



## Configuring Online Diagnostics

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This chapter describes how to configure the generic online diagnostics (GOLD) feature on Cisco NX-OS devices.

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## About Online Diagnostics

With online diagnostics, you can test and verify the hardware functionality of the device while the device is connected to a live network.

The online diagnostics contain tests that check different hardware components and verify the data path and control signals. Disruptive online diagnostic tests (such as the disruptive loopback test) and nondisruptive online diagnostic tests (such as the ASIC register check) run during bootup, line module online insertion and removal (OIR), and system reset. The nondisruptive online diagnostic tests run as part of the background health monitoring, and you can run these tests on demand.

Online diagnostics are categorized as bootup, runtime or health-monitoring diagnostics, and on-demand diagnostics. Bootup diagnostics run during bootup, health-monitoring tests run in the background, and on-demand diagnostics run once or at user-designated intervals when the device is connected to a live network.

## Bootup Diagnostics

Bootup diagnostics run during bootup and detect faulty hardware before Cisco NX-OS brings a module online. For example, if you insert a faulty module in the device, bootup diagnostics test the module and take it offline before the device uses the module to forward traffic.

Bootup diagnostics also check the connectivity between the supervisor and module hardware and the data and control paths for all the ASICs. The following table describes the bootup diagnostic tests for a module and a supervisor.

Table 1: Bootup Diagnostics

| Diagnostic   | Description   |
|--|---|
| OBFL   | Verifies the integrity of the onboard failure logging (OBFL) flash.   |
| MacSecPortLoopback (Cisco Nexus 9736C-FX and 9736Q-FX line cards only) | <p>Tests the packet path from Supervisor to each physical front panel port on the ASIC, the MACSEC capabilities of each port, and the Encryption and Decryption capabilities of the Cisco Nexus 9736C-FX and 9736Q-FX line cards. The MacSecPortLoopback test runs at boot time when the <b>diagnostic bootup level</b> is set to <b>complete</b>.</p> <p>The MacSecPortLoopback test runs on every port of the 36 front ports on the Cisco Nexus 9736C-FX and 9736Q-FX line cards, including ports that are broken out. The MAC sec hardware is tested for the four available cipher suite algorithms: GCM-AES-128, GCM-AES-256, GCM-AES-XPB-128, and GCM-AES-XPB-256.</p> <p><b>Note</b><br/>If a MacSecPortLoopback test failure occurs, the test reports in the form of SYSLOG or OBFL. When a test failure occurs, the port is taken down and display <code>MACsec failure</code> in the <b>show interface</b> CLI output. You can skip the MACsec test by setting the <b>diagnostic bootup level</b> to either <b>minimal</b> or <b>bypass</b>.</p> |
| USB  | Nondisruptive test. Checks the USB controller initialization on a module.   |
| ManagementPortLoopback   | Disruptive test, not an on-demand test. Tests loopback on the management port of a module.  |
| EOBCPortLoopback   | Disruptive test, not an on-demand test. Ethernet out of band.   |

Bootup diagnostics log failures to onboard failure logging (OBFL) and syslog and trigger a diagnostic LED indication (on, off, pass, or fail).

You can configure the device to either bypass the bootup diagnostics or run the complete set of bootup diagnostics.

## Runtime or Health Monitoring Diagnostics

Runtime diagnostics are also called health monitoring (HM) diagnostics. These diagnostics provide information about the health of a live device. They detect runtime hardware errors, memory errors, the degradation of hardware modules over time, software faults, and resource exhaustion.

Health monitoring diagnostics are non-disruptive and run in the background to ensure the health of a device that is processing live network traffic. You can enable or disable health monitoring tests or change their runtime interval.

The following table describes the health monitoring diagnostics and test IDs for a module and a supervisor.



**Note** Some tests may or may not be present, depending on the capabilities of the module. A list of tests available to the module can be found using the CLI command **show diagnostic content module <module>**.

