



# SSH Algorithms for Common Criteria Certification

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## Information About SSH Algorithms for Common Criteria Certification

This section provides information about the Secure Shell (SSH) Algorithms for Common Criteria Certification, the Cisco IOS SSH Server Algorithms and Cisco IOS SSH Client Algorithms.

## SSH Algorithms for Common Criteria Certification

A Secure Shell (SSH) configuration enables a Cisco IOS SSH server and client to authorize the negotiation of only those algorithms that are configured from the allowed list. If a remote party tries to negotiate using only those algorithms that are not part of the allowed list, the request is rejected and the session is not established.

## Cisco IOS SSH Server Algorithms

Cisco IOS secure shell (SSH) servers support the encryption algorithms (Advanced Encryption Standard Counter Mode [AES-CTR], AES Cipher Block Chaining [AES-CBC], Triple Data Encryption Standard [3DES]) in the following order:

Supported Default Encryption Order:

1. aes128-ctr
2. aes192-ctr
3. aes256-ctr

Supported Non-Default Encryption Order:

1. aes128-cbc

2. aes192-cbc
3. aes256-cbc
4. 3des

Cisco IOS SSH clients support the Message Authentication Code (MAC) algorithms in the following order:

Supported Default HMAC order:

1. hmac-sha2-256
2. hmac-sha2-512
3. hmac-sha1
4. hmac-sha1-96

Cisco IOS SSH clients support only one host key algorithm and do not need a CLI configuration.

Supported Default Host Key order:

1. x509v3-ssh-rsa
2. ssh-rsa

## Cisco IOS SSH Client Algorithms

Cisco IOS secure shell (SSH) clients support the encryption algorithms (Advanced Encryption Standard counter mode [AES-CTR], AES Cipher Block Chaining [AES-CBC], Triple Data Encryption Standard [3DES]) in the following order:

Supported Default Encryption Order:

1. aes128-ctr
2. aes192-ctr
3. aes256-ctr

Supported Non-Default Encryption Order:

1. aes128-cbc
2. aes192-cbc
3. aes256-cbc
4. 3des

Cisco IOS SSH clients support the Message Authentication Code (MAC) algorithms in the following order:

Supported Default HMAC order:

1. hmac-sha2-256
2. hmac-sha2-512
3. hmac-sha1

#### 4. hmac-sha1-96

Cisco IOS SSH clients support only one host key algorithm and do not need a CLI configuration.

Supported Default Host Key order:

1. x509v3-ssh-rsa
2. ssh-rsa

## How to Configure SSH Algorithms for Common Criteria Certification

This section provides information on how to configure and troubleshoot:

- Encryption key algorithm for a Cisco IOS SSH server and client
- MAC algorithm for a Cisco IOS SSH server and client
- Host Key algorithm for a Cisco IOS SSH server

## Configuring an Encryption Key Algorithm for a Cisco IOS SSH Server and Client

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> <b>enable</b>	Enables privileged EXEC mode.  Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 3</b>	<b>ip ssh {server   client} algorithm encryption {aes128-ctr   aes192-ctr   aes256-ctr   aes128-cbc   aes192-cbc   aes256-cbc   3des-cbc }</b>  <b>Example:</b> Device(config)# <b>ip ssh server algorithm encryption aes128-ctr aes192-ctr aes256-ctr aes128-cbc 3des-cbc aes192-cbc aes256-cbc</b>  Device(config)# <b>ip ssh client algorithm encryption aes128-ctr aes192-ctr</b>	Defines the order of encryption algorithms in the SSH server and client. This order is presented during algorithm negotiation.  <b>Note</b> The Cisco IOS SSH server and client must have at least one configured encryption algorithm.  <b>Note</b> To disable one algorithm from the previously configured algorithm list, use the <b>no</b> form of

	Command or Action	Purpose
	<pre> aes256-ctr aes128-cbc 3des-cbc aes192-ctr aes256-cbc </pre>	<p>this command. To disable more than one algorithm, use the <b>no</b> form of this command multiple times with different algorithm names.</p> <p><b>Note</b> For a default configuration, use the default form of this command as shown below:</p> <pre> Device(config)# ip ssh server algorithm encryption aes128-ctr aes192-ctr aes256-ctr aes128-cbc 3des-cbc aes192-cbc aes256-cbc </pre>
<b>Step 4</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre> Device(config)# end </pre>	Exits global configuration mode and returns to privileged EXEC mode.

## Troubleshooting Tips

If you try to disable the last encryption algorithm in the configuration, the following message is displayed and the command is rejected:

```
% SSH command rejected: All encryption algorithms cannot be disabled
```

## Configuring a MAC Algorithm for a Cisco IOS SSH Server and Client

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<p><b>enable</b></p> <p><b>Example:</b></p> <pre> Device&gt; enable </pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<p><b>configure terminal</b></p> <p><b>Example:</b></p> <pre> Device# configure terminal </pre>	Enters global configuration mode.
<b>Step 3</b>	<p><b>ip ssh {server   client} algorithm mac {hmac-sha2-256   hmac-sha2-512   hmac-sha1   hmac-sha1-96}</b></p> <p><b>Example:</b></p>	Defines the order of MAC (Message Authentication Code) algorithms in the SSH server and client. This order is presented during algorithm negotiation.

