file. Host command execution is allowed for all superusers, regardless of the settings in the etc/securetty file.	Superusers can execute the scp and sftp commands, regardless of the settings in the etc/securetty file.
YES	Forced-Command-only	Host login and host command executions are not allowed for all superusers, regardless of the settings in the etc/securetty file. Forced-command execution [4] is dictated by the pty or	Forced-command execution is allowed for all superusers, regardless of the setting in the etc/securetty file, and the pty setting in the authorized_keys file. However, no pty is allocated even if it specified in the authorized_keys file.

Table 16 Behavior of the ssh, scp, and sftp commands with Different Combinations of EnforceSecureTTY and PermitRootLogin *(continued)*

EnforceSecureTTY	PermitRootLogin	Behavior of the sshCommand	Behavior of the scp and sftp Commands
		no-pty option. This option is specified in the authorized_keys file, located in the home directory of the superuser on the server. The default option is pty. If run with a pty option, forced-command execution is allowed only for superusers whose ptys are listed in the etc/securetty file. If run with a no-pty option, then forced-command execution is allowed for all superusers, regardless of the settings in the etc/securetty file. **NOTE:** For Forced-commands only, superusers must log in using public key authentication. This additional requirement is not related to EnforceSecureTTY . This applies to the scp, ssh, and sftp commands.	**IMPORTANT:** The scp and sftp commands, and forced-command are mutually exclusive. If forced-command execution is set, only forced-command is executed and no file transfers are allowed.
YES	Without Password	Host login is allowed only for superusers whose ptys are listed in the etc/securetty file. These superusers must authenticate with a method other than password authentication. This additional requirement is not related to EnforceSecureTTY. Host command execution is allowed for all superusers, regardless of the settings in the etc/securetty file.	Superusers can execute the scp and sftp commands, regardless of the settings in the etc/securetty file. These superusers must authenticate with a method other than password authentication.
NO	Forced-Commands-only	Host login and host command executions are not allowed for all superusers. Forced-commands execution is allowed for all superusers. **NOTE:** For Forced-Commands-only, superusers must authenticate using public key authentication. This additional requirement is not related to EnforceSecureTTY. This applies to the ssh, scp, and sftp commands.	Forced-command execution is allowed for all superusers regardless of the settings in the etc/securetty file, and the pty setting in the authorized_keys file. However, no pty is allocated even if it specified in the authorized_keys file.

Table 16 Behavior of the ssh, scp, and sftp commands with Different Combinations of EnforceSecureTTY and PermitRootLogin *(continued)*

EnforceSecureTTY	PermitRootLogin	Behavior of the sshCommand	Behavior of the scp and sftp Commands
			IMPORTANT: The scp and sftp commands, and forced-commands are mutually exclusive. If forced-command execution is set, only forced-command is executed and no file transfers are allowed.
NO	Without Password	Host login is allowed for all superusers. Superusers must authenticate with a method other than password authentication. However this requirement is not related to EnforceSecureTTY. Host command execution is allowed for all users, regardless of the setting in the etc/securetty file.	Superusers can execute the scp and sftp commands, regardless of the settings in the etc/securetty file. Superusers must authenticate with a method other than password authentication.

[1] Host login refers to a client directly logging into a host. Following is an example of host login:

```
$ ssh hostxyz
```

[2] Host command execution refers to a client executing only one command against a server. The client logs into the server, executes the command, and exits. Following is an example of the host command execution:

```
$ ssh hostxyz ls /tmp
```

[3] The execution of the scp and sftp commands is similar to that of host command. However, no pty is allocated for scp and sftp, and the /etc/securetty file is not checked. Any combination of EnforceSecureTTY and PermitRootLogin that allows host command execution for ssh allows scp and sftp execution.

[4] Forced-command execution refers to a client executing a command predefined in the authorized_keys file of the client. This file is located in the home directory of the client on the server.

Behavior of EnforceSecureTTY with the UseLogin Configuration Directive

The EnforceSecureTTY configuration directive works in conjunction with the UseLogin configuration directive. Although the login(1) function has the code to check the etc/securetty file, this code is part of the authentication. If UseLogin is set to yes, HP-UX Secure Shell invokes the login(1) function with the do not authenticate option. As a result, the section of the login(1) code related to the etc/securetty file is ignored. HP-UX Secure Shell reads and processes the etc/securetty file even if UseLogin is set to yes.

Behavioral differences between telnet and ssh logins because of EnforceSecureTTY

The addition of the EnforceSecureTTY configuration directive modifies the behavior of the ssh login, causing it to differ from a telnet login. In telnet, a pty is allocated to a user connection before authentication. In HP-UX Secure Shell, a user must authenticate successfully before the sshd daemon allocates a pty. Once a user is successfully authenticated, the sshd daemon does not prompt the user for a password. Table 17 describes the difference between a telnet and an ssh login.

Table 17 Difference in Behavior Between `telnet` and `ssh` Logins

A `telnet` Login	**An `ssh` Login**
When a superuser tries to login using `telnet` with a `tty` that is not listed in the `etc/securetty` file, `telnet` continues to prompt the user for a password regardless of whether the user types a valid or invalid password.	If the `EnforceSecureTTY` configuration directive is set to `yes`, and a superuser attempts an `ssh` login with a `tty` that is not listed in the `etc/securetty` file, HP-UX Secure Shell continues to prompt the user for a password as long as the user types invalid passwords. Once the user types the valid password, the `sshd` daemon does the following: • Authenticates the user • Allocates a `pty` • Finds out that the `pty` is not permitted • Closes the connection

Behavioral differences between `remsh` and `ssh` logins because of `EnforceSecureTTY`

The addition of the `EnforceSecureTTY` configuration directive modifies the behavior of the `ssh` login, causing it to differ from a `remsh` login. Both `remsh` and `ssh` logins allow the `forced-command` option for superusers logging in with a `tty` not listed in the `etc/securetty` file. However, in a `remsh` login, the settings in the `etc/securetty` file are enforced only if a user logs in using password authentication. If a `remsh` user authenticates using host-based authentication, `remsh` ignores the settings in the `etc/securetty` file.

In an `ssh` login, there is no distinction between authentication methods when enforcing the settings in the `etc/securetty` file.

5 Configuring HP-UX Secure Shell as a SOCKS Proxy

This chapter describes how to configure HP-UX Secure Shell as a SOCKS proxy. This chapter addresses the following topics:

- "SOCKS Overview."
- "Implementations of SOCKS."
- "DanteSOCKS."
- "Dynamic Port Forwarding " (page 49)

SOCKS Overview

SOCKS is an Internet protocol that enables client-server applications to transparently use the services of a network firewall. This protocol enables a client which is behind a firewall to connect to external servers through a SOCKS proxy server. The SOCKS proxy server determines the eligibility of the client to access the external server.

Implementations of SOCKS

SOCKS can be implemented in various ways. This section discusses the following implementation types:

- "DanteSOCKS."
- "Dynamic Port Forwarding " (page 49)

DanteSOCKS

DanteSOCKS is a circuit-level firewall or proxy that you can use to provide convenient and secure network connectivity to a wide range of hosts. However, the server on which DanteSOCKS runs must be connected to an external network. Once installed, DanteSOCKS can be made transparent to the clients, while offering detailed access control and logging facilities to the server administrator.

Prerequisites

Download and install the following products to use Dante SOCKS with HP-UX Secure Shell:

- DanteSOCKS- DanteSOCKS is a part of the Internet Express suite of products. It is available for download at: www.software.hp.com
- SOCKS Client product- The SOCKS client product (connect.c) is a simple relaying command that makes network connections using SOCKS and https proxy. It is available for download at: http://www.taiyo.co.jp/~gotoh/ssh/connect.c

Usage Examples

Enter the following command to run the DanteSOCKS daemon in the proxy-server system:

```
# sockd
```

Example 4 and Example 5 illustrate how to connect to an external server and transfer data using a SOCKS proxy.

Example 4 Connecting to an External Server Using a DanteSOCKS Proxy

Enter the following command to connect to an external server using a DanteSOCKS proxy:

```
# ssh -o "ProxyCommand connect -S proxy-server  %h  %p"  external-server
```

The system is connected to external-server through proxy-server.

Example 5 Data Transfer Using a DanteSOCKS Proxy

Enter the following command to transfer data using a DanteSOCKS proxy:

```
# scp -o "ProxyCommand  connect  -S proxy-server  %h  %p"  external-server
:remotefile   localfile
```

or

```
# sftp -o "ProxyCommand  connect -S proxy-server    %h    %p"  external-server
```

The system is connected to external-server using proxy-server, and `remotefile` is copied. to `localfile`.

Dynamic Port Forwarding

You can configure the dynamic port forwarding feature of HP-UX Secure Shell to serve as a SOCKS server, instead of forwarding from specific ports on the local and remote servers. The dynamic port forwarding feature in HP-UX Secure Shell replaces the socks proxy. To connect to a SOCKS server, you need a socks client, or the actual application client must have the socks client feature. In local and remote port forwarding, the `ssh` client statically configures the port to which the application client will connect. However, in dynamic port forwarding, HP-UX Secure Shell provides an option that enables the application client to choose the port that must be connected in the remote system dynamically. For example, enter the following command to specify the port number that `ssh` must listen on:

```
# ssh -D <port number> localhost
```

In the following command, the port to be connected in the remote machine is picked up by `%p` . The SOCKS server on the specified `<port number>` then connects to the port `%p` running on the specified host (`%h`).

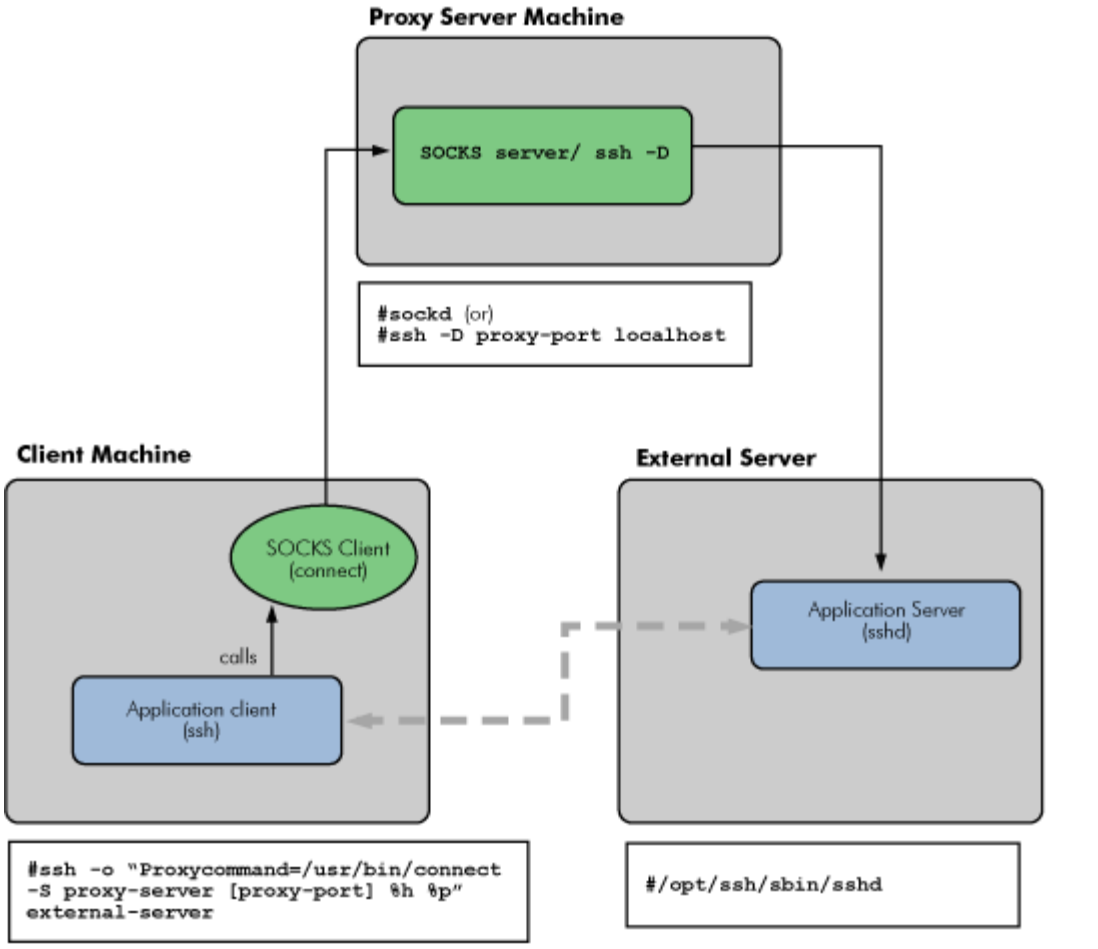
```
# ssh-o  "ProxyCommand   connect -S proxy-server:<port number>   %h   %p"
  external-server
```

NOTE: Currently, both the SOCKS4 and SOCKS5 protocols are supported.

Dynamic Port Forwarding Process

Figure 5 (page 50) illustrates the dynamic port forwarding process.