Table 2: Health Monitoring Non-disruptive Diagnostics

| Diagnostic         | Default Interval   | Default Setting          | Description  | Corrective Action   |
|--------------------|--|--------------------------|--|---|
| <b>Module</b>      |  |                          |  |   |
| ACT2               | 30 minutes   | active                   | Verifies the integrity of the security device on the module.   | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "ACT2" test  |
| ASICRegisterCheck  | modular switches: 1 minute<br>non-modular switches: 20 seconds and a minimum configuration default simulation interval of 10 seconds | active                   | Validates read/write access to the ASICs on a module.  | Do CallHome, log error, and disable further HM testing for that ASIC device/instance after 20 consecutive failures of GOLD "ASICRegisterCheck" test |
| PrimaryBootROM     | 24 hours<br><a href="#">1</a>  | active                   | Verifies the integrity of the primary boot device on a module.   | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "PrimaryBootROM" test                                  |
| SecondaryBootROM   | 24 hours<br><a href="#">1</a>  | active                   | Verifies the integrity of the secondary boot device on a module.   | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "SecondaryBootROM" test                                |
| BootupPortLoopback | Only on bootup   | Only on boot up - active | Checks if the supervisor to front-panel port (and back) path is operational. For every front port, the test generates a packet on an active supervisor, sends the packet toward a target port, and, using the internal loopback inside a front port, redirects the packet back to the active supervisor. | Do CallHome, Error-disable affected ports, log error testing on affected ports after 1 consecutive failures of GOLD "BootupPortLoopback" test       |

| Diagnostic            | Default Interval | Default Setting                                    | Description  | Corrective Action   |
|-----------------------|------------------|--|--|---|
| PortLoopback          | 30 minutes       | active   | Checks diagnostics on a per-port basis on all admin down ports.                                    | Do CallHome, log error in Syslog/OBFL/Exception Log, and disable further HM testing on affected ports after 10 consecutive failures of GOLD "PortLoopback" test   |
| RewriteEngineLoopback | 1 minute         | active   | Verifies the integrity of the nondisruptive loopback for all ports up to the 1 Engine ASIC device. | Do CallHome, log error in Syslog/OBFL/Exception Log, and disable further HM testing on affected ports after 10 consecutive failures of GOLD "RewriteEngine" test  |
| AsicMemory            | Only on boot up  | Only on boot up - inactive                         | Checks if the AsicMemory is consistent using the Mbist bit in the ASIC.                            | Do CallHome and log error when GOLD "AsicMemory" test fails. As the issue causing the test failure may be transient, attempt recovery reload through kernel panic.<br><br><b>Note</b><br>To avoid a kernel panic when the test fails, you can override the EEM system policy.   |
| FpgaRegTest           | 30 seconds       | Health monitoring test - every 30 seconds - active | Test the FPGA status by read/write to FPGA.  | Do CallHome, log error, disable further HM testing after 20 consecutive failures of GOLD "FpgaRegTest" test. As the issue causing the test failure may be transient, attempt recovery reload through kernel panic.<br><br><b>Note</b><br>To avoid a kernel panic when the test fails, you can override the EEM system policy. |

| Diagnostic             | Default Interval | Default Setting                                | Description   | Corrective Action  |
|------------------------|------------------|--|---|--|
| L2ACLRedirect          | 1 minute         | Health monitoring test - every minute - active | Checks if the active inband path is operational. The test generates a packet on an active supervisor through the active fabric module. It then sends the packet toward the front panel port (physical interface on the line card) and, using the ACL entry, redirects the packet back to the active supervisor. | Do CallHome, log error, disable further HM testing after 10 consecutive failures of L2ACLRedirect test. As the issue causing the test failure may be transient, attempt recovery reload through kernel panic.<br><br><b>Note</b><br>To avoid a kernel panic when the test fails, you can override the EEM system policy. |
| OBFL                   | 30 minutes       | active   | Verifies the integrity of the onboard failure logging (OBFL) flash, and monitors for available storage in the device.   |  |
| FabricConnectivityTest | 1 minute         | active   | Verifies fabric/linecard link status.<br><br>Validates that the fabric links are functioning.<br><br><b>Note</b><br>Only available on Cisco Nexus 9500-R series line cards.   |  |

