



## Configuring Graceful Insertion and Removal

This chapter describes how to configure graceful insertion and removal (GIR) on the Cisco Nexus 9000 Series switches.

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## About Graceful Insertion and Removal

You can use graceful insertion and removal to gracefully eject a switch and isolate it from the network in order to perform debugging or upgrade operations. The switch is removed from the regular forwarding path with minimal traffic disruption. When you are finished performing debugging or upgrade operations, you can use graceful insertion to return the switch to its fully operational (normal) mode.

When you place the switch in maintenance mode, all configured Layer 3 control-plane protocols are isolated from the network. Directly connected routes are not withdrawn or modified during this state. When normal mode is restored, the advertisement of all routes is restored.

In graceful removal, all protocols and vPC domains are gracefully brought down and the switch is isolated from the network. In graceful insertion, all protocols and vPC domains are restored.

The following protocols are supported (for both IPv4 and IPv6 address families):

- Border Gateway Protocol (BGP)
- Enhanced Interior Gateway Routing Protocol (EIGRP)
- Intermediate System-to-Intermediate System (ISIS)

- Open Shortest Path First (OSPF)
- Protocol Independent Multicast (PIM)
- Routing Information Protocol (RIP)



**Note** For graceful insertion and removal, the PIM protocol is applicable only to vPC environments. During graceful removal, the vPC forwarding role is transferred to the vPC peer for all northbound sources of multicast traffic.

## Profiles

By default, the system isolates all enabled protocols during graceful removal and restores them during graceful insertion. The protocols are isolated and restored in a predefined order.

If you want to isolate, shut down, or restore the protocols individually (or perform additional configurations), you can create a profile with configuration commands that can be applied during graceful removal or graceful insertion. However, you need to make sure that the order of the protocols is correct and any dependencies are considered.

The switch supports the following profiles:

- Maintenance-mode profile—Contains all the commands that will be executed during graceful removal, when the switch enters maintenance mode.
- Normal-mode profile—Contains all the commands that will be executed during graceful insertion, when the switch returns to normal mode.

The following commands (along with any configuration commands) are supported in the profiles.



**Note** The **shutdown** command takes precedence when both **shutdown** and **isolate** are configured under a routing protocol instance or maintenance-mode profile.

| Command                                                  | Description                                                                      |
|----------------------------------------------------------|----------------------------------------------------------------------------------|
| <b>isolate</b>                                           | Isolates the protocol from the switch and puts the protocol in maintenance mode. |
| <b>no isolate</b>                                        | Restores the protocol and puts the protocol in normal mode.                      |
| <b>shutdown</b>                                          | Shuts down the protocol or vPC domain.                                           |
| <b>no shutdown</b>                                       | Brings up the protocol or vPC domain.                                            |
| <b>system interface shutdown [exclude fex-fabric]</b>    | Shuts down the system interfaces (except the management interface).              |
| <b>no system interface shutdown [exclude fex-fabric]</b> | Brings up the system interfaces.                                                 |

| Command                                                                                                                          | Description                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>sleep instance</b> <i>instance-number seconds</i>                                                                             | Delays the execution of the command by a specified number of seconds. You can delay multiple instances of the command.<br><br>The range for the <i>instance-number</i> and <i>seconds</i> arguments is from 0 to 2177483647. |
| <b>python instance</b> <i>instance-number uri [python-arguments]</i><br>Example: <b>python instance 1 bootflash://script1.py</b> | Configures Python script invocations to the profile. You can add multiple invocations of the command to the profile.<br><br>You can enter a maximum of 32 alphanumeric characters for the Python arguments.                  |



**Note** Beginning with Cisco NX-OS Release 9.3(5), the **isolate** command is provided with the **include-local** option, which is applicable only to **router bgp**.

If you use this option, BGP withdraws all the routes from its peers. If you do not use this option, then BGP only withdraws remotely learned routes, and the locally originated routes such as aggregate, injected, network and redistribute continue to be advertised with maximum Multi-Exit Discriminator (MED) to eBGP peers and minimum local preference to iBGP peers.