Figure 5 Dynamic Port Forwarding Process



NOTE:

Machine	Command running
*Client Machine	#ssh -o "ProxyCommand=connect -S proxy-server proxy-port %h %p" external-server
*Proxy Machine	#sockd (or) ssh -D proxy-port localhost
*External Server	#/opt/ssh/sbin/sshd

To establish a connection, an application client calls the SOCKS client, which then makes a connection to the SOCKS server with the following command:

```
# ssh -o "ProxyCommand=/usr/bin/connect -S proxy-server <proxy-port number>
 %h  %p" external server
```

Prerequisites

The SOCKS Client product (connect.c). It is available for download at: http://www.taiyo.co.jp/~gotoh/ssh/connect.c

Usage Examples

Example 6 (page 51) and Example 7 (page 51) illustrate how to connect to an external server and transfer data using dynamic port forwarding.

Example 6 Connecting to an External Server Using Dynamic Port Forwarding

Enter the following command to connect to an external server using dynamic port forwarding:

```
# ssh -o "ProxyCommand  connect -S proxy-server:<port number>    %h    %p"
  external-server
```

This establishes a connection to external-server using proxy-server.

Example 7 Data Transfer Using Dynamic Port Forwarding

Enter the following command to transfer data using dynamic port forwarding:

```
# scp -o "ProxyCommand  connect -S proxy-server:<port number>    %h    %p"
  external-server:remotefile   localfile
```

or

```
# sftp -o "ProxyCommand  connect -S proxy-server:<port number>    %h    %p"
  external-server
```

The system is connected to external-server through proxy-server, and `remotefile` is copied to `localfile`.

6 Enabling HP-UX Secure Shell to Take Advantage of High Speed Networks

HP-UX Secure Shell includes a High Performance Enabled SSH/SCP (HPN) patch, which enables HP-UX Secure Shell to take advantage of the large `tcp` send and receive buffers that are available in high bandwidth networks.

In some situations (such as transfers on LANs), the HPN patch can degrade HP-UX Secure Shell performance. In such cases, you can disable the HPN patch by setting `HPNDisabled=no` in the `sshd_config` and `ssh_config` files. By default, the HPN patch is turned on.

Table 18 lists configuration directives that you can use to configure the HPN patch.

Table 18 Configuration Directives to Configure the HPN Patch

Configuration Directive	Location	Functionality
`TcpRcvBuf=[int]KB`	Present on client	Use this configuration directive to set the TCP socket receive buffer to n Kilobytes. You can set the buffer up to the maximum socket size allowed by the system. Use this configuration directive in situations when the `tcp` receive window is set low, but the maximum buffer size is set higher. The default value of this directive is the current systemwide `tcp` receive buffer size.
`TcpRcvBufPoll=[yes/no]`	Present on client and server	Use this configuration directive to enable or disable the polling of the `tcp` receive buffer while the connection is active. The default value of this directive is `no`.
`NoneEnabled=[yes/no]`	Present on client and server	Use this configuration directive to enable or disable the use of the None cipher. The default value of this directive is `no`. **IMPORTANT:** Enable this directive with caution, because this allows users to send unencrypted data through the network. However, authentication information remains encrypted.
`NoneSwitch=[yes/no]`	Present on client	Use this configuration directive to switch the encryption cipher to the None cipher after the user is authenticated. You must enable `NoneEnabled` on the client and server before enabling `NoneSwitch`. The default value of this directive is `no`. **NOTE:** You cannot use the None cipher in interactive Shell sessions. If you do so, HP-UX Secure Shell fails without displaying any error messages.
`HPNDisabled=[yes/no]`	Present on client and server	Use this configuration directive to disable the HPN functionality. You can disable HPN if the impact of the HPN code produces a net decrease in performance. This can happen sometimes when there are transfers on

Table 18 Configuration Directives to Configure the HPN Patch *(continued)*

Configuration Directive	Location	Functionality
		a local area network. By default `HPNDisabled` is set to `yes`.
`HPNBufferSize=[int] KB`	Present on client and server	Use this configuration directive to set the buffer size when interacting with Secure Shell installations that do not have the HPN patch. The value of this directive ranges from 1 KB to 14 MB. The default value of this directive is 2 MB. If `TcpRecvBufPoll` is set to `yes`, this overrides the value specified in `HPNBufferSize`. **CAUTION:** Use of oversized or undersized buffers can cause performance issues depending on the length of the network path.

NOTE: A client with the HPN patch can work with a non-HPN-enabled sshd server. However, the client-server connection does not result in optimal performance. While establishing a connection, the `ssh` client checks the server version. If the server version has a `-hpn` suffix, the client assumes that the server is HPN-enabled, and dynamically adjusts the window size based on the `tcp` buffer size. If the server version does not have a `-hpn` suffix, the client assumes that the server does not have the HPN patch, and retains the window size to 128 KB.

Changes in the `ssh` Command due to the HPN Patch

The following changes are made to the `ssh` command, because of the inclusion of the HPN patch:

- The `-w` option is replaced with the `TcpRecvBuf` configuration directive
- A new `-z` option is introduced to support the None cipher.

7 Troubleshooting HP-UX Secure Shell

This chapter discusses methods to troubleshoot problems with HP-UX Secure Shell connections.

This chapter addresses the following topics:

Overview

HP-UX Secure Shell servers and clients provide built-in debugging. When an HP-UX Secure Shell client tries to establish a connection with an HP-UX Secure Shell server, the HP-UX Secure Shell server presents a list of authentication methods that it supports. If the HP-UX Secure Shell client fails to authenticate itself using one method, it can try the next authentication method on the list. HP-UX Secure Shell server attempts all supported authentication methods before declining the connection request from the client.

When you experience a problem during a HP-UX Secure Shell connection, first run the HP-UX Secure Shell client and server in debug mode. By default, debugging is not enabled on either the HP-UX Secure Shell server or the HP-UX Secure Shell client. When invoked with appropriate debugging command-line options, HP-UX Secure Shell server and client display messages about their progress and failures. You can analyze these messages to identify problems. You can increase the level of detail displayed in the debug output to obtain more information about the problem. You can use either command-line options or the configuration directive on the HP-UX Secure Shell server and client to control the debugging message level.

Depending on how debugging is configured, HP-UX Secure Shell logs error messages to the console or to the `/var/adm/syslog/syslog.log` file.

Apart from the debugging options, the HP-UX Secure Shell Frequently Asked Questions (FAQ) available at the following URL can help you solve some common problems:
http://www.hp.com/go/hpux-security-docs

Debugging the HP-UX Secure Shell Server

The HP-UX Secure Shell server logs debug and error messages in the `/var/adm/syslog/syslog.log` file. You can also configure the HP-UX Secure Shell server to log the messages in a different file.

Debugging Options

The HP-UX Secure Shell server daemon, `sshd`, provides the following debugging options:

`-d` Specifies debug mode. The server sends verbose debug output to the system log and does not put itself in the background. The server does not fork and processes only one connection at a time. This option is intended only for debugging the server.

NOTE: If you run `sshd` in debug mode, `sshd` allows only one client connection at a time. Additional clients cannot connect to the HP-UX Secure Shell server until the connected client logs out.

`-e` Directs `sshd` to send the output to the standard console instead of the system log.

`-p` *port* Specifies the port on which the server listens for connections. The default port is 22. HP-UX Secure Shell allows multiple port options. If you specify a command-line port, HP-UX Secure Shell ignores the ports specified in the configuration file.

Running sshd in Debug Mode

If you run `sshd` in debug mode, log messages display on the standard output and are also logged in the `/var/adm/syslog/syslog.log` file.

Following is the syntax to generate debug messages on the HP-UX Secure Shell server:

```
$ /usr/sbin/sshd -[d dd ddd] -e [-p port] [2> <outputfile>]
```

Where:

<outputfile> Specifies the file to which the error messages are redirected.

You can use this file to analyze the problem or you can to send the file to HP support if you are unable to resolve the problem.

You can use multiple `-d` options to increase the amount and detail of debugging information. The `-d` command-line option pertains only to debug messages and does not control the generation of error messages. Error messages are generated regardless of the command-line option setting.

NOTE: You can use a maximum of three `-d` options to generate debug messages.

Table 19 lists the information that is displayed for the `-d`, `-dd`, and `-ddd` debug options.

Table 19 Debug Information for `-d`, `-dd`, and `-ddd` Options

Debug Option	Details Displayed
`-d`	• The client protocol and the `sshd` version number • The private host key type
`-dd`	• The `-d` debug messages • The private key bit set • The user authentication method request
`-ddd`	• All the `-d` and `-dd` messages • The privileged user and group

The following sample debug messages show the level of detail displayed for the same HP-UX Secure Shell connection, using the `-d`, `-dd`, and `-ddd` debug command-line options:

- Following is an example of some `-d` command-line option:

```
debug1: sshd version OpenSSH_4.4p1-hpn [ HP-UX Secure Shell-A.04.40.005]
debug1: read PEM private key done: type RSA
debug1: private host key: #0 type 1 RSA
debug1: read PEM private key done: type DSA
debug1: private host key: #1 type 2 DSA
debug1: Bind to port 1111 on 0.0.0.0.
Server listening on 0.0.0.0 port 1111.
```

- Following is the output for the `-dd` command-line option:

```
debug2: load_server_config: filename /opt/ssh/etc/sshd_config
debug2: load_server_config: done config len = 270
debug2: parse_server_config: config /opt/ssh/etc/sshd_config len 270
```

```
debug1: sshd version OpenSSH_4.4p1-hpn [ HP-UX Secure Shell-A.04.40.005 ]
debug1: read PEM private key done: type RSA
debug1: private host key: #0 type 1 RSA
debug1: read PEM private key done: type DSA
debug1: private host key: #1 type 2 DSA
debug2: fd 4 setting O_NONBLOCK
debug1: Bind to port 1111 on 0.0.0.0.
Server listening on 0.0.0.0 port 1111.
```

This level of debug output includes the `debug1` and `debug2` level messages.

- Following is the output for the `-ddd` command-line option:

```
debug3: RNG is ready, skipping seeding
debug2: load_server_config: filename /opt/ssh/etc/sshd_config
debug2: load_server_config: done config len = 270
debug2: parse_server_config: config /opt/ssh/etc/sshd_config len 270
debug1: sshd version OpenSSH_4.4p1-hpn [ HP-UX Secure Shell-A.04.40.005 ]
debug3: Not a RSA1 key file /opt/ssh/etc/ssh_host_rsa_key.
debug1: read PEM private key done: type RSA
debug1: private host key: #0 type 1 RSA
debug3: Not a RSA1 key file /opt/ssh/etc/ssh_host_dsa_key.
debug1: read PEM private key done: type DSA
debug1: private host key: #1 type 2 DS
Adebug2: fd 4 setting O_NONBLOCK
debug1: Bind to port 1111 on 0.0.0.0.
Server listening on 0.0.0.0 port 1111.
```

This level of debug output includes the `debug1`, `debug2`, and `debug3` level messages.

Debugging the HP-UX Secure Shell Client

One of the best tools for troubleshooting the HP-UX Secure Shell client is the verbose option, `-v`. With the `-v` command-line option, the HP-UX Secure Shell client displays helpful messages such as the version number of HP-UX Secure Shell, type of authentication methods it is attempting, and the authentication method that has succeeded.

In addition to the HP-UX Secure Shell client, the `-v` debugging command-line option is available for the following HP-UX Secure Shell commands:

- `ssh-keyscan`
- `sftp`
- `scp`
- `ssh-keygen`

Debugging Option

The HP-UX Secure Shell client provides the following debugging command-line option:

`-v` Indicates the verbose mode. When `ssh` is run in the verbose mode, `ssh` prints debugging messages about its progress. This is helpful in debugging connection, authentication, and configuration problems. Multiple `-v` options increase the verbosity of the debugging messages.

Running ssh in Debug Mode

Following is the syntax to run the HP-UX Secure Shell client in verbose mode:

```
$ ssh -[v vv vvv] [2> <outputfile>]
```

Where:

<outputfile> specifies the file to which the error messages are redirected. You can use this file to analyze the problem or to send the file to HP support if you are unable to solve the problem.

You can use multiple `-v` options to increase the amount and detail of the debug messages.

NOTE: You can use a maximum of three `-v` options to generate different levels of debug messages.

Table 20 lists the information that is displayed for the -v, -vv, and -vvv debug options.

Table 20 Debug Information for -v, -vv, and -vvv Options

Debug Option	Details Displayed
-v	• The Identity File • The "Authentication succeeded" message
-vv	• All the -v messages • The private key bit set
-vvv	• All the -v and -vv messages • Details such as authmethod_lookup and authmethod_is_enabled

The following sample debug messages show the level of detail displayed for the same HP-UX Secure Shell connection, using the -v, -vv, and -vvv debug command-line options.