| Diagnostic             | Default Interval | Default Setting | Description   | Corrective Action  |
|------------------------|------------------|-----------------|---|--|
| FabricReachabilityTest | 1 minute         | active          | <p>Verifies fabric/linecard reachability status.</p> <p>Validates that each fabric component has a valid path to every other fabric component in the system.</p> <p><b>Note</b><br/>Only available on Cisco Nexus 9500-R series line cards.</p> |  |
| <b>Supervisor</b>      |                  |                 |   |  |
| Backplane              | 30 minutes       | active          | Verifies the integrity of the backplane SPROM devices.  |  |
| NVRAM                  | 5 minutes        | active          | Verifies the sanity of the NVRAM blocks on a supervisor.  | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "NVRAM" test            |
| RealTimeClock          | 5 minutes        | active          | Verifies that the real-time clock on the supervisor is ticking.   | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "RealTimeClock" test    |
| PrimaryBootROM         | 30 minutes       | active          | Verifies the integrity of the primary boot device on the supervisor.  | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "PrimaryBootROM" test   |
| SecondaryBootROM       | 30 minutes       | active          | Verifies the integrity of the secondary boot device on the supervisor.  | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "SecondaryBootROM" test |
| BootFlash              | 30 minutes       | active          | Verifies access to the bootflash devices.   | Do CallHome and log error when GOLD "BootFlash" test fails   |

| Diagnostic    | Default Interval | Default Setting                                    | Description  | Corrective Action   |
|---------------|------------------|--|--|---|
| USB           | 30 minutes       | active   | Verifies access to the USB devices.  | Do Call Home and log error when GOLD "USB" test fails   |
| SystemMgmtBus | 30 seconds       | active   | Verifies the availability of the system management bus.  | Do Call Home, log error, and disable further HM testing for that fan or power supply after 20 consecutive failures of GOLD "SystemMgmtBus" test   |
| Mce           | 30 minutes       | Health monitoring test - 30 minutes - active       | This test uses the mcd_dameon and reports any machine check error reported by the Kernel.      | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "Mce" test   |
| Pcie          | Only on boot up  | Only on boot up - inactive                         | Reads PCIe status registers and check for any error on the PCIe device.                        | Do CallHome and log error when GOLD "Pcie" test fails   |
| Console       | Only on boot up  | Only on boot up - inactive                         | This runs a port loopback test on the management port on boot up to check for its consistency. | Do CallHome, log error, and disable further HM testing after 20 consecutive failures of GOLD "Console" test   |
| FpgaRegTest   | 30 seconds       | Health monitoring test - every 30 seconds - active | Test the FPGA status by read/write to FPGA.  | Do CallHome, log error, disable further HM testing after 20 consecutive failures of GOLD "FpgaRegTest" test. As the issue causing the test failure may be transient, attempt recovery reload through kernel panic.<br><br><b>Note</b><br>To avoid a kernel panic when the test fails, you can override the EEM system policy. |

<sup>1</sup> Minimum configurable test interval is 6 hours

## On-Demand Diagnostics

On-demand tests help localize faults and are usually needed in one of the following situations:

- To respond to an event that has occurred, such as isolating a fault.
- In anticipation of an event that may occur, such as a resource exceeding its utilization limit.

You can run all the health monitoring tests on demand. You can schedule on-demand diagnostics to run immediately.

You can also modify the default interval for a health monitoring test.

## High Availability

A key part of high availability is detecting hardware failures and taking corrective action while the device runs in a live network. Online diagnostics in high availability detect hardware failures and provide feedback to high availability software components to make switchover decisions.

Cisco NX-OS supports stateless restarts for online diagnostics. After a reboot or supervisor switchover, Cisco NX-OS applies the running configuration.

## Virtualization Support

Online diagnostics are virtual routing and forwarding (VRF) aware. You can configure online diagnostics to use a particular VRF to reach the online diagnostics SMTP server.

