Configuring Graceful Insertion and Removal

Graceful Insertion and Removal (GIR) provides an alternative method to minimize network service impact caused by device maintenance. GIR leverages redundant paths in the network to smoothly remove a device under maintenance, out of service, and insert it back to service when the maintenance is complete. This module describes the how to configure GIR.

Restrictions for Graceful Insertion and Removal

This feature is not supported on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

GIR is supported for layer two interface shutdown, ISIS routing protocol, HSRP, VRRPv3 and BGP. This is configured either by creating customized templates or without a template.

Information about Graceful Insertion and Removal

Overview

Graceful Insertion and Removal (GIR) isolates a switch from the network in order to perform debugging or an upgrade. The switch can be put into maintenance mode using the **start maintenance** command. When switch maintenance is complete, the switch will return to normal mode on either reaching the configured maintenance timeout, or by enabling the **stop maintenance** command.

Creating a maintenance mode template before you put the switch in maintenance mode is optional. The objective of maintenance mode for a device is to minimize traffic disruption at the time of removal from the network, as well as during the time of insertion. There are mainly three stages:

- Graceful removal of the node from network.

- Performing maintenance on the device.

- Graceful insertion into the network.

A switch can be put into maintenance mode using default template or a custom template. The default template contains all the ISIS instances, along with **shut down l2**. In the custom template, you can configure the required ISIS instances and **shutdown l2**option. On entering maintenance mode, all participating protocols are isolated, and L2 ports are shut down. When normal mode is restored, all the protocols and L2 ports are brought back up.

Snapshots are taken automatically while entering and exiting the maintenance mode. You can use the **snapshot create** *snapshot-name snapshot-description* command to capture and store snapshots for pre-selected features. Snapshots are useful to compare the state of a switch before it went into maintenance mode and after it came back to normal mode. The snapshot process consists of three parts:

- Creating a snapshot of the states of a few preselected features on the switch and storing them onthe persistent storage media.

- Listing the snapshots taken at various time intervals and managing them.

- Comparing snapshots and showing the summary and details of each feature.

The maximum number of snapshots that may be stored on the switch is 10. You can use the command **snapshot delete** *snapshot-name* to delete a specific snapshot from the device.

The user can create multiple templates for the maintenance template or the snapshot template. Only one maintenance template and one snapshot template can be applied to the device at one time.

Snapshot templates can be created to generate specific snapshots. A new snapshot template can be created using the **snapshot-template***template-name* command. The command **snapshot-template***default-snapshot-template* can be used to specify the default snapshot template in the maintenance mode. The **snapshot create** [**template***template-name*] *snapshot-namesnapshot-description* command can be used to apply a specific template to the snapshot create feature.

Layer 2 interface shutdown

Layer 2 interfaces, such as ports on a switch, will be shut down when the system is transitioning into maintenance mode. Layer 2 interfaces are shut down using the **shutdown l2** command in the custom template.

Custom Template

The network administrator can create a template that will be applied when the system goes into maintenance mode. This allows the administrator to isolate specific protocols. All instances that need to be isolated must be explicitly specified.

The admin can create multiple templates with different configurations. However, only a single template will be applied to the maintenance mode CLI. Once applied, the template cannot be updated. If the template needs to be updated, then you must remove it, make the changes, and then re-apply.

Starting from Cisco IOS XE Fuji 16.9.1 release, support has been added to service protocols belonging to one class within a template in parallel. The priority order of the protocols will be the same as that of the default template. To configure this feature, enter the maintenance mode using the **system mode maintenance** command and enable the functionality using the **template***template-name***calss** command.

For example if the custom template has the following protocols:

```
Maintenance-template foo
  router isis 100
  hsrp Et0/1 1
  hsrp Et0/1 2
  router isis 200

Maintenance-template foo class
  router isis 100
  hsrp Et0/1 1
  hsrp Et0/1 2
  router isis 200
```

In the above example, since isis belongs to CLASS_IGP, router isis 100 & router isis 200 will be serviced in parallel. Once acks are received for both these protocols belonging to IGP class, FHRP_CLASS clients, hsrp Et0/1 and hsrp Et0/1 2 will be serviced in parallel.

When the template-class feature is configured, the protocols follow an order based on the class they belong to when entering maintenance mode. The protocols follow the opposite order when returning to normal mode.

System Mode Maintenance Counters

GIR has counters to track the following events:

- Number of times the switch went into maintenance.

- Ack statistics per client.

- Nack statistics per client

- Number of times a particular client did not acknowledge.

- Number of times switch over happened during GIR. GIR infra will rsync this counter to track multiple switchovers.