- Following is the output for the -v command-line option:

```
debug1: Reading configuration data /opt/ssh/etc/ssh_config
debug1: Connecting to localhost [127.0.0.1] port 1111.
debug1: Connection established.
debug1: permanently_set_uid: 0/3
debug1: identity file /.ssh/id_rsa type 1
debug1: identity file /.ssh/id_dsa type -1
debug1: Remote protocol version 2.0, remote software version OpenSSH_4.4p1-hpn
```

- Following is the output for the -vv command-line option:

```
debug1: Reading configuration data /opt/ssh/etc/ssh_config
debug2: ssh_connect: needpriv 0
debug1: Connecting to localhost [127.0.0.1] port 1111.
debug1: Connection established.
debug1: permanently_set_uid: 0/3
debug2: key_type_from_name: unknown key type '-----BEGIN'
debug2: key_type_from_name: unknown key type '-----END'
debug1: identity file /.ssh/id_rsa type 1
```

- Following is the output for the -vvv command-line option:

```
debug1: Reading configuration data /opt/ssh/etc/ssh_config
debug3: RNG is ready, skipping seeding
debug2: ssh_connect: needpriv 0
debug1: Connecting to localhost [127.0.0.1] port 1111.
debug1: Connection established.
debug1: permanently_set_uid: 0/3
debug3: Not a RSA1 key file /.ssh/id_rsa.
```

Interpreting the Debug Output

Use the HP-UX Secure Shell debug output to analyze problems. The debug output describes the various stages of an HP-UX Secure Shell connection.

This section provides sample debug output for an HP-UX Secure Shell client that uses public-key authentication.

NOTE: Annotations are highlighted in bold and marked with >>>>. HP-UX Secure Shell does not display these annotations on the console as part of the debug output. Annotations included here are for your information only.

When an HP-UX Secure Shell client connects to the HP-UX Secure Shell server in verbose mode, the following output is displayed:

```
# ssh -v <server_name>
```

```
OpenSSH_4.4, OpenSSL 0.9.7l 25 Oct 2006
HP-UX Secure Shell-A.04.40.005, HP-UX Secure Shell version
debug1: Reading configuration data /opt/ssh/etc/ssh_config
 >>>> Specifies the location of the client
configuration file.
debug1: Connecting to ssh1100 [172.16.1.163] port 22.
>>>> Specifies the remote
machine and port to which the client is trying to connect.
debug1: Connection established. >>>>> Indicates that
 a TCP connection is
established between the client and server.
debug1: permanently_set_uid: 0/3
debug1: identity file /.ssh/identity type 0
debug1: identity file /.ssh/id_rsa type -1
debug1: identity file /.ssh/id_dsa type -1
debug1: Remote protocol version 2.0, remote software version
OpenSSH_4.4p1-hpn
>>>> Shows the Secure Shell version of the remote
server.
debug1: match: OpenSSH_4.4p1-hpn pat OpenSSH*
debug1: Enabling compatibility mode for protocol 2.0
debug1: Local version string SSH-2.0-OpenSSH_4.4p1-hpn
debug1: SSH2_MSG_KEXINIT sent >>>> Indicates the
 start of the key file exchange.
debug1: SSH2_MSG_KEXINIT received
debug1: kex: server->client aes128-cbc hmac-md5 none
 >>>> Indicates the start of
the encryption algorithm negotiation from server to client.
debug1: kex: client->server aes128-cbc hmac-md5 none
 >>>> Indicates the start of the encryption algorithm
 negotiation from client to server.
debug1: SSH2_MSG_KEX_DH_GEX_REQUEST(1024<1024<8192) sent
debug1: expecting SSH2_MSG_KEX_DH_GEX_GROUP
debug1: SSH2_MSG_KEX_DH_GEX_INIT sent
debug1: expecting SSH2_MSG_KEX_DH_GEX_REPLY
The authenticity of host 'ssh1100 (172.16.1.163)' can't be
established. >>>>>
Indicates that the host key of the remote server is not part of the
known_hosts file of the client
RSA key fingerprint is
89:29:ac:b2:0f:7c:3a:60:c4:43:5e:31:13:01:b5:a8.
Are you sure you want to continue connecting (yes/no)? yes
>>>> Prompts for confirmation to add the host key of
the remote server in the known_hosts file of the client.
Warning: Permanently added 'ssh1100,172.16.1.163' (RSA) to the list
of known hosts. >>>> Indicates that the host key of
the remote server has been added to the known_hosts file of the
client.
debug1: ssh_rsa_verify: signature correct >>>>
Indicates that the host key of the remote server is verified.

debug1: SSH2_MSG_NEWKEYS sent
debug1: expecting SSH2_MSG_NEWKEYS
debug1: SSH2_MSG_NEWKEYS received
debug1: SSH2_MSG_SERVICE_REQUEST sent
debug1: SSH2_MSG_SERVICE_ACCEPT received
debug1: Authentications that can continue: publickey,password,
keyboard-interactive >>>> Displays the list of
authentication methods supported by the remote server.
debug1: Next authentication method: publickey >>>>
Indicates that the client is trying public-key authentication
.
debug1: Trying private key: /.ssh/id_rsa
debug1: Trying private key: /.ssh/id_dsa
debug1: Next authentication method: keyboard-interactive
 >>>> Indicates that
public-key authentication has failed and the client is trying the
next authentication on the list.
Password: >>>> Indicates the password prompt in which
you must enter your HP-UX Secure Shell password.
debug1: Authentication succeeded (keyboard-interactive).
 >>>> Indicates that the authentication succeeded.
```

```
debug1: channel 0: new [client-session]
>>>> Indicates that a new client session is open.
debug1: Entering interactive session.
>>>> Indicates that the client has entered into an
interactive session.
```

Generating Debug Messages Using the LogLevel Configuration Directive

You can use the `LogLevel` configuration directive in the HP-UX Secure Shell server and client configuration files `/opt/ssh/etc/sshd_config` and `/opt/ssh/etc/ssh_config` to control the level of debug information generated during an HP-UX Secure Shell connection.

The LogLevel Configuration Directive

You can set `LogLevel` to one of the following values:

`QUIET` Indicates that messages are not logged.

`FATAL` Indicates that fatal messages are logged.

`ERROR` Indicates that HP-UX Secure Shell logs all error messages.

`INFO` Indicates the information that must go to the log.

`VERBOSE` Indicates that HP-UX Secure Shell logs more detailed messages.

`DEBUG` Specifies debugging messages that must not be logged during normal operation.

`debug1` Specifies the debugging mode level one. This mode is the same as `DEBUG`. It is also the same as specifying `-d` or `-v` on the command line.

`debug2` Specifies debugging level two. It is also the same as specifying `-dd` or `-vv` on the command line.

`debug3` Specifies debugging level three. It is also the same as specifying `-ddd` or `-vvv` on the command-line.

Of the different types of messages listed, only `FATAL` and `ERROR` values pertain to error messages. The other values generate messages you can use for informational or debug-trace purposes.

The `-d` and `-v` command-line options do not log `FATAL` or `ERROR` messages. The `LogLevel` directive is more flexible and friendly compared to the command-line options.

The default value for `LogLevel` is `INFO`.

Table 21 lists the `LogLevel` values and the equivalent `-d` and `-v` command-line options.

Table 21 LogLevel and Debugging Values

LogLevel Value	Equivalent Debugging Option
`debug1`	`-d` and `-v`
`debug2`	`-dd` and `-vv`
`debug2`	`-ddd` and `-vvv`

IMPORTANT: Be cautious when using debug levels higher than `debug1`. HP-UX Secure Shell displays sensitive information at higher levels, such as the private keys of the user or server.

Logging Error and Debug Messages

HP-UX Secure Shell logs error messages in different locations depending on how debugging is configured.

Following are the different locations in which HP-UX Secure Shell logs error and debug messages:

- The `/var/adm/syslog/syslog.log` File – If you specify only the `LogLevel` directive in the `/opt/ssh/etc/sshd_config` file and you do not specify the `-d` or `-v` command-line options with `sshd`, HP-UX Secure Shell logs all the messages (debug and error messages) in

the /var/adm/syslog/syslog.log file. HP-UX Secure Shell error messages are prefixed with sshd in the /var/adm/syslog/syslog.log file.

Following is a sample error message in the /var/adm/syslog/syslog.log file:

```
May 12 16:47:39 system_name sshd[2618]: error: PAM: Authentication failed
```

Where:

PAM Authentication failed is the error message.

- The Standard Output – If you specify the -d or -v option with sshd, HP-UX Secure Shell sends debug messages to the standard output, whether or not LogLevel is configured in the HP-UX Secure Shell configuration files. Command-line arguments override the LogLevel configuration directive.
- The /var/adm/syslog/syslog.log File – Error messages continue to be logged in the /var/adm/syslog/syslog.log file, regardless of the LogLevel or the command-line specifications.
- The Standard Error – If you specify the -e command-line option with sshd, the error messages are logged to standard error instead of the /var/adm/syslog/syslog.log file, regardless of any LogLevel or other command-line specifications.

Authentication Problems

This section discusses common problems encountered during authentication.

Public-Key Authentication Problems

Following are some common public-key authentication setup mistakes:

- Not moving the public key to the authorized_keys file in the HP-UX Secure Shell server.
- Granting incorrect permissions for the authorized_keys file or one of the parent directories.
- Forgetting the passphrase. Passphrases are not recoverable.
- Generating a key pair and accidentally replacing the public key with an older one.
- Attempting to use a key that is in incorrect format.

Host-Based Authentication Problems

Following are some common host-based authentication configuration mistakes:

- You must ensure that the public host key of the client is in the known_hosts file in the server.
- You must use the correct canonical name of the client so that the server is able to resolve this canonical name.
- HP recommends that you provide read/write permission for the user for the $HOME/.shosts file, and no permission for other users.

Reporting Problems

If you are unable to troubleshoot HP-UX Secure Shell yourself, follow these steps:

1. Read the release notes for HP-UX Secure Shell to see if the problem is known. If it is, follow the instructions offered to solve the problem.

   The HP-UX Secure Shell release notes is available at:
   http://www.hp.com/go/hpux-security-docs
2. Access http://www.hp.com/go/hpsc and search the technical knowledge databases to determine if the problem you are experiencing has already been reported. The type of documentation and resources you have access to depend on your support contract level.

   To search the ITRC forum for a solution, follow these steps:

a. Navigate to the ITRC Web site at: http://www.hp.com/go/hpsc
b. Enter keywords for the problem in the search text box.

   The search results page displays solutions available in the ITRC forums, training materials, and manuals.

NOTE: The ITRC forums offer peer-to-peer support and are free after registration.

3. Search the HP-UX Secure Shell FAQ available at: http://www.hp.com/go/hpux-security-docs
4. If this is a new problem or if you are unable to solve the problem using the previously listed resources, log the problem with the HP Response Center either by calling HP Support or online through the support case manager at: http://www.hp.com/go/hpsc

   When you contact HP support, have the following information available:

   - Client debug information

     Use the `-vvv` option to obtain the client debug output.
   - Server debug information

     Use the `-ddd` option to obtain the server debug output.
   - The `swlist` output to identify the version of HP-UX Secure Shell.
   - A copy of HP-UX Secure Shell client and server configuration files.
   - A clear description of the problem.

A Configuration Files and Directives

This appendix describes the configuration files that are created upon installing HP-UX Secure Shell. This appendix also describes various configuration directives available in the HP-UX Secure Shell server and client configuration files.

This chapter addresses the following topics:

HP-UX Secure Shell Configuration Files

When you install HP-UX Secure Shell, the configuration files are automatically created on the system. The configuration files contain the directive settings for both the server and the clients. Table 22 lists the HP-UX Secure Shell server and client configuration files.

Table 22 Configuration Files

File	File Name
Server configuration file	`/opt/ssh/etc/sshd_config`
Client configuration file	`/opt/ssh/etc/ssh_config`

You can use the default settings listed in these files, or you can modify these values according to your needs.

Server Configuration Directives

The `/etc/ssh/sshd_config` file is the systemwide server configuration file for HP-UX Secure Shell. This configuration file enables you to set options that modify the operation of the `sshd` daemon. This file contains configuration directives in the form of keyword-value pairs.

NOTE: The keywords are case insensitive and arguments are case sensitive.

AcceptEnv

Use this directive to specify the environment variables sent by the client that must be copied into the session environment. Specify variables using their names. Variables can contain the wildcard characters star (`*`) and question mark (`?`). Use white space to separate multiple environment variables. You can spread multiple environment variables across multiple `AcceptEnv` directives.

The `AcceptEnv` directive is available only for the SSH-2 protocol.

By default, HP-UX Secure Shell does not pass any environment variables.

NOTE: Some environment variables can bypass the restricted user environment, so you must be careful when using the `AcceptEnv` directive.

For example:

```
AcceptEnv yes
```

AddressFamily

Use this directive to specify the address family to be used by `sshd(8)`. Valid arguments are `any`, `inet` (use IPv4 only), or `inet6` (use IPv6 only).

The default is `any`.

For example:

```
AddressFamily any
```

AllowAgentForwarding

Use this directive to specify whether the `ssh-agent(1)` forwarding is permitted.

The default is `yes`.

For example:

```
AllowAgentForwarding no
```

AllowGroups

Use this directive to enable login only for users whose primary or supplementary group list matches a specified string. The star (*) and question mark (?) characters can be used as wildcards in the strings. Enter the `AllowGroups` directive followed by a list of group name strings, separated by spaces. Only group names are valid. By default, login is enabled for all groups.

By default, this directive is not specified in the `sshd_config` file.

NOTE: Numerical group IDs are not recognized.

For example:

```
AllowGroups   root staff users
```

AllowUsers

Use this directive to allow login for user names that match one of the specified strings. The star (*) and question mark (?) characters can be used as wildcards in the strings.

NOTE: Only user names are valid; numerical user IDs are not recognized.