# Guidelines and Limitations for Online Diagnostics

Online diagnostics has the following configuration guidelines and limitations:

- The following Cisco Nexus platform switches and line cards do not support the run-time PortLoopback test but do support the BootupPortLoopback test:

### Switches

- Cisco Nexus 92160YC-X
- Cisco Nexus 92304QC
- Cisco Nexus 9264PQ
- Cisco Nexus 9272Q
- Cisco Nexus 9232C
- Cisco Nexus 9236C
- Cisco Nexus 9256PV
- Cisco Nexus 92300YC
- Cisco Nexus 93108TC-EX
- Cisco Nexus 93108TC-EX-24
- Cisco Nexus 93180LC-EX
- Cisco Nexus 93180YC-EX
- Cisco Nexus 93180YC-EXU
- Cisco Nexus 93180YC-EX-24



- Cisco Nexus 9232E-B1
- Cisco Nexus 93180YC-FX3S

#### Line Cards

- Cisco Nexus 9736C-EX
  - Cisco Nexus 97160YC-EX
  - Cisco Nexus 9732C-EX
  - Cisco Nexus 9732C-EXM
- You cannot run disruptive online diagnostic tests on demand.
  - Interface Rx and Tx packet counters are incremented (approximately four packets every 15 minutes) for ports in the shutdown state.
  - The PortLoopback test is periodic, so the packet counter is incremented on admin down ports every 30 minutes. The test runs only on admin down ports. When a port is unshut, the counters are not affected.
  - When a port fails for the per-port BootupPortLoopback test, the port enters the error-disabled state. (To remove this state, enter the **shutdown** and **no shutdown** commands on the port.)

## Default Settings for Online Diagnostics

The following table lists the default settings for online diagnostic parameters.

| Parameters               | Default  |
|--------------------------|----------|
| Bootup diagnostics level | complete |
| Nondisruptive tests      | active   |

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**Note** Be aware that the Cisco NX-OS commands for this feature may differ from those commands used in Cisco IOS.

### Setting the Bootup Diagnostic Level

You can configure the bootup diagnostics to run the complete set of tests, or you can bypass all bootup diagnostic tests for a faster module bootup time.



**Note** We recommend that you set the bootup online diagnostics level to complete. We do not recommend bypassing the bootup online diagnostics.

### Procedure

|               | Command or Action  | Purpose  |
|---------------|--|--|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre>  | Enters global configuration mode.  |
| <b>Step 2</b> | <b>diagnostic bootup level {complete   minimal   bypass}</b><br><br><b>Example:</b><br><pre>switch(config)# diagnostic bootup level complete</pre> | Configures the bootup diagnostic level to trigger diagnostics as follows when the device boots: <ul style="list-style-type: none"> <li>• <b>complete</b>—Perform a complete set of bootup diagnostics. The default is complete.</li> <li>• <b>minimal</b>—Perform a minimal set of bootup diagnostics for the supervisor engine and bootup port loopback tests.</li> <li>• <b>bypass</b>—Do not perform any bootup diagnostics.</li> </ul> |
| <b>Step 3</b> | (Optional) <b>show diagnostic bootup level</b><br><br><b>Example:</b><br><pre>switch(config)# show diagnostic bootup level</pre>                   | Displays the bootup diagnostic level (bypass or complete) that is currently in place on the device.  |
| <b>Step 4</b> | (Optional) <b>copy running-config startup-config</b><br><br><b>Example:</b><br><pre>switch(config)# copy running-config startup-config</pre>       | Copies the running configuration to the startup configuration.   |

## Activating a Diagnostic Test

You can set a diagnostic test as active and optionally modify the interval (in hours, minutes, and seconds) at which the test runs.