	Command or Action	Purpose
	<pre>Device(config)# ip ssh server algorithm mac hmac-sha2-256 hmac-sha2-512 hmac-sha1 hmac-sha1-96  Device(config)# ip ssh client algorithm mac hmac-sha2-256 hmac-sha2-512 hmac-sha1 hmac-sha1-96</pre>	<p><b>Note</b> The Cisco IOS SSH server and client must have at least one configured Hashed Message Authentication Code (HMAC) algorithm.</p> <p><b>Note</b> To disable one algorithm from the previously configured algorithm list, use the <b>no</b> form of this command. To disable more than one algorithm, use the <b>no</b> form of this command multiple times with different algorithm names.</p> <p><b>Note</b> For default configuration, use the default form of this command as shown below:</p> <pre>Device(config)# ip ssh server algorithm mac hmac-sha2-256 hmac-sha2-512 hmac-sha1 hmac-sha1-96</pre>
<b>Step 4</b>	<p><b>end</b></p> <p><b>Example:</b></p> <pre>Device(config)# end</pre>	Exits global configuration mode and returns to privileged EXEC mode.

## Troubleshooting Tips

If you try to disable the last MAC algorithm in the configuration, the following message is displayed and the command is rejected:

```
% SSH command rejected: All mac algorithms cannot be disabled
```

## Configuring a Host Key Algorithm for a Cisco IOS SSH Server

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<p><b>enable</b></p> <p><b>Example:</b></p> <pre>Device&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <p>Enter your password if prompted.</p>
<b>Step 2</b>	<p><b>configure terminal</b></p> <p><b>Example:</b></p>	Enters global configuration mode.

	Command or Action	Purpose
	Device# <code>configure terminal</code>	
<b>Step 3</b>	<b>ip ssh server algorithm hostkey</b> <b>{x509v3-ssh-rsa   ssh-rsa}</b>  <b>Example:</b>  Device(config)# <code>ip ssh server algorithm</code> <code>hostkey x509v3-ssh-rsa ssh-rsa</code>	<p>Defines the order of host key algorithms. Only the configured algorithm is negotiated with the Cisco IOS secure shell (SSH) client.</p> <p><b>Note</b> The Cisco IOS SSH server must have at least one configured host key algorithm:</p> <ul style="list-style-type: none"> <li>• x509v3-ssh-rsa—X.509v3 certificate-based authentication</li> <li>• ssh-rsa—Public-key-based authentication</li> </ul> <p><b>Note</b> To disable one algorithm from the previously configured algorithm list, use the <b>no</b> form of this command. To disable more than one algorithm, use the <b>no</b> form of this command multiple times with different algorithm names.</p> <p><b>Note</b> For default configuration, use the default form of this command as shown below:</p> <p>Device(config)# <code>ip ssh server algorithm</code>  <code>hostkey x509v3-ssh-rsa ssh-rsa</code></p>
<b>Step 4</b>	<b>end</b>  <b>Example:</b>  Device(config)# <code>end</code>	Exits global configuration mode and returns to privileged EXEC mode.

## Troubleshooting Tips

If you try to disable the last host key algorithm in the configuration, the following message is displayed and the command is rejected:

```
% SSH command rejected: All hostkey algorithms cannot be disabled
```

## Configuration Examples For SSH Algorithms for Common Criteria Certification

This section provides configuration examples for SSH algorithms for common certification.

## Example: Configuring Encryption Key Algorithms for a Cisco IOS SSH Server

```
Device> enable
Device# configure terminal
Device(config)# ip ssh server algorithm encryption aes128-ctr aes192-ctr aes256-ctr aes128-cbc
aes192-cbc aes256-cbc 3des
Device(config)# end
```

## Example: Configuring Encryption Key Algorithms for a Cisco IOS SSH Client

```
Device> enable
Device# configure terminal
Device(config)# ip ssh client algorithm encryption aes128-ctr aes192-ctr aes256-ctr aes128-cbc
aes192-cbc aes256-cbc 3des
Device(config)# end
```

## Example: Configuring MAC Algorithms for a Cisco IOS SSH Server

```
Device> enable
Device# configure terminal
Device(config)# ip ssh server algorithm mac hmac-sha2-256, hmac-sha2-512, hmac-sha1,
hmac-sha1-96
Device(config)# end
```

## Example: Configuring Host Key Algorithms for a Cisco IOS SSH Server

```
Device> enable
Device# configure terminal
Device(config)# ip ssh server algorithm hostkey x509v3-ssh-rsa ssh-rsa
Device(config)# end
```

# Verifying SSH Algorithms for Common Criteria Certification

### Procedure

- |               |  |
|---------------|--|
| <b>Step 1</b> | <b>enable</b><br>Enables privileged EXEC mode. |
|---------------|--|

- Enter your password if prompted.

**Example:**

```
Device> enable
```

**Step 2**    **show ip ssh**

Displays configured Secure Shell (SSH) encryption, host key, and Message Authentication Code (MAC) algorithms.

**Example:**

The following sample output from the **show ip ssh** command shows the encryption algorithms configured in the default order:

```
Device# show ip ssh
```

```
Encryption Algorithms: aes128-ctr, aes192-ctr, aes256-ctr, aes128-cbc, aes192-cbc, aes256-cbc, 3des
```

The following sample output from the **show ip ssh** command shows the MAC algorithms configured in the default order:

```
Device# show ip ssh
```

```
MAC Algorithms: hmac-sha2-256, hmac-sha2-512, hmac-sha1, hmac-sha1-96
```

The following sample output from the **show ip ssh** command shows the host key algorithms configured in the default order:

```
Device# show ip ssh
```

```
Hostkey Algorithms: x509v3-ssh-rsa, ssh-rsa
```

## Feature Information for Secure Shell Algorithms for Common Criteria Certification

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Secure Shell Algorithms for Common Criteria Certification	The SSH Algorithms for Common Criteria Certification feature provides the list and order of the algorithms that are allowed for Common Criteria Certification. This module describes how to configure the encryption, Message Authentication Code (MAC), and host key algorithms for a secure shell (SSH) server and client so that SSH connections can be limited on the basis of the allowed algorithms list.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>.