Login is allowed for all users by default. If the pattern takes the form `USER@HOST`, then `USER` and `HOST` are separately checked, and the logins to particular users from particular hosts is restricted. The allow or deny directives are processed in the following order: `DenyUsers`, `AllowUsers`, `DenyGroups` and `AllowGroups`.

For example:

```
AllowUsers Clay@zin.org Arian
```

This command allows login to the user Clay, connecting from zin.org. It also allows login from all addresses to anyone logging in as Arian.

AllowTCPForwarding

Use this directive to enable or disable TCP forwarding.

The default setting is `yes`.

NOTE: To improve security, disable TCP forwarding and deny users shell access.

For example:

```
AllowTcpForwarding    yes
```

AuthorizedKeysFile

Use this directive to specify the file to be used for public-key authentication. The `AuthorizedKeysFile` can contain tokens in a `%T` form, where `T` is the token. The following tokens are available:

`%%` Use this token to specify `%`.

`%h` Use this token to specify the home directory of the user being authenticated.

`%u` Use this token to specify the user name of the user being authenticated.

HP-UX Secure Shell substitutes these tokens with the token values during connection setup. After this substitution, `AuthorizedKeysFile` becomes an absolute path or a path relative to the home directory of the user.

The default setting is the `.ssh/authorized_keys .ssh/authorized_keys2`.

For example:

```
#AuthorizedKeysFile     %h/.ssh/authorized_keys  %h/.ssh/authorized_keys2
```

If the home directory of the user being authenticated (`%h`) is `/home/user1`, then the `AuthorizedKeysFile` directive is set to the `/home/user1/.ssh/authorized_keys` and `/home/user1/.ssh/authorized_keys2` files after substitution.

AuthorizedPrincipalsFile

Use this directive to specify a file that lists principal names that are accepted for certificate authentication. When using certificates signed by a key listed in `TrustedUserCAKeys`, this file lists names, one of which must appear in the certificate for it to be accepted for authentication. The names are listed one per line preceded by key options (as described in AUTHORIZED_KEYS FILE FORMAT in `sshd(8)`). Empty lines and comments starting with # are ignored.

`AuthorizedPrincipalsFile` may contain tokens of the form %T that are substituted during connection setup. The following tokens are defined:

`%%` is replaced by a literal `%`

`%h` is replaced by the home directory of the user being authenticated

`%u` is replaced by the username of that user

The default is not to use a principals file, in this case, the username of the user must appear in a certificate's principals list for it to be accepted.

NOTE: `AuthorizedPrincipalsFile` is not used for certification authorities trusted through $HOME/.ssh/authorized_keys.

For example:

```
AuthorizedPrincipalsFile /opt/ssh/etc/authorized_principal
```

Banner

Use this directive to specify whether the contents of the specified file must be sent to the remote user before authentication is allowed. By default, no banner is displayed.

For example:

```
Banner  none
```

NOTE: This directive is applicable to protocol version 2 only.

ChallengeResponseAuthentication

Use this directive to enable Challenge-Response (also known as Keyboard-Interactive) authentication. HP-UX Secure Shell supports all authentication styles from *login.conf*(5). For more information on the Keyboard-Interactive authentication, see "Keyboard-Interactive Authentication" (page 29).

The default setting is `yes`.

For example:

```
ChallengeResponseAuthentication  yes
```

ChallRespAuthAllowUsers

This configuration directive has been introduced by the 3rd party "Auth Selection" patch. Use this configuration directive to specify which users can be authenticated using Challenge Response authentication.

The default setting is to allow all users.

For example:

```
ChallRespAuthAllowUsers    Allow All
```

ChallRespAuthDenyUsers

This configuration directive has been introduced by the 3rd party "Auth Selection" patch. Use this configuration directive to specify which users must be denied authentication using Challenge Response authentication.

The default setting is to deny no users.

For example:

```
ChallRespAuthDenyUsers    Deny none
```

ChrootDirectory

Use this directory to specify a path to `chroot` after authentication. This path, and all its components, must be root-owned directories that are not writable by any other user or group. The pathname may contain the following tokens that are expanded at runtime after the connecting user is authenticated:

`%%` is replaced by a literal `%`

`%h` is replaced by the home directory of the user being authenticated, and

`%u` is replaced by the username of that user.

The default setting is `not to chroot`.

For example:

```
ChrootDirectory   not to chroot
```

NOTE: The `ChrootDirectory` must contain the necessary files and directories to support the users session.

Ciphers

Use this directive to specify the ciphers used by SSH-2 in the order of preference. Multiple ciphers must be separated by commas. The supported ciphers are as follows:

- `3des-cbc`
- `aes128-cbc`
- `aes192-cbc`
- `aes256-cbc`
- `aes128-ctr`
- `aes192-ctr`
- `aes256-ctr`
- `arcfour128`
- `arcfour256`
- `arcfour`
- `blowfish-cbc`
- `cast128-cbc`

The default setting is `aes128-cbc,3des-cbc,blowfish-cbc,cast128-cbc,arcfour128, arcfour256,arcfour,aes192-cbc,aes256-cbc,aes128-ctr,aes192-ctr,aes256-ctr`.

For example:

```
Ciphers aes128-cbc,3des-cbc,blowfish-cbc,cast128-cbc,arcfour,aes192-cbc,aes256-cbc
```

ClientAliveCountMax

The `ClientAliveCountMax` directive enables a client or a server to detect an inactive connection. Use this directive to specify the number of client alive messages that can be sent before `sshd` receives messages from the client. If the number of client alive messages reaches the specified

threshold, the sshd daemon disconnects the client and terminates the session. The client alive messages are sent through an encrypted channel and cannot be spoofed. The default value is three. If ClientAliveInterval is set to 15, and ClientAliveCountMax is left at the default, unresponsive SSH clients is disconnected after approximately 45 seconds.

For example:

```
ClientAliveCountMax    3
```

NOTE: The ClientAliveCountMax is available for the SSH-2 protocol only. The use of client alive messages is different from TCPKeepAlive.

ClientAliveInterval

Use this directive to send a request to nonresponsive clients and to expect a reply within a specified time interval. This directive sets the timeout interval in seconds. If no data is received from the client after the specified timeout interval, the sshd daemon sends a message through the encrypted channel requesting a response from the client.

The default value is 0.

```
ClientAliveInterval    0
```

NOTE: The ClientAliveInterval is available for the SSH-2 protocol only.

Compression

Use this directive to compress data sent over HP-UX Secure Shell connections before they are encrypted. It also decompresses the data received by the client after it is decrypted. You can use the yes, no, or delayed values to enable, enable delayed, or disable compression.

The default setting is delayed. In this setting, the server invokes the zlib compression modules only after the user is successfully authenticated. Using compression=delayed eliminates the risk of any zlib vulnerability leading to the server being compromised by unauthenticated users.

For example:

```
Compression   delayed
```

NOTE: HP-UX Secure SHell client version 3.5 and earlier do not support delayed compression. The earlier versions of HP-UX Secure Shell cannot connect to a newer version of the server unless compression is disabled (on the client-side), or the original compression method is enabled on the server (by setting Compression yes in the sshd_config file).

CountKeyAuthBadLogins

Use this directive to control the logging of bad login attempts to the btmp file when using the GSS-API, public-key, and host-based authentication methods.

The default setting is no. When CountKeyAuthBadLogins is set to no, failed authentication attempts for key-based authentication do not generate btmp records.

For example:

```
CountKeyAuthBadLogins    no
```

NOTE: This configuration directive is specific to HP-UX Secure Shell, and is not available in OpenSSH base code.

DenyGroups

Use this directive to deny login for users whose primary group or supplementary group list matches one of the specified strings. This directive must be followed by a list of group name strings separated by spaces. You can use the star (*) and question mark (?) characters as wildcards in the strings.

NOTE: Only group names are valid; numerical group IDs are not recognized.

By default, login is enabled for all groups.

For example:

```
DenyGroups   staff
```

DenyUsers

Use this directive to deny login for user names that match one of the specified strings. This directive must be followed by a list of user name strings separated by spaces. You can use the star (*) and question mark (?) characters as wildcards in the strings.

NOTE: Only user names are valid; numerical user IDs are not recognized.

If the pattern takes the form `USER@HOST` then `USER` and `HOST` are checked separately, restricting logins to particular users from particular hosts.

By default, login is allowed for all users.

For example:

```
DenyUsers   Clay@zin.org   Arian
```

This command denies login to user Clay, connecting from zin.org. It also denies login from all addresses to anyone logging in as Arian.

DisIStrip

Use this directive to specify whether to disable ISTRIP for tty connections. By default `ssh ptys` set ISTRIP. Setting this directive to `yes` allow users to use multibyte chars.

The default is `no`.

For example:

```
DisIStrip yes
```

NOTE: This configuration directive is specific to HP-UX Secure Shell, and is not available in the OpenSSH base code. This configuration directive is only applicable on HP-UX Secure Shell A.05.90 and above.

DoubleMaxDisps

Use this directive to specify whether to increase the limit of X window pseudo-displays to 2000. By default the limit is 1000.

The default is `no`.

For example:

```
DoubleMaxDisps yes
```

NOTE: This configuration directive is specific to HP-UX Secure Shell, and is not available in the OpenSSH base code. This configuration directive is only applicable on HP-UX Secure Shell A.05.90 and above.

EnforceSecureTTY

Use this directive to specify whether the `sshd` daemon must restrict root logins to the `tty` names listed in the `/etc/securetty` file only.

The default setting is `no`.

For example:

```
EnforceSecureTTY    no
```

NOTE: This configuration directive is specific to HP-UX Secure Shell, and is not available in the OpenSSH base code.

ForceCommand

Use this directive to force the execution of the command specified by `ForceCommand`, ignoring any other command specified by the client. The command originally supplied by the client is available in the `SSH_ORIGINAL_COMMAND` environment variable. Previous releases of HP-UX Secure Shell specified this option in the `authorised_keys` file.

For example:

ForceCommand pwd

In the above scenario, the `pwd` is executed regardless of the command specified by the client.

GatewayPorts

Use this directive to ensure that the `sshd` daemon enables remote port forwardings to bind to non-loopback IP addresses, and enables other hosts to connect. Use one of the following arguments with this directive:

`no`	Forces remote port forwardings to be available to the local host only.
`yes`	Forces remote port forwardings to bind to the wildcard addresses.
`clientspecified`	Enables the client to select the address to which the port must be forwarded. If `GatewayPorts` is set to `clientspecified`, the SSH server honours the binding address specified for remote port forwarding.

The default setting is `no`.

For example:

```
GatewayPorts   no
```

GSSAPIAuthentication

Use this directive to specify whether GSS-API can be used to authenticate users.

The default setting is `no`.

For example:

```
GSSAPIAuthentication    no
```

GSSAPICleanupCredentials

Use this directive to specify whether the user credentials must be automatically destroyed on logout.

The default setting is `yes`.

For example:

```
GSSAPICleanupCredentials    yes
```

GSSAPIEnableMitmAttack

Use this directive to enable GSS-API authentication for the server.

TIP: Set this directive to `yes` for older versions of HP-UX Secure Shell clients to connect to an HP-UX Secure Shell A.04.20 server using GSS-API authentication.

The `GSSAPI_WITH_MIC` authentication method was introduced in HP-UX Secure Shell 3.8, but a patch was provided to maintain compatibility with the previous GSS-API authentication method. This patch enables older versions of the client to connect to newer versions of the server using GSS-API authentication. Similarly, newer versions of the client can connect to older versions of the server.

To enable the server to support the older GSS-API authentication methods, set this directive to `yes`.

The default setting is `no`.

For example:

```
GSSAPIEnableMitmAttack    yes
```

NOTE: This directive is available for the SSH-2 protocol only.

HostbasedAuthAllowUsers

This configuration directive has been introduced by the 3rd party Auth Selection patch. Use this configuration directive to specify which users can authenticate using host based authentication.

The default setting is to allow all users.

For example:

```
HostbasedAuthAllowUsers    Allow All
```

HostbasedAuthDenyUsers

This configuration directive has been introduced by the 3rd party Auth Selection patch. Use this configuration directive to specify which users cannot authenticate using host based authentication.

The default setting is to deny no users.

For example:

```
HostBasedAuthDenyUsers    Deny None
```

HostbasedAuthentication

Use this directive to specify whether host-based authentication combined with successful public-key authentication is enabled. This directive checks the `/etc/ssh_known_hosts` and `$HOME/.ssh/known_hosts` files for a valid public key.

The default setting is `no`.

For example:

```
HostbasedAuthentication    no
```

NOTE: This directive is available for the SSH-2 protocol only.

HostKey

Use this directive to specify the file that contains a private host key that is used by HP-UX Secure Shell.

NOTE: The `sshd` daemon does not use a file if that file is accessible to all users or to a group of users. Use the `HostKey` directive to specify multiple host key files. Use RSA1 keys if you are using SSH-1, and ECDSA, DSA or RSA keys if you are using SSH-2.

The following examples display the default values of `HostKey` for the SSH-1 and SSH-2 protocols.