## Snapshots

In Cisco NX-OS, a snapshot is the process of capturing the running states of selected features and storing them on persistent storage media.

Snapshots are useful to compare the state of a switch before graceful removal and after graceful insertion. The snapshot process consists of three parts:

- Creating a snapshot of the states of a few preselected features on the switch and storing them on the persistent storage media
- Listing the snapshots taken at various time intervals and managing them
- Comparing snapshots and showing the differences between features

## Guidelines and Limitations for GIR

Graceful Insertion and Replacement have the following configuration guidelines and limitations:

- Beginning with Cisco NX-OS Release 9.2(1), L2 Graceful Insertion and Replacement is supported. When moving from normal to maintenance mode, MCT goes down resulting in north to south traffic convergence.

Zero packet loss is not supported. The following table provides an example of traffic convergence of 10 vPCs with 2 port member on each VPC port and 60k mac scale.

**Table 1:**

| Trigger                    | Role      | North to South Traffic | South to North Traffic |
|----------------------------|-----------|------------------------|------------------------|
| Normal to maintenance mode | Primary   | 760 ms                 | 1320 ms                |
| Maintenance mode to normal | Primary   | 13155 ms               | 27980 ms               |
| Normal to maintenance mode | Secondary | 300 ms                 | 1375 ms                |
| Maintenance mode to normal | Secondary | 15905 ms               | 23350 ms               |

- Beginning with Cisco NX-OS Release 9.2(1), if you configure the **isolate** option for OSPF, direct routes and stub routes are advertised as max-metric routes. As a result, north-to-south traffic to the SVI hosts goes through the vPC peer when only one vPC switch is isolated.
- Remove all existing custom profiles before creating new custom profiles for normal-mode and maintenance-mode.
- Beginning with Cisco NX-OS Release 9.3(5), the **include-local** option is added to the existing **isolate** command. However, the **include-local** option applies only to **router bgp**.
- Beginning with Cisco NX-OS Release 10.3(1)F, during a binary reload scenario, when the system is switched to maintenance mode, the interface is shut until the system boots up completely and declares system readiness.

## GIR Workflow

Follow these steps to complete the graceful insertion and removal (GIR) workflow:

1. (Optional) Create the maintenance-mode profile. (See [Configuring the Maintenance-Mode Profile, on page 5.](#))
2. (Optional) Create the normal-mode profile. (See [Configuring the Normal-Mode Profile, on page 6.](#))
3. Take a snapshot before triggering graceful removal. (See [Creating a Snapshot, on page 8.](#))
4. Trigger graceful removal to put the switch in maintenance mode. (See [Triggering Graceful Removal, on page 10.](#))
5. Trigger graceful insertion to return the switch to normal mode. (See [Triggering Graceful Insertion, on page 13.](#))
6. Take a snapshot after triggering graceful insertion. (See [Creating a Snapshot, on page 8.](#))

- Use the **show snapshots compare** command to compare the operational data before and after the graceful removal and insertion of the switch to make sure that everything is running as expected. (See [Verifying the GIR Configuration, on page 16.](#))

## Configuring the Maintenance-Mode Profile

You can create a maintenance-mode profile with configuration commands that can be applied during graceful removal or graceful insertion.



**Note** During the maintenance mode the SVI becomes UP after the reload. In this scenario, use the **isolate include-local** command under router BGP or keep interfaces in shutdown state through maintenance mode to avoid the impact of advertising connected/static routes.

### Procedure

|               | Command or Action                                                                                                                                                                                                                               | Purpose                                                                                                                                                                                                                                                                                                                                                     |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>[no] configure maintenance profile maintenance-mode</b><br><br><b>Example:</b><br><pre>switch# configure maintenance profile maintenance-mode Enter configuration commands, one per line. End with CNTL/Z. switch(config-mm-profile) #</pre> | <p>Enters a configuration session for the maintenance-mode profile. The <b>no</b> option deletes the maintenance profile maintenance-mode.</p> <p>Depending on which protocols you have configured, you must now enter the appropriate commands to bring down the protocols. For a list of supported commands, see <a href="#">Profiles, on page 2.</a></p> |
| <b>Step 2</b> | <b>end</b><br><br><b>Example:</b><br><pre>switch(config-mm-profile) # end switch#</pre>                                                                                                                                                         | Closes the maintenance-mode profile.                                                                                                                                                                                                                                                                                                                        |
| <b>Step 3</b> | <b>show maintenance profile maintenance-mode</b><br><br><b>Example:</b><br><pre>switch# show maintenance profile maintenance-mode</pre>                                                                                                         | Displays the details of the maintenance-mode profile.                                                                                                                                                                                                                                                                                                       |

