



# Configuring Secure Shell

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## Information About Configuring Secure Shell

Secure Shell (SSH) is a protocol that provides a secure, remote connection to a device. SSH provides more security for remote connections than Telnet does by providing strong encryption when a device is authenticated. This software release supports SSH Version 1 (SSHv1) and SSH Version 2 (SSHv2).

### SSH and Device Access

Secure Shell (SSH) is a protocol that provides a secure, remote connection to a device. SSH provides more security for remote connections than Telnet does by providing strong encryption when a device is authenticated. This software release supports SSH Version 1 (SSHv1) and SSH Version 2 (SSHv2).

SSH functions the same in IPv6 as in IPv4. For IPv6, SSH supports IPv6 addresses and enables secure, encrypted connections with remote IPv6 nodes over an IPv6 transport.

### SSH Servers, Integrated Clients, and Supported Versions

The Secure Shell (SSH) Integrated Client feature is an application that runs over the SSH protocol to provide device authentication and encryption. The SSH client enables a Cisco device to make a secure, encrypted connection to another Cisco device or to any other device running the SSH server. This connection provides functionality similar to that of an outbound Telnet connection except that the connection is encrypted. With authentication and encryption, the SSH client allows for secure communication over an unsecured network.

The SSH server and SSH integrated client are applications that run on the switch. The SSH server works with the SSH client supported in this release and with non-Cisco SSH clients. The SSH client works with publicly and commercially available SSH servers. The SSH client supports the ciphers of Data Encryption Standard (DES), 3DES, and password authentication.

The switch supports an SSHv1 or an SSHv2 server.

The switch supports an SSHv1 client.



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**Note** The SSH client functionality is available only when the SSH server is enabled.

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User authentication is performed like that in the Telnet session to the device. SSH also supports the following user authentication methods:

- TACACS+
- RADIUS
- Local authentication and authorization

## SSH Configuration Guidelines

Follow these guidelines when configuring the switch as an SSH server or SSH client:

- An RSA key pair generated by a SSHv1 server can be used by an SSHv2 server, and the reverse.
- If the SSH server is running on an active switch and the active switch fails, the new active switch uses the RSA key pair generated by the previous active switch.
- If you get CLI error messages after entering the **crypto key generate rsa** global configuration command, an RSA key pair has not been generated. Reconfigure the hostname and domain, and then enter the **crypto key generate rsa** command.
- When generating the RSA key pair, the message No host name specified might appear. If it does, you must configure a hostname by using the **hostname** global configuration command.
- When generating the RSA key pair, the message No domain specified might appear. If it does, you must configure an IP domain name by using the **ip domain-name** global configuration command.
- When configuring the local authentication and authorization authentication method, make sure that AAA is disabled on the console.

## Secure Copy Protocol Overview

The Secure Copy Protocol (SCP) feature provides a secure and authenticated method for copying switch configurations or switch image files. SCP relies on Secure Shell (SSH), an application and a protocol that provides a secure replacement for the Berkeley r-tools.

For SSH to work, the switch needs an RSA public/private key pair. This is the same with SCP, which relies on SSH for its secure transport.

Because SSH also relies on AAA authentication, and SCP relies further on AAA authorization, correct configuration is necessary.

- Before enabling SCP, you must correctly configure SSH, authentication, and authorization on the switch.
- Because SCP relies on SSH for its secure transport, the router must have an Rivest, Shamir, and Adelman (RSA) key pair.



**Note** When using SCP, you cannot enter the password into the copy command. You must enter the password when prompted.

## Secure Copy Protocol

The Secure Copy Protocol (SCP) feature provides a secure and authenticated method for copying device configurations or switch image files. The behavior of SCP is similar to that of remote copy (rcp), which comes from the Berkeley r-tools suite, except that SCP relies on SSH for security. SCP also requires that authentication, authorization, and accounting (AAA) authorization be configured so the device can determine whether the user has the correct privilege level. To configure the Secure Copy feature, you should understand the SCP concepts.

## SFTP Support

SFTP client support is introduced from Cisco IOS XE Gibraltar 16.10.1 release onwards. SFTP client is enabled by default and no separate configuration required.