For example, using SSH-1:

```
HostKey   /opt/ssh/etc/ssh_host_key
```

For example, using SSH-2:

```
HostKey   /opt/ssh/etc/ssh_host_rsa_key
HostKey   /opt/ssh/etc/ssh_host_dsa_key
HostKey   /opt/ssh/etc/ssh_host_ecdsa_key
```

IgnoreRhosts

Use this directive to specify that HP-UX Secure Shell not to use the `.rhosts` and `.shosts` files in `RhostsRSAAuthentication` and `HostbasedAuthentication`. With this directive set to `yes`, HP-UX Secure Shell continues to use the `/etc/hosts.equiv` and `/opt/ssh/etc/shosts.equiv` files.

The default value is `yes`.

For example:

```
IgnoreRhosts   yes
```

IgnoreUserKnownHosts

Use this directive to specify whether the `sshd` daemon ignores the `$HOME/.ssh/known_hosts` files while authenticating the user using `RhostsRSAAuthentication` or `HostbasedAuthentication`.

The default setting is `no`.

For example:

```
IgnoreUserKnownHosts    no
```

IPQoS

Use this directive to specify the IPv4 type-of-service or DSCP class for connections. The accepted values are as follows:

- `af11`
- `af12`
- `af13`
- `af14`
- `af22`
- `af23`
- `af31`
- `af32`
- `af33`
- `af41`
- `af42`
- `af43`
- `cs0`
- `cs1`
- `cs2`
- `cs3`
- `cs4`
- `cs5`
- `cs6`
- `cs7`
- `ef`
- `lowdelay`
- `throughput`
- `reliability`

You can specify more than one argument, separated by whitespace. If one argument is specified, it is used as the packet class unconditionally. If two values are specified, the first is automatically selected for interactive sessions and the second for non-interactive sessions.

The default is `lowdelay` for interactive sessions and `throughput` for non-interactive sessions.

For example:

```
IPQoS lowdelay,throughput
```

KerberosAuthAllowUsers

This configuration directive has been introduced by the 3rd party "Auth Selection" patch. Use this configuration directive to specify which users can authenticate using GSSAPI authentication.

The default setting is to allow all users.

For example:

```
KerberosAuthDenyUsers    Allow All
```

KerberosAuthDenyUsers

This configuration directive has been introduced by the 3rd party "Auth Selection" patch. Use this configuration directive to specify which users must not be allowed to authenticate using GSSAPI authentication.

The default setting is to deny no users.

For example:

```
KerberosAuthDenyUsers    Deny none
```

KerberosAuthentication

Use this directive to specify whether the Kerberos KDC validates the password provided by the user for password authentication. The server needs a Kerberos `servtab` to verify the KDC identity.

The default setting is `yes`.

For example:

```
KerberosAuthentication    yes
```

KerberosOrLocalPasswd

Use this directive to specify password validation with mechanisms such as `/etc/passwd/` when password authentication through Kerberos fails.

TIP: Use `KerberosOrLocalPasswd` in an environment where every user does not authenticate using Kerberos.

The default setting is `yes`.

For example:

```
KerberosOrLocalPasswd    yes
```

KerberosTicketCleanup

Use this directive to specify whether the user ticket cache file must be destroyed automatically after the user logs out.

The default setting is `yes`.

For example:

```
KerberosTicketCleanup    yes
```

KexAlgorithms

Use this directive to specify the available KEX (Key Exchange) algorithms. Multiple algorithms must be separated by commas.

The default is `ecdh-sha2-nistp256, ecdh-sha2-nistp384, ecdh-sha2-nistp521, diffie-hellman-group-exchange-sha256, diffie-hellman-group-exchange-sha1, diffie-hellman-group14-sha1, diffie-hellman-group1-sha1`.

For example:

```
KexAlgorithms ecdh-sha2-nistp256,ecdh-sha2-nistp384,ecdh-sha2-nistp521
```

KeyRegenerationInterval

Use this directive to specify the time interval after which the ephemeral server key is automatically regenerated. If the value is 0, the key is never regenerated.

The default is 3600 (seconds).

For example:

```
KeyRegenerationInterval 1h
```

NOTE: This directive is applicable for the protocol version 1 only.

ListenAddress

Use this directive to specify the local addresses that the `sshd` daemon listens on. You can set one of the following values for this directive depending on the type of IP address (IPv4 or IPv6) the system uses:

- *host IPv4_addr IPv6_addr*
- *host IPv4_addr*:*port*
- [*host IPv6_addr*]:*port*

If a port is not specified, the `sshd` daemon listens on the specified address and all prior specified port options. You can specify multiple `ListenAddress` options. `Port` directives must precede `ListenAddress` directives for non-port-qualified addresses.

The default setting is 0.0.0.0 (listen on all local addresses).

For example:

```
ListenAddress    0.0.0.0
```

LoginGraceTime

Use this directive to specify the period of time that `sshd` waits for users to log in. The server daemon disconnects after this period of time elapses. If `LoginGraceTime` is set to `0`, there is no time limit for users to log in. The time is set in seconds.

The default setting is `120` seconds.

For example:

```
LoginGraceTime    120
```

LogLevel

Use this directive to specify the verbosity level for `sshd` log messages. For more information on the `LogLevel` directive, see "Generating Debug Messages Using the LogLevel Configuration Directive" (page 59).

MACs

Use this directive to specify the available Message Authentication Code (MAC) algorithms. The `MACs` directive is used by SSH-2 for data integrity protection. Multiple algorithms must be comma separated.

The default setting is as follows:

```
hmac-md5, hmac-sha1, umac-64@openssh.com, hmac-ripemd160, hmac-sha1-96, hmac-md5-96,
 hmac-sha2-256, hmac-sha256-96, hmac-sha2-512, hmac-sha2-512-96.
```

For example:

```
MACs   hmac-md5,hmac-sha1
```

Match

Use this directive to specify configuration options based on user, group, hostname, or address. This directive overrides the global option in the `sshd_config` file. The arguments to `Match` are one or more criteria-pattern pairs. The available criteria are User, Group, Host, and Address. The

match patterns can consist of single entries or comma-separated lists, and can use the wildcard and negation operators.

The patterns in an Address criteria can additionally contain addresses to match in CIDR address or masklen format, for example: 192.0.2.0/24 or 3ffe:ffff::/32.

The following keywords can be used on the lines following a `Match` keyword:

- `AllowAgentForwarding`
- `AllowTcpForwarding`
- `Banner`
- `ChrootDirectory`
- `ForceCommand`
- `GatewayPorts`
- `GSSApiAuthentication`
- `HostbasedAuthentication`
- `KbdInteractiveAuthentication`
- `KerberosAuthentication`
- `MaxAuthTries`
- `MaxSessions`
- `PasswordAuthentication`
- `PermitEmptyPasswords`
- `PermitOpen`
- `PermitRootLogin`
- `PubkeyAuthentication`
- `RhostsRSAAuthentication`
- `RSAAuthentication`
- `X11DisplayOffset`
- `X11Forwarding`
- `X11UseLocalHost`

For example:

MatchUser xxxx X11DisplayOffset 20

In the above configuration, the criteria `User` is given as the argument for `Match`. The `X11DisplayOffset` option is set below it. This directive overrides the global section of the `sshd_config` file for User `xxxx`.

MaxAuthTries

Use this directive to specify the maximum number of authentication attempts that are permitted per connection.

The default value is `6`.

For example:

```
MaxAuthTries     6
```

MaxSessions

Use this directive to specify the maximum number of open sessions that are permitted per network connection.

The default is `10`.

For example:

```
MaxSessions 20
```

MaxStartups

Use this directive to specify the maximum number of concurrent unauthenticated connections to the `sshd` daemon. Additional connections are refused until authentication succeeds or the `LoginGraceTime` expires.

The default setting is `10`.

For example:

```
MaxStartups   10
```

PasswordAuthAllowUsers

This configuration directive has been introduced by the 3rd party Auth Selection patch. Use this configuration directive to specify which users can authenticate using password authentication.

The default setting is to allow all users.

For example:

```
PasswordAuthAllowUsers    Allow All
```

PasswordAuthDenyUsers

This configuration directive has been introduced by the 3rd party Auth Selection patch. Use this configuration directive to specify which users cannot authenticate using password authentication.

The default setting is to deny no users.

For example:

```
PasswordAuthDenyUsers    Deny none
```

PasswordAuthentication

Use this directive to specify whether a password must be accepted as proof of identity at login. If `KerberosAuthentication` is disabled, the login password is sufficient. If `KerberosAuthentication` is also enabled, the Kerberos server password is accepted as a proof of identity.

The default setting is `yes`.

For example:

```
PasswordAuthentication    yes
```

PermitEmptyPasswords

Use this directive to specify whether the server allows users to login to accounts with empty password strings. Use this directive when password-based authentication is used.

The default setting is `no`.

For example:

```
PermitEmptyPasswords    no
```

PermitOpen

Use this directive to specify the destinations to which TCP port forwarding is permitted. Use one of the following formats:

PermitOpen host:port

PermitOpen IPv4_addr:port

PermitOpen [IPv6_addr]:port

Multiple forwards can be specified by separating them with whitespace. An argument of `any` can be used to remove all restrictions and permit any forwarding requests. All port forwarding requests by default, are permitted.

For example:

```
PermitOpen      host 3:23
```

In the above scenario, HP-UX Secure Shell permits port forwardings only to the host specified by the `PermitOpen` directive.

PermitRootLogin

Use this directive to enable users to log in as superuser using `ssh`. Following are the supported arguments:

- `yes`

  If this option is set to `yes`, privileged users are allowed to login.

- `without-password`

  If this option is set to `without-password`, password authentication is disabled for privileged user.

  NOTE: Other authentication methods (for example, keyboard-interactive or PAM) can still allow privileged user to log in using a password.

- `forced-commands-only`

  If this option is set to `forced-commands-only`, privileged users can log in with public key authentication, if the command option has been specified (which may be useful for taking remote backups even if a privileged user login is normally not allowed). All other authentication methods are disabled for a privileged user.

- `no`

  If this option is set to `no`, privileged users are not allowed to login.

You can use this directive to achieve the following:

- Disable all superuser logins.
- Enable all superuser logins with any authentication method.
- Enable superuser logins with limited authentication methods.

The default setting is `yes`.

For example:

```
PermitRootLogin   yes
```

PermitTunnel

Use this directive to specify whether tun device forwarding is allowed. The argument must be `yes`, `point-to-point` (layer 3), `ethernet` (layer 2), or `no`. The `yes` permits both `point-to-point` and `ethernet`.

The default is `no`.

For example:

```
PermitTunnel no
```

PermitUserEnvironment

Use this directive to specify whether `$HOME/.ssh/environment` and `environment=options` in the `$HOME/.ssh/authorized_keys` file are processed by the `sshd` daemon to control environment processing. The `$HOME/.ssh/environment` file must be writable by the user only; it need not be readable by anyone else. Environment processing enables users to bypass access restrictions.

NOTE: This option is automatically disabled when the `UseLogin` configuration directive is enabled.

The default setting is `no`.

For example:

```
PermitUserEnvironment    no
```

PidFile

Use this directive to specify where to look for the `sshd` process ID (PID). This file contains the most recent instance of the running `sshd` daemon if multiple `sshd` daemons are running. If an `sshd` daemon is not running, this file is empty.

NOTE: This directive is not valid if you start `sshd` in debug mode.

The default value is`/var/run/sshd.pid`

For example:

```
PidFile   /var/run/sshd.pid
```

Port

Use this directive to ensure that the `sshd` daemon listens on a particular port. The client must connect to the same port the daemon is listening on.

The default setting is `22`.

NOTE: Specify the `Port` directive before the `ListenAddress` directive.

For example:

```
Port  22
```

PrintLastLog

Use this directive to display the date and time a user last logged in. This information is displayed when the user logs in.

The default setting is `yes`.

For example:

```
PrintLastLog   yes
```

PrintMotd

Use this directive to display information at login time. The `sshd` daemon displays information from the `/etc/motd` file when a user logs in.

The default setting is `yes`.

For example:

```
PrintMotd   yes
```

Protocol

Use this directive to specify the version number of the protocol that the `sshd` daemon supports. You can specify multiple versions of the protocol with comma-separated values.

NOTE: This directive specifies only the list of protocol versions available for the client. It does not prioritize protocols. Specifying 2,1 is identical to specifying 1,2.

The default value is `2`.

For example:

```
Protocol       2
```

PubkeyAuthAllowUsers

This configuration directive has been introduced by the 3rd party Auth Selection patch. Use this configuration directive to specify which users can authenticate using Kerberos or local password.

The default setting is to allow all users.

For example:

```
PubkeyAuthAllowUsers    Allow All
```

PubkeyAuthDenyUsers

This configuration directive has been introduced by the 3rd party "Auth Selection" patch. Use this configuration directive to specify which users cannot authenticate using Kerberos or local password authentication.

The default setting of this directive is to deny no users.

For example:

```
PubkeyAuthDenyUsers    Deny none
```

PubkeyAuthentication

Use this directive to enable public-key authentication. When this directive is enabled, the `sshd` daemon uses cryptographic keys to verify the identity of the user.

The default value is `yes`.

For example:

```
PubkeyAuthentication    yes
```

RhostsRSAAuthentication

Use this directive to perform RSA host-based authentication in addition to standard `.rhosts` or `/etc/hosts.equiv` authentication.

The default value is `no`.