### Example

This example shows how to create a maintenance-mode profile:

```
switch# configure maintenance profile maintenance-mode
Enter configuration commands, one per line. End with CNTL/Z.
switch(config-mm-profile) # ip pim isolate
switch(config-mm-profile) # router bgp 100
```

```

switch(config-mm-profile-router)# shutdown
switch(config-mm-profile)# router eigrp 10
switch(config-mm-profile-router)# shutdown
switch(config-mm-profile-router)# address-family ipv6 unicast
switch(config-mm-profile-router-af)# shutdown
switch(config-mm-profile)# vpc domain 10
switch(config-mm-profile-config-vpc-domain)# shutdown
switch(config-mm-profile)# system interface shutdown
switch(config-mm-profile)# end
Exit maintenance profile mode.
switch# show maintenance profile maintenance-mode
[Maintenance Mode]
ip pim isolate
router bgp 100
    shutdown
router eigrp 10
    shutdown
    address-family ipv6 unicast
        shutdown
vpc domain 10
    shutdown
system interface shutdown

```

This example shows how to configure sleep instance in a custom profile to add a delay before the next protocol change.

```

switch# configure maintenance profile maintenance-mode
Enter configuration commands, one per line. End with CNTL/Z.
switch(config-mm-profile)# router bgp 65001
switch(config-mm-profile-router)# isolate
switch(config-mm-profile-router)# sleep instance 1 10
switch(config-mm-profile)# router eigrp 200
switch(config-mm-profile-router)# isolate
switch(config-mm-profile-router)# sleep instance 2 15
switch(config-mm-profile)# router ospf 100
switch(config-mm-profile-router)# isolate
switch(config-mm-profile-router)# sleep instance 3 20
switch(config-mm-profile)# router ospfv3 300
switch(config-mm-profile-router)# isolate
switch(config-mm-profile-router)# sleep instance 4 5
switch(config-mm-profile)# router isis 400
switch(config-mm-profile-router)# isolate
switch(config-mm-profile)#end
Exit maintenance profile mode.
switch#

```




---

**Note** If you need to run exec commands or add a dynamic delay while the maintenance mode profile is applied, use the **python instance** *instance-number uri [python-arguments]* script.

---

## Configuring the Normal-Mode Profile

You can create a normal-mode profile with configuration commands that can be applied during graceful removal or graceful insertion.

## Procedure

|               | Command or Action                                                                                                                                                                                                                     | Purpose                                                                                                                                                                                                                                                                                                                                          |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>[no] configure maintenance profile normal-mode</b><br><br><b>Example:</b><br><pre>switch# configure maintenance profile normal-mode Enter configuration commands, one per line. End with CNTL/Z. switch(config-mm-profile) #</pre> | <p>Enters a configuration session for the normal-mode profile. The <b>no</b> version removes the maintenance profile normal-mode.</p> <p>Depending on which protocols you have configured, you must now enter the appropriate commands to bring up the protocols. For a list of supported commands, see <a href="#">Profiles, on page 2</a>.</p> |
| <b>Step 2</b> | <b>end</b><br><br><b>Example:</b><br><pre>switch(config-mm-profile) # end switch#</pre>                                                                                                                                               | Closes the normal-mode profile.                                                                                                                                                                                                                                                                                                                  |
| <b>Step 3</b> | <b>show maintenance profile normal-mode</b><br><br><b>Example:</b><br><pre>switch# show maintenance profile normal-mode</pre>                                                                                                         | Displays the details of the normal-mode profile.                                                                                                                                                                                                                                                                                                 |

