

Configuring FIPS

This chapter describes how to configure the Federal Information Processing Standards (FIPS) mode on Cisco NX-OS devices.

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About FIPS

The FIPS 140–2 Publication, *Security Requirements for Cryptographic Modules*, details the U.S. government requirements for cryptographic modules. FIPS 140–2 specifies that a cryptographic module is a set of hardware, software, firmware, or some combination thereof that implements cryptographic functions or processes, including cryptographic algorithms and, optionally, key generation, and is contained within a defined cryptographic boundary.

FIPS specifies certain cryptographic algorithms as secure, and it identifies which algorithms should be used if a cryptographic module is to be called FIPS compliant.

FIPS Self-Tests

A cryptographic module must perform power-up self-tests and conditional self-tests to ensure that it is functioning properly.

Power-up self-tests run automatically after the device powers up. A device goes into FIPS mode only after all self-tests are successfully completed. If any self-test fails, the device logs a system message and moves into an error state.

The device uses a cryptographic algorithm known-answer test (KAT) to test FIPS mode for each FIPS 140-2-approved cryptographic function (encryption, decryption, authentication, and random number generation)

implemented on the device. The device applies the algorithm to data for which the correct output is already known. It then compares the calculated output to the previously generated output. If the calculated output does not equal the known answer, the KAT fails.

Conditional self-tests run automatically when an applicable security function or operation is invoked. Unlike the power-up self-tests, conditional self-tests are executed each time their associated function is accessed.

Conditional self-tests include the following:

Pair-wise consistency test

This test is run when a public or private key-pair is generated.

Continuous random number generator test

This test is run when a random number is generated.

The Cisco TrustSec manager also runs a bypass test to ensure that encrypted text is never sent as plain text.



Note A bypass test failure on CTS-enabled ports causes only those corresponding ports to be shut down. The bypass test might fail because of packet drops caused by data path congestion. In such cases, we recommend that you try bringing up the port again.

FIPS Error State

When the system is booted up in FIPS mode, the FIPS power-up self-tests run on the supervisor and line card modules. If any of these bootup tests fail, the whole system is moved to the FIPS error state. In this state, as per the FIPS requirement, all cryptographic keys are deleted, and all line cards are shut down. This mode is exclusively meant for debugging purposes.

Once the switch is in the FIPS error state, any reload of a line card moves it to the failure state. To move the switch back to FIPS mode, it has to be rebooted. However, once the switch is in FIPS mode, any power-up self-test failure on a subsequent line card reload or insertion affects only that line card, and only the corresponding line card is moved to the failure state.

Prerequisites for FIPS

FIPS has the following prerequisites:

- Disable Telnet. Users should log in using Secure Shell (SSH) only.
- Disable SNMPv1 and v2. Any existing user accounts on the device that have been configured for SNMPv3 should be configured only with SHA for authentication and AES/3DES for privacy.
- Delete all SSH server RSA1 key-pairs.
- Enable HMAC-SHA1 message integrity checking (MIC) for use during the Cisco TrustSec Security Association Protocol (SAP) negotiation. To do so, enter the **sap hash-algorithm HMAC-SHA-1** command from the cts-manual or cts-dot1x mode.

Guidelines and Limitations for FIPS

FIPS has the following configuration guidelines and limitations:

- The user authentication mechanisms supported for SSH are usernames and passwords, public keys, and X.509 certificates.
- Your passwords should have a minimum of eight alphanumeric characters.
- Disable Radius and TACACS when FIPS mode is on. This is enforced due to OpenSSL in FIPS mode.
- When RadSec is enabled, Radius doesn't need to be disabled when FIPS is enabled.

Default Settings for FIPS

This table lists the default settings for FIPS parameters.

Table 1: Default FIPS Parameters

Parameters	Default
FIPS	Disabled
mode	

Configuring FIPS

This section describes how to configure FIPS mode on Cisco NX-OS devices.

Enabling FIPs Mode

Beginning with Cisco NX-OS Release 7.0(3)I5(1), you can enable FIPS mode on the device.

Before you begin

Ensure that you are in the default VDC.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example:	
	<pre>switch# configure terminal switch(config)#</pre>	
Step 2	fips mode enable	Enables FIPS mode.
	Example:	

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	Command or Action	Purpose	
	<pre>switch(config)# fips mode enable</pre>	Note	fips mode enable can be entered only when all LCs are online or else it leads to LC failure.
Step 3	exit	Exits conf	iguration mode.
	Example:		
	switch(config)# exit switch#		
Step 4	(Optional) show fips status	Displays t	he status of FIPS mode.
	Example:		
	switch# show fips status FIPS mode is enabled		
Step 5	Required: copy running-config startup-config	Copies the running configuration to the startu	
	Example:	configurat	ion.
	switch# copy running-config startup-config		
Step 6	Required: reload	Reloads th	ne Cisco NX-OS device.
	Example: switch# reload	Note	After you enable FIPS, a reboot is required for the system to operate in FIPS mode.

Disabling FIPS

You can disable FIPS mode on the device.

Before you begin

Ensure that you are in the default VDC.

Procedure

	Command or Action	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example:	
	<pre>switch# configure terminal switch(config)#</pre>	
Step 2	no fips mode enable	Disables FIPS mode.
	Example:	
	<pre>switch(config)# no fips mode enable</pre>	

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	Command or Action	Purpose
Step 3	exit	Exits configuration mode.
	Example:	
	<pre>switch(config)# exit switch#</pre>	
Step 4	(Optional) show fips status	Displays the status of FIPS mode.
	Example: switch# show fips status FIPS mode is disabled	
Step 5	copy running-config startup-config	Copies the running configuration to the startup
Exan	Example:	configuration.
	<pre>switch# copy running-config startup-config</pre>	
Step 6	reload	Reloads the Cisco NX-OS device.
	Example:	
	switch# reload	
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Verifying the FIPS Configuration

To display FIPS configuration information, perform one of the following tasks:

Command	Purpose
show fips status	Displays the status of the FIPS feature.

For detailed information about the fields in the output from this command, see the *Cisco Nexus* 9000 Series NX-OS Security Command Reference.

Create 2048 bit RSA Key

Steps to create a 2048 bit RSA key:

• N9k-Switch# conf t

Enter configuration commands, one per line. End with CNTL/Z.

• N9k-Switch(config) # no feature ssh

XML interface to system may become unavailable since ssh is disabled

- N9k-Switch(config) # no ssh key rsa
- N9k-Switch(config) # ssh key rsa 2048
- New SSH Key has a bitcount of 2048:
- N9k-Switch(config) # show ssh key

Configuration Example for FIPS

The following example shows how to enable FIPS mode:

```
config terminal
fips mode enable
show fips status
exit
copy running-config startup-config
reload
```

Additional References for FIPS

This section includes additional information related to implementing FIPS.

Related Documents

Related Topic	Document Title
Cisco NX-OS licensing	Cisco NX-OS Licensing Guide
Command reference	Cisco Nexus 9000 Series NX-OS Security Command Reference

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Standards

Standards	Title
FIPS 140-2	Security Requirements for Cryptographic Modules