For example:

```
RhostsRSAAuthentication     no
```

NOTE: This directive does not work for outbound connections from privileged ports. This directive is available for the SSH-1 protocol only.

RSAAuthentication

Use this directive to specify whether RSA authentication is enabled.

The default value is `yes`.

For example:

```
RSAAuthentication    yes
```

NOTE: This directive is available for the SSH-1 protocol only.

ServerKeyBits

Use this directive to specify the number of bits in the ephemeral protocol version 1 server key. The minimum value is `512`, and the default is `1024`.

For example:

```
ServerKeyBits 1024
```

StrictModes

Use this directive to check access rights and permissions for files. The `sshd` daemon checks the file modes, user file ownership, and home directory before accepting a user login.

The default value is `yes`.

TIP: HP recommends setting this directive to `yes`, because users can accidentally leave their directories or files world-writable.

For example:

```
StrictModes      yes
```

Subsystem

Use this directive to configure an external subsystem such as a file transfer daemon. Arguments must be a subsystem name and a command (with optional arguments) to execute upon subsystem request. The *sftp-server*(8) implements the `sftp` file transfer subsystem. Alternately the name `internal-sftp` implements an in-process `sftp` server. This may simplify configurations using the `ChrootDirectory` directive to force a different file system root on clients. By default no subsystems are defined.

NOTE: The `subsystem` directive is available to SSH protocol version-2 only.

SyslogFacility

Use this directive to specify the facility code to be used when logging messages from the `sshd` daemon.

The default setting is `AUTH`.

Table 23 lists the valid values for the `SyslogFacility` directive.

Table 23 SyslogFacility Values

Value	Description
`DAEMON`	Directs `syslog` to log `sshd` messages based on the `LOG_DAEMON` log facility specification.
`USER`	Specifies that messages are logged based on the `LOG_USER` log facility specification.
`AUTH`	Logs authentication-related messages
`LOCAL 0-7`	Specifies that the messages are reserved for local use.

For example:

```
SyslogFacility   AUTH
```

TCPKeepAlive

Use this directive to control the flow of TCP keep-alive messages. If keep-alive messages are sent, the connection terminates, or one of the hosts crashes, this directive prevents infinitely hanging sessions.

However, if keep-alive messages are not sent, sessions can hang indefinitely on the server, resulting in ghost users and large consumption of server resources.

The default setting is `yes`.

For example:

```
TCPKeepAlive   yes
```

TrustedUserCAKeys

Use this directive to specify a file containing public keys of certificate authorities that are trusted to sign user certificates for authentication. The keys are listed one per line; empty lines and comments starting with # are allowed. If a certificate is presented for authentication and has its signing CA

key listed in this file, then it might be used for authentication of any user listed in the certificate's principals list.

For example:

```
TrustedUserCAKeys /opt/ssh/etc/user-ca-key.pub
```

NOTE: Certificates without principals will not be permitted for authentication using `TrustedUserCAKeys`.

UseDNS

Use this directive to specify the order in which the `sshd` daemon must look up the remote host name, and to check that the resolved host name for the remote IP address maps back to the same IP address.

The default setting is `yes`.

For example:

```
UseDNS   yes
```

UseLogin

Use this directive to specify whether to use `login` for interactive login sessions. Enabling this option automatically disables X11 forwarding, because `login` cannot handle `xauth` cookies.

NOTE: When you enable `UseLogin`, the `PermitUserEnvironment` configuration directive is automatically disabled.

The default setting is `no`.

For example:

```
UseLogin   no
```

UsePAM

Use this directive to enable PAM authentication and session setup.

NOTE: If `PasswordAuthentication` and `UsePAM` are set to `yes`, the user gets three chances to enter the correct password after which a new prompt is displayed indicating that `ssh` is using the password authentication method.

The default setting is `yes`.

TIP: HP recommends that you disable password authentication when enabling the `UsePAM` directive.

For example:

```
UsePAM   yes
```

UsePrivilegeSeparation

Use this directive to specify whether `sshd` must separate privileges by creating an unprivileged child process to handle incoming network traffic. After successfully authenticating the user, the server creates another process that has the same privileges as the authenticated user. By enabling the `UsePrivilegeSeparation` directive, you can prevent privilege escalation by containing any corruption within the unprivileged processes. If UsePrivilegeSeparation is set to sandbox, then the pre-authentication unprivileged process is subject to additional restrictions.

The default value is `yes`.

For example:

```
UsePrivilegeSeparation    yes
```

X11DisplayOffset

Use this directive to specify the first display number the `sshd` daemon must use for X11 forwarding. This prevents the `sshd` daemon from crashing the X11 servers.

The default value is `10`.

For example:

```
X11DisplayOffset   10
```

X11Forwarding

Use this directive to enable X11 forwarding. When you enable this directive, there is additional exposure to the server, and the client displays whether the `sshd` proxy display is configured to listen on the wildcard address.

NOTE: Security risks are involved in using this directive, because authentication spoofing, authentication data verification, and substitution can occur on the client side. HP recommends that you disable this directive for high security.

The default setting is `yes`.

For example:

```
X11Forwarding   yes
```

X11UseLocalhost

Use this directive to bind the X11 forwarding server to the loopback address or the wildcard address. For a loopback address, the host name part of the `DISPLAY` environment variable is `localhost`. This prevents remote hosts from connecting to the proxy display. However, some older X11 clients cannot function with this configuration.

Set the `X11UseLocalhost` directive to `no` to bind the forwarding server to the wildcard address.

The default setting is `no`.

For example:

```
X11useLocalhost   no
```

XAuthLocation

Use this directive to specify the full pathname of the `xauth(1)` program.

The default is `/usr/bin/X11/xauth`.

For example:

```
XAuthLocation usr/bin/X11/xauth
```

Sample HP-UX Secure Shell Server Configuration File

Following is a sample HP-UX Secure Shell server configuration file:

```
# $OpenBSD: sshd_config,v 1.73 2005/12/06 22:38:28 reyk Exp $

# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/bin:/bin:/usr/sbin:/sbin:/opt/ssh/bin

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options change a
# default value.

#Port 22
Protocol 2
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::
```

```
# HostKey for protocol version 1
#HostKey /opt/ssh/etc/ssh_host_key
# HostKeys for protocol version 2
#HostKey /opt/ssh/etc/ssh_host_rsa_key
#HostKey /opt/ssh/etc/ssh_host_dsa_key

# Lifetime and size of ephemeral version 1 server key
#KeyRegenerationInterval 1h
#ServerKeyBits 768

# Logging
# obsoletes QuietMode and FascistLogging
#SyslogFacility AUTH
#LogLevel INFO

# Authentication:

#LoginGraceTime 2m
#PermitRootLogin yes
#StrictModes yes
#MaxAuthTries 6
#CountKeyAuthBadLogins no

# Auth selection

#HostbasedAuthAllowUsers
#HostbasedAuthDenyUsers
#PubkeyAuthAllowUsers
#PubkeyAuthDenyUsers
#KerberosAuthAllowUsers
#KerberosAuthDenyUsers
#KerberosOrLocalPasswdAllowUsers
#KerberosOrLocalPasswdDenyUsers
#PasswordAuthAllowUsers
#PasswordAuthDenyUsers
#ChallRespAuthAllowUsers [pam] user1 user2 ...
#ChallRespAuthDenyUsers  [pam] user1 user2 ...
#ChallRespAuthAllowUsers [bsdauth] user1 user2 ...
#ChallRespAuthDenyUsers  [bsdauth] user1 user2 ...
#ChallRespAuthAllowUsers [skey] user1 user2 ...
#ChallRespAuthDenyUsers  [skey] user1 user2 ...
#ChallRespAuthAllowUsers [securid] user1 user2 ...
#ChallRespAuthDenyUsers  [securid] user1 user2 ...
#GSSAPIAuthAllowUsers
#GSSAPIAuthDenyUsers


#RSAAuthentication yes
#PubkeyAuthentication yes
#AuthorizedKeysFile .ssh/authorized_keys

# For this to work you will also need host keys in /opt/ssh/etc/ssh_known_hosts
#RhostsRSAAuthentication no
# similar for protocol version 2
#HostbasedAuthentication no
# Change to yes if you don't trust ~/.ssh/known_hosts for
# RhostsRSAAuthentication and HostbasedAuthentication
#IgnoreUserKnownHosts no
# Don't read the user's ~/.rhosts and ~/.shosts files
#IgnoreRhosts yes

# To disable tunneled clear text passwords, change to no here!
#PasswordAuthentication yes
#PermitEmptyPasswords no

# Change to no to disable s/key passwords
#ChallengeResponseAuthentication yes

# Kerberos options
KerberosAuthentication yes
#KerberosOrLocalPasswd yes
```

```
#KerberosTicketCleanup yes
#KerberosGetAFSToken no

# GSSAPI options
#GSSAPIAuthentication no
#GSSAPICleanupCredentials yes

# Set this to 'yes' to enable PAM authentication, account processing,
# and session processing. If this is enabled, PAM authentication will
# be allowed through the ChallengeResponseAuthentication mechanism.
# Depending on your PAM configuration, this may bypass the setting of
# PasswordAuthentication, PermitEmptyPasswords, and
# "PermitRootLogin without-password". If you just want the PAM account and
# session checks to run without PAM authentication, then enable this but set
# ChallengeResponseAuthentication=no
UsePAM yes

#AllowTcpForwarding yes
#GatewayPorts no
X11Forwarding yes
#X11DisplayOffset 10
X11UseLocalhost no
#PrintMotd yes
#PrintLastLog yes
#TCPKeepAlive yes
#UseLogin no
#EnforceSecureTTY no
#UsePrivilegeSeparation yes
#PermitUserEnvironment no
#Compression delayed
#ClientAliveInterval 0
#ClientAliveCountMax 3
#UseDNS yes
#PidFile /var/run/sshd.pid
#MaxStartups 10
#PermitTunnel no

# no default banner path
#Banner /some/path

#The following are HPN related configuration options
#tcp receive buffer polling. enable in autotuning kernels
#TcpRcvBufPoll no

# allow the use of the none cipher
#NoneEnabled no

# disable hpn performance boosts.
HPNDisabled yes

# buffer size for hpn to non-hn connections
#HPNBufferSize 2048

# override default of no subsystems
Subsystem sftp /opt/ssh/libexec/sftp-server

# Example of overriding settings on a per-user basis
#Match User anoncvs
#     X11Forwarding no
#     AllowTcpForwarding no
#     ForceCommand cvs server
```

Client Configuration Directives

The `/etc/ssh/ssh_config` file is the systemwide client configuration file for HP-UX Secure Shell. This configuration file enables you to set options that modify the operation of the client programs. The file contains keyword-value pairs.

NOTE: The keywords are case insensitive and arguments are case sensitive.

Host

Use this directive to specify restricts on the declarations (up to the next Host keyword) to be only for those hosts that match one of the string pattern given after the keyword. A single * as a pattern can be used to provide global defaults for all hosts. The host is the hostname argument given on the command line (that is, the name is not converted to a canonicalized host name before matching). A pattern entry may be negated by prefixing it with an exclamation mark (!). If a negated entry is matched, then the Host entry is ignored, regardless of whether any other patterns on the line match. Negated matches are therefore useful to provide exceptions for wildcard matches.

The default value is *.

For example:

```
Host *
```

AddressFamily

Use this directive to specify the address family to be used when connecting to the server. Following are the valid values:

- `any`
- `inet` (IPv4 only)
- `inet6`(IPv6 only)

The default value is `any`.

For example:

```
AddressFamily inet
```

BatchMode

Use this directive to specify whether passphrase or password querying is disabled. Use this directive with scripts and other batch jobs where no user is present to supply a password.

The default setting is `no`.

For example:

```
BatchMode no
```

BindAddress

Use this directive to specify the address on the local host as the source address for the connection. Use this directive on systems with more than one address.

The default setting is the loopback address.

For example:

```
BindAddress yes
```

NOTE: The `BindAddress` directive does not work if the `UsePrivilegedPort` directive is set to `yes`.

ChallengeResponseAuthentication

Use this directive to specify whether to use challenge-response (keyboard-interactive) authentication.

The default setting is `yes`.

For example:

```
ChallengeResponseAuthentication yes
```

CheckHostIP

Use this directive to specify whether to check the host IP address in the `known_hosts` file. This enables HP-UX Secure Shell to detect whether a host key was modified because of DNS spoofing. If the option is set to `no`, the check is not executed.

The default setting is `yes`.

For example:

```
CheckHostIP yes
```

Cipher

Use this directive to specify the cipher to be used to encrypt SSH-1 sessions.

TIP: The `blowfish`, `3des`, and `des` ciphers are supported. The `des` cipher is supported only in the HP-UX Secure Shell client for interoperability with legacy SSH-1 protocol implementations that do not support `3des`. HP does not recommend using `des`.

The default setting is `3des`.

For example:

```
Ciper 3des
```

Ciphers

Use this directive to specify the ciphers used by SSH-2 in the order of preference. Multiple ciphers must be comma separated. The supported ciphers are as follows:

- `3des-cbc`
- `aes128-cbc`
- `aes192-cbc`
- `aes256-cbc`
- `aes128-ctr`
- `aes192-ctr`
- `aes256-ctr`
- `arcfour128`
- `arcfour256`
- `arcfour`
- `blowfish-cbc`
- `cast128-cbc`

The default setting is `aes128-cbc,3des-cbc,blowfish-cbc,cast128-cbc,arcfour128,arcfour256,arcfour,aes192-cbc,aes256-cbc,aes128-ctr,aes192-ctr,aes256-ctr`.