## Example

This example shows how to create a maintenance profile normal-mode:

```
switch# configure maintenance profile normal-mode
switch(config-mm-profile) # no system interface shutdown
switch(config-mm-profile) # vpc domain 10
switch(config-mm-profile-config-vpc-domain) # no shutdown
switch(config-mm-profile) # router eigrp 10
switch(config-mm-profile-router) # no shutdown
switch(config-mm-profile-router) # address-family ipv6 unicast
switch(config-mm-profile-router-af) # no shutdown
switch(config-mm-profile) # router bgp 100
switch(config-mm-profile-router) # no shutdown
switch(config-mm-profile) # no ip pim isolate
switch(config-mm-profile) # end
Exit maintenance profile mode.
switch# show maintenance profile normal-mode
[Normal Mode]
no system interface shutdown
vpc domain 10
  no shutdown
  router eigrp 10
    no shutdown
address-family ipv6 unicast
  no shutdown
router bgp 100
  no shutdown
no ip pim isolate
```

# Creating a Snapshot

You can create a snapshot of the running states of selected features. When you create a snapshot, a predefined set of **show** commands are run and the outputs are saved.

## Procedure

|               | Command or Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Purpose                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>snapshot create <i>snapshot-name description</i></b><br><br><b>Example:</b><br><pre>switch# snapshot create snap_before_maintenance Taken before maintenance Executing 'show interface'... Done Executing 'show ip route summary vrf all'... Done Executing 'show ipv6 route summary vrf all'... Done Executing 'show bgp sessions vrf all'... Done Executing 'show ip eigrp topology summary'... Done Executing 'show ipv6 eigrp topology summary'... Done Feature 'vpc' not enabled, skipping... Executing 'show ip ospf vrf all'... Done Feature 'ospfv3' not enabled, skipping... Feature 'isis' not enabled, skipping... Feature 'rip' not enabled, skipping... Snapshot 'snap_before_maintenance' created</pre> | <p>Captures the running state or operational data of selected features and stores the data on persistent storage media.</p> <p>You can enter a maximum of 64 alphanumeric characters for the snapshot name and a maximum of 254 alphanumeric characters for the description.</p> <p>Use the <b>snapshot delete {all   <i>snapshot-name</i>}</b> command to delete all snapshots or a specific snapshot.</p> |
| <b>Step 2</b> | <b>show snapshots</b><br><br><b>Example:</b><br><pre>switch# show snapshots Snapshot Name          Time           Description ----- snap_before_maintenance  Wed Aug 19 13:53:28 2015  Taken before maintenance</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Displays snapshots present on the switch.                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Step 3</b> | <b>show snapshots compare <i>snapshot-name-1 snapshot-name-2</i> [summary   ipv4routes   ipv6routes]</b><br><br><b>Example:</b><br><pre>switch# show snapshots compare snap_before_maintenance snap_after_maintenance</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>Displays a comparison of two snapshots.</p> <p>The <b>summary</b> option displays just enough information to see the overall changes between the two snapshots.</p> <p>The <b>ipv4routes</b> and <b>ipv6routes</b> options display the changes in IPv4 and IPv6 routes between the two snapshots.</p>                                                                                                    |

### Example

The following example shows a summary of the changes between two snapshots:

```
switch# show snapshots compare snapshot1 snapshot2 summary
feature                               snapshot1  snapshot2  changed
basic summary
  # of interfaces                     16         12         *
  # of vlans                          10         4         *
  # of ipv4 routes                    33         3         *
  .....

interfaces
  # of eth interfaces                 3          0         *
  # of eth interfaces up              2          0         *
  # of eth interfaces down            1          0         *
  # of eth interfaces other           0          0
  .....

  # of vlan interfaces                3          1         *
  # of vlan interfaces up             3          1         *
  # of vlan interfaces down           0          0
  # of vlan interfaces other          0          1         *
```

The following example shows the changes in IPv4 routes between two snapshots:

```
switch# show snapshots compare snapshot1 snapshot2 ipv4routes
metric                               snapshot1  snapshot2  changed
# of routes                         33         3         *
# of adjacencies                    10         4         *

Prefix                               Changed Attribute
-----
23.0.0.0/8                          not in snapshot2
10.10.10.1/32                       not in snapshot2
21.1.2.3/8                          adjacency index has changed from 29 (snapshot1) to 38 (snapshot2)
.....

There were 28 attribute changes detected
```

## Adding Show Commands to Snapshots

You can specify additional **show** commands to be captured in snapshots. These **show** commands are defined in user-specified snapshot sections.