The SFTP procedures can be invoked using the **copy** command, which is similar to that of **scp** and **tftp** commands. A typical file download procedure using **sftp** command can be carried out as shown below:

```
copy sftp://user :password @server-ip/file-name flash0:// file-name
```

For more details on the **copy** command, see the following URL:

[https://www.cisco.com/c/m/en\\_us/techdoc/dc/reference/cli/nxos/commands/fund/copy.html](https://www.cisco.com/c/m/en_us/techdoc/dc/reference/cli/nxos/commands/fund/copy.html)

## Prerequisites for Configuring Secure Shell

The following are the prerequisites for configuring the switch for secure shell (SSH):

- For SSH to work, the switch needs an Rivest, Shamir, and Adleman (RSA) public/private key pair. This is the same with Secure Copy Protocol (SCP), which relies on SSH for its secure transport.
- Before enabling SCP, you must correctly configure SSH, authentication, and authorization on the switch.
- Because SCP relies on SSH for its secure transport, the router must have an Rivest, Shamir, and Adelman (RSA) key pair.
- SCP relies on SSH for security.
- SCP requires that authentication, authorization, and accounting (AAA) authorization be configured so the router can determine whether the user has the correct privilege level.
- A user must have appropriate authorization to use SCP.
- A user who has appropriate authorization can use SCP to copy any file in the Cisco IOS File System (IFS) to and from a switch by using the **copy** command. An authorized administrator can also do this from a workstation.
- The Secure Shell (SSH) server requires an IPsec (Data Encryption Standard [DES] or 3DES) encryption software image; the SSH client requires an IPsec (DES or 3DES) encryption software image.)

- Configure a hostname and host domain for your device by using the **hostname** and **ip domain-name** commands in global configuration mode.



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**Note** While upgrading from 16.11 to a later version, if you encounter a host key change by SSH client, you need to know the following:

- Wave 2 AP now supports a third key type ED25519 along with the RSA and ECDSA keys.
  - The RSA and ECDSA keys are used for normal operations.
  - The ED25519 key is used for FIPS mode.
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## Restrictions for Configuring Secure Shell

The following are restrictions for configuring the device for secure shell.

- From Cisco IOS XE Dublin 17.10.x, Key Exchange and MAC algorithms like diffie-hellman-group14-sha1, hmac-sha1, hmac-sha2-256, and hmac-sha2-512 are not supported by default and it may impact some SSH clients that only support these algorithms. However, you can add them manually if required. For information on manually adding these algorithms, see the **SSH Algorithms for Common Criteria Certification** document available at: [https://www.cisco.com/c/en/us/td/docs/routers/ios/config/17-x/sec-vpn/b-security-vpn/m\\_sec-secure-shell-algorithm-ccc.html](https://www.cisco.com/c/en/us/td/docs/routers/ios/config/17-x/sec-vpn/b-security-vpn/m_sec-secure-shell-algorithm-ccc.html)
- The switch supports Rivest, Shamir, and Adelman (RSA) authentication.
- SSH supports only the execution-shell application.
- The SSH server and the SSH client are supported only on Data Encryption Standard (DES) (56-bit) and 3DES (168-bit) data encryption software. In DES software images, DES is the only encryption algorithm available. In 3DES software images, both DES and 3DES encryption algorithms are available.
- The device supports the Advanced Encryption Standard (AES) encryption algorithm with a 128-bit key, 192-bit key, or 256-bit key. However, symmetric cipher AES to encrypt the keys is not supported.
- When using SCP, you cannot enter the password into the **copy** command. You must enter the password when prompted.
- The login banner is not supported in Secure Shell Version 1. It is supported in Secure Shell Version 2.
- The **-l** keyword and **userid** : {number} {ip-address} delimiter and arguments are mandatory when configuring the alternative method of Reverse SSH for console access.
- To authenticate clients with FreeRADIUS over RADSEC, you should generate an RSA key longer than 1024 bit. Use the **crypto key generate rsa general-keys exportable label label-name** command to achieve this.