### Procedure

|               | Command or Action                                | Purpose                           |
|---------------|--|-----------------------------------|
| <b>Step 1</b> | <b>configure terminal</b><br><br><b>Example:</b> | Enters global configuration mode. |

|               | Command or Action   | Purpose  |
|---------------|---|--|
|               | <pre>switch# configure terminal switch(config)#</pre>   |  |
| <b>Step 2</b> | <p><b>diagnostic monitor interval module <i>slot</i> test</b><br/> <code>[<i>test-id</i>   <i>name</i>   all] hour <i>hour</i> min <i>minute</i><br/> second <i>second</i></code></p> <p><b>Example:</b></p> <pre>switch(config)# diagnostic monitor interval module 6 test 3 hour 1 min 0 second 0</pre> | <p>Configures the interval at which the specified test is run. If no interval is set, the test runs at the interval set previously, or the default interval.</p> <p>The argument ranges are as follows:</p> <ul style="list-style-type: none"> <li>• <i>slot</i>—The range is from 1 to 10.</li> <li>• <i>test-id</i>—The range is from 1 to 14.</li> <li>• <i>name</i>—Can be any case-sensitive, alphanumeric string up to 32 characters.</li> <li>• <i>hour</i>—The range is from 0 to 23 hours.</li> <li>• <i>minute</i>—The range is from 0 to 59 minutes.</li> <li>• <i>second</i>—The range is from 0 to 59 seconds.</li> </ul> |
| <b>Step 3</b> | <p><b>[no] diagnostic monitor module <i>slot</i> test</b><br/> <code>[<i>test-id</i>   <i>name</i>   all]</code></p> <p><b>Example:</b></p> <pre>switch(config)# diagnostic monitor interval module 6 test 3</pre>  | <p>Activates the specified test.</p> <p>The argument ranges are as follows:</p> <ul style="list-style-type: none"> <li>• <i>slot</i>—The range is from 1 to 10.</li> <li>• <i>test-id</i>—The range is from 1 to 14.</li> <li>• <i>name</i>—Can be any case-sensitive, alphanumeric string up to 32 characters.</li> </ul> <p>The <b>[no]</b> form of this command inactivates the specified test. Inactive tests keep their current configuration but do not run at the scheduled interval.</p>   |
| <b>Step 4</b> | <p>(Optional) <b>show diagnostic content module</b><br/> <code>{<i>slot</i>   all}</code></p> <p><b>Example:</b></p> <pre>switch(config)# show diagnostic content module 6</pre>  | Displays information about the diagnostics and their attributes.   |

## Starting or Stopping an On-Demand Diagnostic Test

You can start or stop an on-demand diagnostic test. You can optionally modify the number of iterations to repeat this test, and the action to take if the test fails.

We recommend that you only manually start a disruptive diagnostic test during a scheduled network maintenance time.

## Procedure

|               | Command or Action  | Purpose   |
|---------------|--|---|
| <b>Step 1</b> | (Optional) <b>diagnostic ondemand iteration</b> <i>number</i><br><br><b>Example:</b><br>switch# diagnostic ondemand iteration 5  | Configures the number of times that the on-demand test runs. The range is from 1 to 999. The default is 1.  |
| <b>Step 2</b> | (Optional) <b>diagnostic ondemand action-on-failure</b> { <b>continue failure-count</b> <i>num-fails</i>   <b>stop</b> }<br><br><b>Example:</b><br>switch# diagnostic ondemand action-on-failure stop  | Configures the action to take if the on-demand test fails. The <i>num-fails</i> range is from 1 to 999. The default is 1.   |
| <b>Step 3</b> | Required: <b>diagnostic start module</b> <i>slot test</i> [ <i>test-id</i>   <i>name</i>   <b>all</b>   <b>non-disruptive</b> ] [ <b>port</b> <i>port-number</i>   <b>all</b> ]<br><br><b>Example:</b><br>switch# diagnostic start module 6 test all | Starts one or more diagnostic tests on a module. The module slot range is from 1 to 10. The <i>test-id</i> range is from 1 to 14. The test name can be any case-sensitive, alphanumeric string up to 32 characters. The port range is from 1 to 48. |
| <b>Step 4</b> | Required: <b>diagnostic stop module</b> <i>slot test</i> [ <i>test-id</i>   <i>name</i>   <b>all</b> ]<br><br><b>Example:</b><br>switch# diagnostic stop module 6 test all   | Stops one or more diagnostic tests on a module. The module slot range is from 1 to 10. The <i>test-id</i> range is from 1 to 14. The test name can be any case-sensitive, alphanumeric string up to 32 characters.                                  |
| <b>Step 5</b> | (Optional) <b>show diagnostic status module</b> <i>slot</i><br><br><b>Example:</b><br>switch# show diagnostic status module 6  | Verifies that the diagnostic has been scheduled.  |