### Procedure

|               | Command or Action                                                                                                                                                                                | Purpose                                                                                                                                                  |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>snapshot section add section "show-command" row-id element-key1 [element-key2]</b><br><br><b>Example:</b><br>switch# snapshot section add myshow "show ip interface brief" ROW_intf intf-name | Adds a user-specified section to snapshots. The <i>section</i> is used to name the <b>show</b> command output. You can use any word to name the section. |

|               | Command or Action                                                                        | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |                                                                                          | <p>The <b>show</b> command must be enclosed in quotation marks. Non-<b>show</b> commands will not be accepted.</p> <p>The <i>row-id</i> argument specifies the tag of each row entry of the <b>show</b> command's XML output. The <i>element-key1</i> and <i>element-key2</i> arguments specify the tags used to distinguish among row entries. In most cases, only the <i>element-key1</i> argument needs to be specified to be able to distinguish among row entries.</p> <p><b>Note</b><br/>To delete a user-specified section from snapshots, use the <b>snapshot section delete section</b> command.</p> |
| <b>Step 2</b> | <b>show snapshots sections</b><br><br><b>Example:</b><br>switch# show snapshots sections | Displays the user-specified snapshot sections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### Example

The following example adds the **show ip interface brief** command to the myshow snapshot section.

```
switch# snapshot section add myshow "show ip interface brief" ROW_intf intf-name
switch# show snapshots sections
user-specified snapshot sections
-----
[myshow]
  cmd: show ip interface brief
  row: ROW_intf
  key1: intf-name
  key2: -

[sect2]
  cmd: show ip ospf vrf all
  row: ROW_ctx
  key1: instance_number
  key2: cname
```

## Triggering Graceful Removal

In order to perform debugging or upgrade operations, you can trigger a graceful removal of the switch, which will eject the switch and isolate it from the network.

### Before you begin

If you want the system to use a maintenance-mode profile that you create, see [Configuring the Maintenance-Mode Profile, on page 5](#).

## Procedure

|        | Command or Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>configure terminal</b><br><br><b>Example:</b><br><pre>switch# configure terminal switch(config)#</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Enters global configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Step 2 | <b>system mode maintenance</b><br><b>[dont-generate-profile   timeout value   shutdown   on-reload reset-reason reason]</b><br><br><b>Example:</b><br><pre>switch(config)# system mode maintenance Following configuration will be applied:  ip pim isolate router bgp 65502     isolate router ospf p1     isolate router ospfv3 p1     isolate  Do you want to continue (y/n)? [no] <b>y</b>  Generating a snapshot before going into maintenance mode  Starting to apply commands...  Applying : ip pim isolate Applying : router bgp 65502 Applying : isolate Applying : router ospf p1 Applying : isolate Applying : router ospfv3 p1 Applying : isolate  Maintenance mode operation successful.</pre> | <p>Puts all enabled protocols in maintenance mode (using the <b>isolate</b> command).</p> <p>The following options are available:</p> <ul style="list-style-type: none"> <li>• <b>dont-generate-profile</b>—Prevents the dynamic searching of enabled protocols and executes commands configured in a maintenance-mode profile. Use this option if you want the system to use a maintenance-mode profile that you have created.</li> <li>• <b>timeout value</b>—Keeps the switch in maintenance mode for a specified number of minutes. The range is from 5 to 65535. Once the configured time elapses, the switch returns to normal mode automatically. The <b>no system mode maintenance timeout</b> command disables the timer.</li> <li>• <b>shutdown</b>—Shuts down all protocols, vPC domains, and interfaces except the management interface (using the <b>shutdown</b> command). This option is disruptive while the default (which uses the <b>isolate</b> command) is not.</li> <li>• <b>on-reload reset-reason reason</b>—Boots the switch into maintenance mode automatically in the event of a specified system crash. The <b>no system mode maintenance on-reload reset-reason</b> command prevents the switch from being brought up in maintenance mode in the event of a system crash.</li> </ul> <p>The maintenance mode reset reasons are as follows:</p> <ul style="list-style-type: none"> <li>• <b>HW_ERROR</b>—Hardware error</li> <li>• <b>SVC_FAILURE</b>—Critical service failure</li> </ul> |