For example:

```
Ciphers aes128-cbc,3des-cbc,blowfish-cbc,cast128-cbc,arcfour,aes192-cbc,aes256-cbc
```

ClearAllForwardings

Use this directive to specify that all local, remote, and dynamic port forwardings in the configuration files or on the command line be cleared. This option can be used to clear port forwarding set in configuration files. It is automatically set by the `scp` and `sftp` commands.

The default is setting `no`.

For example:

```
ClearAllForwardings yes
```

Compression

Use this directive to specify whether to use compression. Setting this directive to `yes` can improve speed over slower lines. Compression can also reduce delays because of encryption.

The default setting is `no`.

For example:

```
Compression yes
```

CompressionLevel

Use this directive to specify the compression level to use if compression is enabled. Valid values are integers between `1` (fast) and `9` (slow, best).

The default setting is `6`, which is sufficient for most applications.

For example:

```
CompressionLevel 9
```

NOTE: The `CompressionLevel` directive is available for the SSH-1 protocol only.

ConnectionAttempts

Use this directive to specify the number of times a user can attempt to connect to the server (one per second) before exiting. Valid values must be integers. Use this directive with scripts in case the connection fails.

The default value is `1`.

For example:

```
ConnectionAttempts 3
```

ConnectTimeout

Use this directive to specify the timeout (in seconds) when connecting to the HP-UX Secure Shell server, instead of using the default system TCP timeout. This value is used only when the target server is down or unreachable.

The default value is `0`.

For example:

```
ConnectTimeout 0
```

ControlMaster

Use this directive to enable sharing of multiple sessions over a single network connection. Following are the valid values for the ControlMaster directive:

`yes` HP-UX Secure Shell listens for connections on a control socket specified using the control path value.

`no` HP-UX Secure Shell connects additional sessions to the socket using the same control path. These sessions reuse the master instance of a network connection than initiating new ones.

`ask` HP-UX Secure Shell listens for control connections, but it requires confirmation using the `SSH_ASKPASS` program before these connections are accepted. For more information, see *ssh-add*(1).

`auto` HP-UX Secure Shell tries to use a master connection but falls back to create a new one if one does not already exist.

`autoask` It is similar to auto but it requires the configuration like the `ask`.

The default setting is `no`.

For example:

```
ControlMaster no
```

ControlPath

Use this directive to specify the path to the control socket used for connection sharing. To disable connection sharing, set `ControlPath` to none. The following substitutions occur for the `ControlPath` value:

`%L` Specifies the first component of the local host name.

`%l` Specifies the local host name (including domain name).

`%h` Specifies the target host name.

`%n` Specifies the original target host name in the command line.

`%p` Specifies the port.

`%r` Specifies the remote login user name.

`%u` Specifies the username of the user running `ssh(1)`.

The default value is `null`.

For example:

```
ControlPath /tmp/socket_control
```

NOTE: HP recommends including all substitutions for connection sharing. This ensures that shared connections are uniquely identified.

DynamicForward

Use this directive to specify the TCP/IP port on the local system to be forwarded over the secure channel, and the application protocol to be used. The value for this directive must be a port number. The SOCKS4 and SOCKS5 protocols are supported, where HP-UX Secure Shell acts as a SOCKS server. You can specify multiple forwarding and add additional forwardings on the command line.

NOTE: Only a superuser can forward privileged ports.

`DynamicForward` does not have a default value.

For example:

```
DynamicForward 8888
```

EnableSSHkeysign

Use this directive to enable the use of the *ssh-keysign*(8) helper program during host-based authentication. This option must be placed in the non-host specific section. For more information, see the *ssh-keysign*(8).

The default setting is `no`.

For example:

```
EnableSSHkeysign no
```

EscapeChar

Use this directive to set the escape character. You can also set the escape character on the command line.

The default value is `~`.

For example:

```
EscapeChar ~
```

ExitOnForwardFailure

Use this directive to specify whether *ssh*(1) must terminate the connection if it cannot set up all requested dynamic, local, and remote port forwardings. The values for `ExitOnForwardFailure` are `yes` or `no`. The default value is `no`.

For example:

ExitOnForwardFailure no

ForwardAgent

Use this directive to specify whether the connection to the authentication agent is forwarded to the remote machine.

NOTE: Enable agent forwarding with caution. Users with privileges to bypass file permissions on the remote host, for the agent's UNIX domain socket, can access the local agent through the forwarded connection. Attackers cannot obtain key material from the agent, but they can perform operations on the keys that enable them to authenticate using the identities loaded into the agent.

The default setting is `no`.

For example:

```
ForwardAgent no
```

ForwardX11

Use this directive to specify whether X11 connections must be automatically redirected over the secure channel and `DISPLAY` set.

NOTE: Enable X11 forwarding with caution. Users with privileges to bypass file permissions on the remote host, for the user's X11 authorization database, can access the local X11 display through the forwarded connection. An attacker can perform activities, such as keystroke monitoring, if the `ForwardX11Trusted` option is also enabled.

The default setting is `no`.

For example:

```
ForwardX11 no
```

ForwardX11Trusted

Use this directive to specify whether remote X11 clients can access the original X11 display. The *xauth*(1) token used for the session is set to expires after 20 minutes. Remote clients are refused access after the time elapses.

The default setting is `no`.

For example:

```
ForwardX11Trusted no
```

GatewayPorts

Use this directive to specify whether remote hosts are allowed to connect to local forwarded ports. By default, HP-UX Secure Shell binds local port forwardings to the loopback address. This prevents other remote hosts from connecting to forwarded ports. Use `GatewayPorts` to specify that HP-UX Secure Shell must bind local port forwarding to the wildcard address, and allow remote hosts to connect to forwarded ports.

The default setting is `no`.

For example:

```
GatewayPorts no
```

GlobalKnownHostsFile

Use this directive to specify one or more files to be used for the global host key database, separated by whitespace.

The default setting is `/opt/ssh/etc/ssh_known_hosts, /opt/ssh/etc/ssh_known_hosts2`.

For example:

```
GlobalKnownHostsFile  /opt/new_known_hosts,  /opt/ssh/etc/ssh_known_hosts2
```

GSSAPIAuthentication

Use this directive to specify whether user authentication based on GSS-API is enabled.

The default setting is `no`.

For example:

```
GSSAPIAuthentication no
```

NOTE: This directive is available for the SSH-2 protocol only.

GSSAPIDelegateCredentials

Use this directive to forward credentials to the server.

The default setting is `no`.

For example:

```
GSSAPIDelegateCredentials no
```

NOTE: This directive is available for the SSH-2 protocol only.

HashKnownHosts

Use this directive to specify that HP-UX Secure Shell must hash host names and addresses when they are added to `$HOME/.ssh/known_hosts`. These hashed names are used by `ssh` and `sshd`, but they do not reveal the identity if the file's contents are disclosed.

NOTE: Hashing of names and addresses are not retrospectively applied to existing known hosts files. However, you can hash these files using *ssh-keygen*(1).

The default setting is `no`.

For example:

```
HashKnownHosts no
```

HostbasedAuthentication

Use this directive to specify whether to try `rhosts`-based authentication with public-key authentication. This directive is similar to `RHostsRSAAuthentication`.

The default setting is `no`.

For example:

```
HostbasedAuthentication no
```

NOTE: This directive is available for the SSH-2 protocol only.

HostKeyAlgorithms

Use this directive to specify the SSH-2 protocol host key algorithms that the client uses, in the order of preference.

The default setting is `ecdsa-sha2-nistp256-cert-v01@openssh.com, ecdsa-sha2-nistp384-cert-v01@openssh.com, ecdsa-sha2-nistp521-cert-v01@openssh.com, ssh-rsa-cert-v01@openssh.com,ssh-dss-cert- v01@openssh.com, ssh-rsa-cert-v00@openssh.com,ssh-dss-cert-v00@openssh.com, ecdsa-sha2-nistp256,ecdsa-sha2-nistp384,ecdsa-sha2-nistp521, ssh-rsa,ssh-dss.`

For example:

```
HostKeyAlgorithms ssh-dsa
```

HostKeyAlias

Use this directive to specify an alias that must be used, instead of the real host name, when looking up or saving the host key in the host key database files. This directive can also be used to tunnel secure connections or for multiple servers running on a single host.

This directive does not have a default value.

For example:

```
HostKeyAlias  server01
```

HostName

Use this directive to specify the real host name to log in to. This directive can also be used to specify nicknames or abbreviations for hosts. If the hostname contains the character sequence `%h`, then this is replaced with the host name specified on the command line.

Numeric IP addresses are permitted on both the command line and `HostName` specifications.

The default setting is the name given on the command line.

For example:

```
HostName john.users.com
```

IdentityFile

Use this directive to specify a file from which the RSA, DSA or ECDSA authentication identity of the user is read.

The default setting is as follows:

For SSH-1:

`$HOME/.ssh/identity`

For SSH-2:

`$HOME/.ssh/id_rsa`, `$HOME/.ssh/id_dsa`, and `$HOME/.ssh/id_ecdsa`

For example:

```
IdentityFile $HOME/.ssh/id_rsa
```

IdentitiesOnly

Use this directive to specify that `ssh` must use only the authentication identity files configured in the `ssh_config` file, even if the`ssh-agent` offers more identities.

The default setting is `no`.

For example:

```
IdentitiesOnly no
```

IPQoS

Use this directive to specify the IPv4 type of service or DSCP class for connections.

The accepted values are as follows:

- `af11`
- `af12`
- `af13`
- `af14`
- `af22`
- `af23`
- `af31`
- `af32`

- af33
- af41
- af42
- af43
- cs0
- cs1
- cs2
- cs3
- cs4
- cs5
- cs6
- cs7
- ef
- lowdelay
- throughput
- reliability

You can specify more than one arguments, separated by whitespace. If one argument is specified, it is used as the packet class unconditionally. If two values are specified, the first is automatically selected for interactive sessions and the second for the non-interactive sessions.

The default is `lowdelay` for interactive sessions and `throughput` for non-interactive sessions.

For example:

```
IPQoS lowdelay,throughput
```

KbdInteractiveAuthentication

Use this directive to specify whether to use keyboard-interactive authentication.

The default is `yes`.

For example:

```
KbdInteractiveAuthentication yes
```

KbdInteractiveDevices

Use this directive to specify the list of methods to use in keyboard-interactive authentication. Multiple method names must be comma-separated.

The default is to use the server specified list.

For example:

```
KbdInteractiveDevices pam
```

KexAlgorithms

Use this directive to specify the available KEX (Key Exchange) algorithms. Multiple algorithms must be comma-separated.

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

For example:

```
KexAlgorithms ecdh-sha2-nistp256,ecdh-sha2-nistp384,ecdh-sha2-nistp521
```

LocalCommand

Use this directive to specify a command to execute on the local machine after successful connection to the server. The following escape character substitutions will be performed:

`%d` local users home directory

`%h` remote host name

`%l` local host name

`%n` host name as provided on the command line

`%p` remote port

`%r` remote user name

`%u` local user name

For example:

```
LocalCommand pwd
```

NOTE: This directive is ignored unless `PermitLocalCommand` is enabled.

LocalForward

Use this directive to specify that a TCP/IP port on the local host must be forwarded over the secure channel to the specified host and port of the remote host. The first value must be *[bind_address:*] *port*. The second value must be *host:hostport*. The IPv6 addresses can be specified by enclosing addresses in square brackets or by using the following syntax: *[bind_address/*] *port* or *host / hostport*.

You can specify multiple forwardings on the command line. Only the superuser can forward privileged ports. By default, the local port is bound in accordance with the `GatewayPorts` setting. However, you can use an explicit *bind_address* to bind the connection to a specific address. The*bind_address* of `localhost` indicates that the listening port is bound for local use only. An empty address or star (*) indicates that the port is available for all interfaces.

This directive does not have a default value.

For example:

```
LocalForward localhost:5001 remotehost:23
```

LogLevel

Use this directive to specify the verbosity level used when logging messages from `ssh`.

Table 24 lists the valid values for the `LogLevel` directive.

Table 24 LogLevelFacility Values

Value	Description
`QUIET`	Does not log messages. The messages are not displayed on the standard output.
`FATAL`	Logs only fatal messages.
`ERROR`	Logs all error messages
`INFO`	Specifies the information that must be logged
`VERBOSE`	Logs detailed messages
`DEBUG`	Specifies debugging messages that must not be logged during a normal operation
`DEBUG1`	Specifies a higher degree of debug level than `DEBUG`. Specifying `debug1` is similar to specifying `d` or `v` on the command line, while invoking `sshd`.

Table 24 LogLevelFacility Values *(continued)*

Value	Description
DEBUG2	Specifies a higher degree of debug level than debug1. Specifying DEBUG1 is similar to specifying a -dd or -vv on the command line, while invoking sshd.
DEBUG3	Specifies a higher degree of debug level than DEBUG2. Specifying DEBUG2 is similar to specifying a -ddd or -vvv on the command line, while invoking sshd.