## Simulating Diagnostic Results

You can simulate a diagnostic test result.

## Procedure

|               | Command or Action   | Purpose  |
|---------------|---|--|
| <b>Step 1</b> | <b>diagnostic test simulation module</b> <i>slot test</i> <i>test-id</i> { <b>fail</b>   <b>random-fail</b>   <b>success</b> } [ <b>port</b> <i>number</i>   <b>all</b> ]<br><br><b>Example:</b><br>switch# diagnostic test simulation module 2 test 2 fail | Simulates a test result. The <i>test-id</i> range is from 1 to 14. The port range is from 1 to 48. |

## Clearing Diagnostic Results

You can clear diagnostic test results.

### Procedure

|               | Command or Action   | Purpose   |
|---------------|---|---|
| <b>Step 1</b> | <b>diagnostic clear result module</b> [ <i>slot</i>   <b>all</b> ] <b>test</b> { <i>test-id</i>   <b>all</b> }<br><br><b>Example:</b><br><pre>switch# diagnostic clear result module 2 test all</pre> | Clears the test result for the specified test.<br><br>The argument ranges are as follows: <ul style="list-style-type: none"> <li>• <i>slot</i>—The range is from 1 to 10.</li> <li>• <i>test-id</i>—The range is from 1 to 14.</li> </ul> |
| <b>Step 2</b> | <b>diagnostic test simulation module</b> <i>slot</i> <b>test</b> <i>test-id</i> <b>clear</b><br><br><b>Example:</b><br><pre>switch# diagnostic test simulation module 2 test 2 clear</pre>            | Clears the simulated test result. The <i>test-id</i> range is from 1 to 14.   |

## Verifying the Online Diagnostics Configuration

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

| Command   | Purpose  |
|---|--|
| <b>show diagnostic bootup level</b>   | Displays information about bootup diagnostics.   |
| <b>show diagnostic content module</b> { <i>slot</i>   <b>all</b> }  | Displays information about diagnostic test content for a module.                                     |
| <b>show diagnostic description module</b> <i>slot</i> <b>test</b> [ <i>test-name</i>   <b>all</b> ]                 | Displays the diagnostic description.   |
| <b>show diagnostic events</b> [ <b>error</b>   <b>info</b> ]  | Displays diagnostic events by error and information event type.                                      |
| <b>show diagnostic ondemand setting</b>   | Displays information about on-demand diagnostics.  |
| <b>show diagnostic result module</b> <i>slot</i> [ <b>test</b> [ <i>test-name</i>   <b>all</b> ]] [ <b>detail</b> ] | Displays information about the results of a diagnostic.  |
| <b>show diagnostic simulation module</b> <i>slot</i>  | Displays information about a simulated diagnostic.   |
| <b>show diagnostic status module</b> <i>slot</i>  | Displays the test status for all tests on a module.  |
| <b>show hardware capacity</b> [ <b>eobc</b>   <b>forwarding</b>   <b>interface</b>   <b>module</b>   <b>power</b> ] | Displays information about the hardware capabilities and current hardware utilization by the system. |
| <b>show module</b>  | Displays module information including the online diagnostic test status.                             |

# Configuration Examples for Online Diagnostics

This example shows how to start all on-demand tests on module 6:

```
diagnostic start module 6 test all
```

This example shows how to activate test 2 and set the test interval on module 6:

```
configure terminal
diagnostic monitor module 6 test 2
diagnostic monitor interval module 6 test 2 hour 3 min 30 sec 0
```