|               | Command or Action                                                                                                                 | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |                                                                                                                                   | <ul style="list-style-type: none"> <li>• KERN_FAILURE—Kernel panic</li> <li>• WDOG_TIMEOUT—Watchdog timeout</li> <li>• FATAL_ERROR—Fatal error</li> <li>• LC_FAILURE—Line card failure</li> <li>• MATCH_ANY—Any of the above reasons</li> </ul> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>• During reload, a binary form of configuration file is used to restore the system. However, this is not possible in all scenarios, for example, when the reloaded image is new. Then, the system switches to ASCII reload.</li> <li>• During an unexpected reload, when the system switches to maintenance mode, the interface will be in a shut state (reason: <b>mmodeBootIntfShut</b>), until the system comes up completely from normal mode to maintenance mode.</li> <li>• During reload, if the system does not come up completely for a duration that is longer than expected, then collect the debugging information using the following commands and contact <a href="#">Cisco Support</a>: <ul style="list-style-type: none"> <li>• <b>show tech support mmode</b></li> <li>• <b>show tech support system manager</b></li> <li>• <b>show tech support interface manager</b></li> <li>• <b>show accounting</b></li> </ul> </li> </ul> <p>The system prompts you to continue. Enter <b>y</b> to continue or <b>n</b> to terminate the process.</p> |
| <b>Step 3</b> | (Optional) <b>show system mode</b><br><br><b>Example:</b><br><pre>switch(config)# show system mode System Mode: Maintenance</pre> | <p>Displays the current system mode.</p> <p>The switch is in maintenance mode. You can now perform any desired debugging or upgrade operations on the switch.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|               | Command or Action                                                                                                                            | Purpose                                                                                                                                              |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <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. This command is required if you want to preserve maintenance mode following a reboot. |

### Example

This example shows how to shut down all protocols, vPC domains, and interfaces on the switch:

```
switch(config)# system mode maintenance shutdown
```

Following configuration will be applied:

```
vpc domain 10
 shutdown
router bgp 65502
 shutdown
router ospf p1
 shutdown
router ospfv3 p1
 shutdown
system interface shutdown
```

Do you want to continue (y/n)? [no] **y**

Generating a snapshot before going into maintenance mode

Starting to apply commands...

```
Applying : vpc domain 10
Applying : shutdown
Applying : router bgp 65502
Applying : shutdown
Applying : router ospf p1
Applying : shutdown
Applying : router ospfv3 p1
Applying : shutdown
```

Maintenance mode operation successful.

This example shows how to automatically boot the switch into maintenance mode if a fatal error occurs:

```
switch(config)# system mode maintenance on-reload reset-reason fatal_error
```

## Triggering Graceful Insertion

When you finish performing any debugging or upgrade operations, you can trigger a graceful insertion to restore all protocols.

**Before you begin**

If you want the system to use a normal-mode profile that you create, see [Configuring the Maintenance-Mode Profile, on page 5](#).