The DEBUG and DEBUG1 arguments are equivalent. The DEBUG2 and DEBUG3 arguments specify higher levels of verbose output.

The default setting is INFO.

For example:

```
LogLevel FATAL
```

MACs

Use this directive to specify the Message Authentication Code (MAC) algorithms in order of preference. SSH-2 uses the MAC algorithm for data integrity protection. Multiple algorithms must be comma-separated.

The default setting is hmac-md5,hmac-sha1, umac-64@openssh.com,hmac-ripemd160, hmac-sha1-96,hmac-md5-96, hmac-sha2-256, hmac-sha2-256-96,hmac-sha2-512,hmac-sha2-512-96.

For example:

```
MACs hmac-md5, hmac-md5-96
```

NoHostAuthenticationForLocalhost

Use this directive to specify whether the home directory is shared across hosts. In this case, localhost refers to a different host on each of the hosts, and the user receives warnings about changed host keys. However, this option disables host authentication for localhost.

The default setting is yes.

For example:

```
NoHostAuthenticationForLocalhost yes
```

NumberOfPasswordPrompts

Use this directive to specify the number of times HP-UX Secure Shell prompts before it stops trying to authenticate the users.

The default setting is 3.

For example:

```
NumberOfPasswordPrompts 3
```

PasswordAuthentication

Use this directive to specify whether to use password-based authentication.

The default setting is yes.

For example:

```
PasswordAuthentication yes
```

PermitLocalCommand

Use this directive to specify whether to allow local command execution through the LocalCommand option or use the ! Ns command escape sequence in ssh(1).

The default is no.

For example:

```
PermitLocalCommand yes
```

Port

Use this directive to specify the port number to connect to the remote host.

The default setting is `22`.

For example:

```
Port 22
```

PreferredAuthentication

Use this directive to specify the order in which the client must try SSH-2 authentication methods. This enables a client to use one method (for example, keyboard-interactive) before another method (for example, password).

The default setting for this directive is: `gssapi-with-mic,hostbased,publickey,keyboard-interactive,password`.

For example:

```
PreferredAuthentication gssapi-with-mic, hostbased, publickey,keyboard-interactive,password
```

Protocol

Use this directive to specify the protocol versions `ssh` must support in order of preference. Valid values are `1` and `2`. Multiple versions must be comma-separated. HP-UX Secure Shell attempts to authenticate using SSH-2 first, and falls back to SSH-1 if SSH-2 is not available.

The default setting is `2,1`.

For example:

```
Protocol 2
```

ProxyCommand

Use this directive to specify the command to be used to connect to the server.

The command can be any command that reads from the standard input and writes to the standard output. It must connect to an HP-UX Secure Shell server, or execute `sshd -i` on a system. Host key management is done using the host name of the host being connected (defaulting to the name typed by the user).

This directive does not have a default value.

For example, the following directive connects to the server through an HTTP proxy at the 192.0.2.0 IP address:

```
ProxyCommand /usr/bin/nc -X connect -x 192.0.2.0:8080 %h %p
```

This `ProxyCommand` string is executed with `/bin/sh`. In the previous command string, the following substitutions occur:

- The host name substitutes for `%h`
- The port number substitutes for `%p`

NOTE: The `CheckHostIP` directive is not available for connections with a `ProxyCommand`.

PubkeyAuthentication

Use this directive to specify whether to use public-key authentication.

The default setting is `yes`.

For example:

```
PubkeyAuthentication yes
```

NOTE: This directive is available for the SSH-2 protocol only.

RekeyLimit

Use this directive to specify the maximum amount of data that may be transmitted before the session key is renegotiated. The argument is the number of bytes, with an optional suffix of K, M, or G to indicate Kilobytes, Megabytes, or Gigabytes, respectively.

The default is between 1G and 4G, depending on the cipher.

For example:

```
RekeyLimit 1G
```

NOTE: This directive is available for the protocol version 2 only.

RemoteForward

Use this directive to specify that a TCP/IP port on the remote system must be forwarded over the secure channel to the specified host and port from the local system. The first value must be [*bind_address:*]*port*. The second value must be *host*:*hostport*. IPv6 addresses can be specified by enclosing addresses in square brackets or by using the following syntax: [*bind_address*/]*port* and *host*/*hostport*. You can also specify multiple forwardings on the command line. Only the superuser can forward privileged ports.

If the *bind_address* is not specified, the default is to bind only to loopback addresses. If the *bind_address* is a star (*) or an empty string, then the forwarding is requested to listen on all interfaces. Specifying a remote *bind_address* succeeds only if the server's `GatewayPorts` directive is enabled. For more information, see *sshd_config*((5)).

By default, remote forward is not used.

For example:

```
RemoteForward localhost:5001 remote:23
```

RequestTTY

Use this directive to specify whether to request a pseudo-tty for the session. The argument may be one of the following:

`no`	never request a TTY
`yes`	always request a TTY when standard input is a TTY
`force`	always request a TTY
`auto`	request a TTY when opening a login session.

This option is similar to the `-t` and `-T` flags for `ssh(1)`.

For example:

```
RequestTTY auto
```

RhostsRSAAuthentication

Use this directive to specify whether to use host-based authentication with RSA host authentication.

NOTE: This directive is available for the SSH-1 protocol only.

The default setting is `no`.

For example:

```
RhostsRSAAuthentication no
```

RSAAuthentication

Use this directive to specify whether to use RSA authentication. RSA authentication is attempted only if the identity file exists, or an authentication agent is running.

The default setting is `yes`.

For example:

```
RSAAuthentication yes
```

NOTE: This directive is available for the SSH-1 protocol only.

SendEnv

Use this directive to specify which variables from the local `environ` must be sent to the server. Variables are specified by name and can contain the wildcard characters (`*`) and (`?`). Multiple environment variables can be separated by spaces or spread across multiple `SendEnv` directives.

The default is not to send any environment variables.

For example:

```
SendEnv DISPLAY
```

Where:

`DISPLAY` is set as follows on the HP-UX Secure Shell client system:

```
$ export DISPLAY=john.users.com:0.0
```

NOTE: Environment passing is available for the SSH-2 protocol only. The server must also support environment passing, and it must be configured to accept environment variables.

For more information on configuring the server, see "AcceptEnv" (page 62).

ServerAliveInterval

Use this directive to set a timeout interval value (in seconds) for a server. If no data has been received from the server within the specified time, `ssh` sends a message through the encrypted channel to request a response from the server.

NOTE: This directive is available for the SSH-2 protocol only.

The default setting is `0`, indicating that no server alive messages are sent to the server.

For example:

```
ServerAliveInterval 0
```

ServerAliveCountMax

Use this directive to set the number of server alive messages that can be sent without `ssh` receiving any messages back from the server.

Use this directive if the client or server depend on knowing when a connection is inactive.

If the number of server keep alive messages reaches the threshold, HP-UX Secure Shell disconnects from the server, terminating the session.

The default setting is `3`. If, for example, `ServerAliveInternal` is set to 15 and `ServerAliveCountMax` is left at the default, if the server becomes unresponsive, `ssh` will disconnect after approximately 45 seconds.

For example:

```
ServerAliveCountMax 3
```

NOTE: This directive is available for the SSH-2 protocol only. `ServerAliveCountMax` is different from `TCPKeepAlive`. Server alive messages are sent through an encrypted channel and are not spoofable. Messages from the `TCPKeepAlive` directive are spoofable.

StrictHostKeyChecking

Use this directive to specify whether HP-UX Secure Shell must add a new host to the `$HOME/.ssh/known_hosts` file. `StrictHostKeyChecking` protects against Trojan horse attacks.

TIP: HP does not recommend using `StrictHostKeyChecking` when the `/opt/ssh/etc/ssh_known_hosts` file is poorly maintained or connections to new hosts are made frequently. If you use `StrictHostKeyChecking`, you must manually add all new hosts.

Following are the valid values of the `StrictHostKeyChecking` directive:

`yes` HP-UX Secure Shell does not automatically add host keys to the `$HOME/.ssh/known_hosts` file and refuses to connect to hosts whose host key has changed.

`no` HP-UX Secure Shell automatically adds new host keys to the `known_hosts` file.

`ask` HP-UX Secure Shell adds the new host keys to the user's `known_hosts` file after confirming with the user. HP-UX Secure Shell then does not connect to hosts with changed host key. The host keys of known hosts are verified automatically.

The default setting is `ask`.

For example:

```
StrictHostKeyChecking ask
```

TCPKeepAlive

Use this directive to specify whether the client must send TCP keep alive messages to the server. If TCP keep alive messages are sent, the client notices termination of the connection or a server crash. However, HP-UX Secure Shell also terminates connections if the route is down temporarily.

The default setting is `yes`, which sends TCP keepalive messages. The client notices if the network goes down or the server terminates. To disable TCP keep alive messages, set `TCPKeepAlive` to `no`.

For example:

```
TCPKeepAlive yes
```

UserPrivilegedPort

Use this directive to specify whether to use a privileged port for outgoing connections.

The default setting is `no`.

For example:

```
UserPrivilegedPort no
```

NOTE: This option must be set to `yes` for `RhostsRSAAuthentication` with older versions of HP-UX Secure Shell.

User

Use this directive to specify the user to log in to the system. Use this directive when different user names are used on different systems. With this directive, you do not have to specify the user name on the command line.

The default value is `null`.

For example:

```
User john
```

UserKnownHostsFile

Use this directive to specify one or more files to use for the user host key database, separated by whitespace.

The default values are `$HOME/.ssh/known_hosts`, `$HOME/.ssh/known_hosts2`.

For example:

```
UserKnownHostsFile /home/john/.ssh/new_known_hosts, $HOME/.ssh/known_hosts2
```

VerifyHostKeyDNS

Use this directive to specify whether or not to verify the remote key using DNS and SSHFP resource records.

Following are some valid values for the VerifyHostKeyDNS directive:

yes Specifies that the client implicitly trusts keys that match a secure fingerprint from DNS.

ask Displays information when fingerprints match.

The default setting is `no`.

For example:

```
VerifyHostKeyDNS no
```

NOTE: This directive is available for the SSH-2 protocol only.

VisualHostKey

Use this directive to specify whether an ASCII art representation of the remote host key fingerprint is printed in addition to the hex fingerprint string at login and for unknown host keys.

The default is `no`.

For example:

```
VisualHostKey yes
```

XAuthLocation

Use this directive to specify the full path name of the `xauth` utility.

The default setting is `/usr/bin/X11/xauth`.

For example:

```
XAuthLocation /usr/bin/X11/xauth
```

Sample HP-UX Secure Shell Client Configuration File

Following is a sample HP-UX Secure Shell client configuration file:

```
# $OpenBSD: ssh_config,v 1.21 2005/12/06 22:38:27 reyk Exp $

# This is the ssh client system-wide configuration file.  See
# ssh_config(5) for more information.  This file provides defaults for
# users, and the values can be changed in per-user configuration files
# or on the command line.

# Configuration data is parsed as follows:
#  1. command line options
#  2. user-specific file
#  3. system-wide file
# Any configuration value is only changed the first time it is set.
# Thus, host-specific definitions should be at the beginning of the
# configuration file, and defaults at the end.

# Site-wide defaults for some commonly used options.  For a comprehensive
# list of available options, their meanings and defaults, please see the
# ssh_config(5) man page.

# Host *
#   ForwardAgent no
#   ForwardX11 no
#   RhostsRSAAuthentication no
#   RSAAuthentication yes
#   PasswordAuthentication yes
#   HostbasedAuthentication no
#   BatchMode no
#   CheckHostIP yes
#   AddressFamily any
#   ConnectTimeout 0
#   StrictHostKeyChecking ask
#   IdentityFile ~/.ssh/identity
#   IdentityFile ~/.ssh/id_rsa
#   IdentityFile ~/.ssh/id_dsa
#   GSSAPIAuthentication no
```

```
#   GSSAPIDelegateCredentials no
#   Port 22
   Protocol 2
   HashKnownHosts yes
   HPNDisabled yes
#   Cipher 3des
#   Ciphers aes128-cbc,3des-cbc,blowfish-cbc,cast128-cbc,arcfour,aes192-cbc,aes256-cbc
#   EscapeChar ~
#   Tunnel no
#   TunnelDevice any:any
#   PermitLocalCommand no
```

B Sample /etc/krb5.conf File

This appendix provides a sample `/etc/krb5.conf` file.

The /etc/krb5.conf Configuration File

Following is a sample `/etc/krb5.conf` Kerberos configuration file `/etc/krb5.conf` on the HP-UX Secure Shell client system:

```
# # Kerberos configuration
#
# See krb5.conf(4) for more details
#
[libdefaults]
      default_realm              = REALM
      default_tkt_enctypes       = DES-CBC-CRC
      default_tgs_enctypes       = DES-CBC-CRC
      ccache_type                   = 2


[realms]
     REALM = {
        kdc          = hostname.domainname.com:88
        admin_server = hostname.domainname.com
}


[domain_realm]
     .kovaiteam.com = REALM


[logging]
     kdc              = FILE: /var/log/krb5kdc.log
     admin_server     = FILE: /var/log/kadmin.log
      default           = FILE: /var/log/krb5lib.log
```

For more information on the `/etc/krb5.conf` file, see *krb5.conf*(4).