# How to Configure SSH

## Setting Up the Device to Run SSH

Follow the procedure given below to set up your device to run SSH:

### Before you begin

Configure user authentication for local or remote access.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Device# <code>Device# configure terminal</code>	Enters global configuration mode.
<b>Step 2</b>	<b>hostname <i>hostname</i></b> <b>Example:</b> Device(config)# <code>hostname your_hostname</code>	Configures a hostname and IP domain name for your device.  <b>Note</b> Follow this procedure only if you are configuring the device as an SSH server.
<b>Step 3</b>	<b>ip domain name <i>domain_name</i></b> <b>Example:</b> Device(config)# <code>ip domain name your_domain</code>	Configures a host domain for your device.
<b>Step 4</b>	<b>crypto key generate rsa</b> <b>Example:</b> Device(config)# <code>crypto key generate rsa</code>	Enables the SSH server for local and remote authentication on the device and generates an RSA key pair. Generating an RSA key pair for the device automatically enables SSH.  We recommend that a minimum modulus size of 1024 bits.  When you generate RSA keys, you are prompted to enter a modulus length. A longer modulus length might be more secure, but it takes longer to generate and to use.  <b>Note</b> Follow this procedure only if you are configuring the device as an SSH server.

	Command or Action	Purpose
<b>Step 5</b>	<b>end</b>  <b>Example:</b> Device(config)# <b>end</b>	Exits configuration mode.

## Configuring the SSH Server

Follow the procedure given below to configure the SSH server:



**Note** This procedure is only required if you are configuring the device as an SSH server.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> Device# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>ip ssh version [2]</b>  <b>Example:</b> Device(config)# <b>ip ssh version 2</b>	(Optional) Configures the device to run SSH Version 2.  If you do not enter this command or do not specify a keyword, the SSH server selects the latest SSH version supported by the SSH client.
<b>Step 3</b>	<b>ip ssh window-size</b>  <b>Example:</b> Device(config)# <b>ip ssh window-size</b>	Specifies the SSH window size. The recommended window size is 32K or lesser than that. The default window size is 8912.  Selecting <b>window-size</b> greater than 32K might have some impact on the CPU, until unless: <ul style="list-style-type: none"> <li>• The network bandwidth is good.</li> <li>• Client can accommodate this size.</li> <li>• No latency in network.</li> </ul> <p><b>Note</b> This CLI is recommended only for SCP operations and can be disabled once the copy is done.</p>
<b>Step 4</b>	<b>ip ssh {timeout <i>seconds</i>   authentication-retries <i>number</i>}</b>  <b>Example:</b> Device(config)# <b>ip ssh timeout 90</b>	Configures the SSH control parameters: <ul style="list-style-type: none"> <li>• Specify the time-out value in seconds; the default is 120 seconds. The range is 0 to 120 seconds. This parameter applies to the SSH negotiation phase. After the</li> </ul>

	Command or Action	Purpose
	<code>authentication-retries 2</code>	<p>connection is established, the device uses the default time-out values of the CLI-based sessions.</p> <p>By default, up to five simultaneous, encrypted SSH connections for multiple CLI-based sessions over the network are available (session 0 to session 4). After the execution shell starts, the CLI-based session time-out value returns to the default of 10 minutes.</p> <ul style="list-style-type: none"> <li>Specify the number of times that a client can re-authenticate to the server. The default is 3; the range is 0 to 5.</li> </ul> <p>Repeat this step when configuring both parameters.</p>
<b>Step 5</b>	<p>Use one or both of the following:</p> <ul style="list-style-type: none"> <li><code>line vty line_number [ending_line_number]</code></li> <li><code>transport input ssh</code></li> </ul> <p><b>Example:</b></p> <pre>Device(config)# line vty 1 10</pre> <p>or</p> <pre>Device(config-line)# transport input ssh</pre>	<p>(Optional) Configures the virtual terminal line settings.</p> <ul style="list-style-type: none"> <li>Enters line configuration mode to configure the virtual terminal line settings. For <i>line_number</i> and <i>ending_line_number</i>, specify a pair of lines. The range is 0 to 15.</li> <li>Specifies that the device prevent non-SSH Telnet connections. This limits the router to only SSH connections.</li> </ul>
<b>Step 6</b>	<p><code>end</code></p> <p><b>Example:</b></p> <pre>Device(config-line)# end</pre>	Returns to privileged EXEC mode.

## Monitoring the SSH Configuration and Status

This table displays the SSH server configuration and status.

*Table 1: Commands for Displaying the SSH Server Configuration and Status*

Command	Purpose
<code>show ip ssh</code>	Shows the version and configuration information for the SSH server.

Command	Purpose
show ssh	Shows the status of the SSH server.