**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>no system mode maintenance [dont-generate-profile]</b><br><br><b>Example:</b><br><pre>switch(config)# no system mode maintenance dont-generate-profile Following configuration will be applied:  no ip pim isolate router bgp 65502 no isolate router ospf p1 no isolate router ospfv3 p1 no isolate  Do you want to continue (y/n)? [no] <b>y</b>  Starting to apply commands...  Applying : no ip pim isolate Applying : router bgp 65502 Applying : no isolate Applying : router ospf p1 Applying : no isolate Applying : router ospfv3 p1 Applying : no isolate  Maintenance mode operation successful.  Generating Current Snapshot</pre> | <p>Puts all enabled protocols in normal mode (using the <b>no isolate</b> command).</p> <p>The <b>dont-generate-profile</b> option prevents the dynamic searching of enabled protocols and executes commands configured in a normal-mode profile. Use this option if you want the system to use a normal-mode profile that you have created.</p> <p>The system prompts you to continue. Enter <b>y</b> to continue or <b>n</b> to terminate the process.</p> |
| <b>Step 3</b> | <b>(Optional) show system mode</b><br><br><b>Example:</b><br><pre>switch(config)# show system mode System Mode: Normal</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Displays the current system mode. The switch is now in normal mode and is fully operational.                                                                                                                                                                                                                                                                                                                                                                 |

# Maintenance Mode Enhancements

Starting with Release 7.0(3)I5(1), the following maintenance mode enhancements have been added to Cisco Nexus 9000 Series switches:

- In the system maintenance shutdown mode, the following message is added:

NOTE: The command `system interface shutdown` will shutdown all interfaces excluding `mgmt0`.

- Entering the CLI command, **system mode maintenance** checks and sends alerts for the orphan ports.
- In isolate mode, when the vPC is configured, the following message is added:

NOTE: If you have vPC orphan interfaces, please ensure `vpc orphan-port suspend` is configured under them, before proceeding further.

- Custom Profile Configuration: A new CLI command, **system mode maintenance always-use-custom-profile** is added for custom profile configuration. A new CLI command, **system mode maintenance non-interactive** is added for Cisco Nexus 9000 Series switches only. It provides a way to facilitate the transition to maintenance mode or normal mode without confirmation being done or each step being printed on the CLI session.

When a loopback interface is configured with an IP address on a device, and this device is advertised to a peer device, then the device (with the loopback interface) moves to maintenance mode. In such a case, use the custom maintenance profile when **system interface shutdown** is configured on the device.

When you create a custom profile (in maintenance or normal mode), it displays the following message:

Please use the command **system mode maintenance always-use-custom-profile** if you want to always use the custom profile.

- A delay has been added before the `after_maintenance` snapshot is taken. The **no system mode maintenance** command exits once all the configuration for the normal mode has been applied, the mode has been changed to normal mode, and a timer has been started to take the `after_maintenance` snapshot. Once the timer expires, the `after_maintenance` snapshot is taken in the background and a new warning syslog, `MODE_SNAPSHOT_DONE` is sent once the snapshot is complete.

The final output of the CLI command **no system mode maintenance** indicates when the `after_maintenance` snapshot is generated:

The `after_maintenance` snapshot will be generated in `<delay>` seconds. After that time, please use `show snapshots compare before_maintenance after_maintenance` to check the health of the system. The timer delay for the `after_maintenance` snapshot is defaulted to 120 seconds but it can be changed by a new configuration command.

The new configuration command to change the timer delay for the `after_maintenance` snapshot is **system mode maintenance snapshot-delay <seconds>**. This configuration overrides the default setting of 120 seconds to any value between 0 and 65535 and it is displayed in the ASCII configuration.

A new show command, **show maintenance snapshot-delay** has also been added to display the current snapshot-delay value. This new show command supports the XML output.

- A visible CLI indicator has been added to display when the system is in the maintenance mode, for example, `switch (maint-mode) #`.

- Support for the SNMP traps has been added when the device moves from the maintenance mode to the normal mode and vice-versa through CLI reload, or system reset. The **snmp-server enable traps mmode cseMaintModeChangeNotify** trap is added to enable changing to the maintenance mode trap notification. The **snmp-server enable traps mmode cseNormalModeChangeNotify** is added to enable changing to the normal mode trap notification. Both the traps are disabled by default.

## Verifying the GIR Configuration

To display the GIR configuration, perform one of the following tasks:

| Command                                                                                                         | Purpose                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>show interface brief</b>                                                                                     | Displays abbreviated interface information.                                                                                                                                                                                                                                                       |
| <b>show maintenance on-reload reset-reasons</b>                                                                 | Displays the reset reasons for which the switch comes up in maintenance mode. For a description of the maintenance mode reset reasons, see <a href="#">Triggering Graceful Removal, on page 10</a> .                                                                                              |
| <b>show maintenance profile</b> [maintenance-mode   normal-mode]                                                | Displays the details of the maintenance-mode or normal-mode profile.                                                                                                                                                                                                                              |
| <b>show maintenance timeout</b>                                                                                 | Displays the maintenance-mode timeout period, after which the switch automatically returns to normal mode.                                                                                                                                                                                        |
| <b>show</b> {running-config   startup-config} mmode [all]                                                       | Displays the maintenance-mode section of the running or startup configuration. The <b>all</b> option includes the default values.                                                                                                                                                                 |
| <b>show snapshots</b>                                                                                           | Displays snapshots present on the switch.                                                                                                                                                                                                                                                         |
| <b>show snapshots compare</b> <i>snapshot-name-1</i> <i>snapshot-name-2</i> [summary   ipv4routes   ipv6routes] | Displays a comparison of two snapshots.<br><br>The <b>summary</b> option displays just enough information to see the overall changes between the two snapshots.<br><br>The <b>ipv4routes</b> and <b>ipv6routes</b> options display the changes in IPv4 and IPv6 routes between the two snapshots. |
| <b>show snapshots dump</b> <i>snapshot-name</i>                                                                 | Displays the content of each file that was generated when the snapshot was taken.                                                                                                                                                                                                                 |
| <b>show snapshots sections</b>                                                                                  | Displays the user-specified snapshot sections.                                                                                                                                                                                                                                                    |
| <b>show system mode</b>                                                                                         | Displays the current system mode.                                                                                                                                                                                                                                                                 |

# Configuration Examples for GIR

The **redistribute direct** configuration under Border Gateway Protocol (BGP) will attract traffic as the BGP isolate mode does not withdraw direct routes. This example shows how to use the **route-map** command to enable BGP to withdraw direct routes in isolate mode.

## Policy Configuration

Use the **route-map my-rmap-deny** command in maintenance mode to exclude SVIs with a tag 200 configuration.

```
switch(config)# route-map my-rmap-deny deny 10
switch(config-route-map)# match tag 200
switch(config-route-map)# exit
switch(config)# route-map my-rmap-deny permit 20
```

Use the **route-map my-rmap-permit** command in normal mode to include SVIs with a tag 200 configuration.

```
switch(config)# route-map my-rmap-permit permit 10
switch(config-route-map)# match tag 200
switch(config-route-map)# exit
switch(config)# route-map my-rmap-permit permit 20
```

## Virtual IP (vIP)/Switch Virtual Interface (SVI) Configuration

```
switch(config)# interface loopback 200
switch(config-if)# ip address 192.0.2.100/8 tag 200
switch(config)# interface vlan 2
switch(config-if)# ip address 192.0.2.108/8 tag 200
....
switch(config)# interface vlan 3
switch(config-if)# ip address 192.0.2.102/8 tag 200
```

## BGP Configuration

```
switch(config)# feature bgp
switch(config)# router bgp 100
switch(config-router)# neighbor 192.0.2.100
....
```

## Maintenance Mode Profile

```
switch# configure maintenance profile maintenance-mode
switch(config-mm-profile)# router bgp 200
switch(config-mm-profile-router)# address-family ipv4 unicast
switch(config-mm-profile-router-af)# redistribute direct route-map my-rmap-deny
switch(config-mm-profile-router-af)# exit
switch(config-mm-profile)# sleep instance 1 10
```

## Normal Mode Profile

```
switch# configure maintenance profile normal-mode
switch(config-mm-profile)# router bgp 100
switch(config-mm-profile-router)# address-family ipv4 unicast
switch(config-mm-profile-router-af)# redistribute direct route-map my-rmap-permit
switch(config-mm-profile-router-af)# exit
switch(config-mm-profile)# sleep instance 1 20
```