- Number of times the failsafe timer expired.

- Number of times system got out of maintenance on a timeout expiry.

The **show system mode maintenance counters** command can be used to display the counters that are being tracked by the feature.

The **clear system mode maintenance counters** command can be used to clear the counters supported by the feature.

The client-ack timeout value can be configured using the **failsafe** *failsafe-timeout-value* command. Failsafe time is the time that the GIR engine allows a client to transition. Each client sends a notification to the GIR engine about its transition. If it takes more than the failsafe time to transition, it is assumed to have transitioned.The failsafe timer can be configured between 5 - 180 minutes, with a default of 30 minutes.

How to Configure Graceful Insertion and Removal

Creating maintenance template

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `# config t`	Enters the global configuration mode.
Step 3	**maintenance-template** *template_name* **Example:** `(config)# maintenance-template gir1`	Creates a template with the specified name. For example, see Examples: Creating customer profile.

Step 4	**router** *routing_protocol instance_id* | **shutdown l2**
	
	Example:
	
	`(config-maintenance-templ)# router isis 1`
	
	`(config-maintenance-templ)# shutdown l2`
	
	`(config-maintenance-templ)# router bgp AS-number`
		Creates instances that should be isolated under this template.
		
		• **router:** Configures routing protocols and associated instance id.
		
		• **shutdown l2:** Shuts down layer 2 interfaces.

Configuring System Mode Maintenance

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `# config t`	Enters the global configuration mode.

	Command or Action	**Purpose**
Step 3	**system mode maintenance** **Example:** `(config)# system mode maintenance`	Enters system mode maintenance configuration mode. Different sub commands to create maintenance mode parameters are configured in this mode.
Step 4	**timeout** *timeout-value* | **template** *template-name* | **failsafe** *failsafe-timeout-value* | **on-reload reset-reason maintenance**	Configures maintenance mode parameters. • **timeout:** Configures maintenance mode timeout period in minutes, after which the system automatically returns to normal mode. The default timeout value is never. • **template:** Configures maintenance mode using the specified template. • **failsafe:**Configures client-ack timeout value. If the system is going into maintenance mode, it will continue to reach maintenance.If the system is exiting from maintenance mode, then it will reach normal mode. • **on-reload reset-reason maintenance:**Configures the system such that when the system is reloaded it enters the maintenance mode. If it is not configured the system enters the normal mode when it is reloaded.

Starting and Stopping Maintenance Mode

Procedure

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**start maintenance** **Example:** `# start maintenance`	Puts the system into maintenance mode.
Step 3	**stop maintenance** **Example:** `# stop maintenance`	Puts the system back into normal mode.

Configuration Examples for Graceful Removal and Insertion

The following examples show the sequence followed to enable GIR during a maintanence window.

Example: Configuring maintenance template

Any protocol that is supported by GIR can be configure in the maintenance template.This example shows how to configure a maintenance template t1 with an ISIS routing protocol instance.

```
Device# config terminal
Device (config)# maintenance-template t1
Device (config-maintenance-templ)# router isis 1
```

This example shows how to configure a maintenance template t1 with shutdown l2.

```
Device# config terminal
Device (config)# maintenance-template t1
Device (config-maintenance-templ)# shutdown l2
```

This example shows how to configure a maintenance template t1 with an BGP routing protocol instance.

```
Device# config terminal
Device (config)# maintenance-template t1
Device (config-maintenance-templ)# router BGP 1
```

Example: Configuring system mode maintenance

This example shows how to create maintenance template and configure the maintenance mode parameters.

```
Device# config terminal
Device(config)# system mode maintenance
Device(config-maintenance)#timeout 20
Device(config-maintenance)#failsafe 30
Device(config-maintenance)#on-reload reset-reason maintenance
Device(config-maintenance)#template t1
Device(config-maintenance)#exit
```

Example: Starting and Stopping maintenance mode

This example shows how to put the system into maintenance mode.

```
Device# start maintenance
```

After the activity is completed, the system can be put out of maintenance mode.

This example shows how to put the system out of maintenance mode.

```
Device# stop maintenance
```

Example: Displaying system mode settings

This example shows how to display system mode settings using different options.

```
Device#show system mode
     System Mode: Normal


Device#show system mode maintenance
     System Mode: Normal
     Current Maintenance Parameters:
     Maintenance Duration: 15(mins)
     Failsafe Timeout: 30(mins)
     Maintenance Template: t1
     Reload in Maintenance: False


Device#show system mode maintenance clients
     System Mode: Normal
     Maintenance Clients:
     CLASS-EGP

     CLASS-IGP
     router isis 1: Transition None

     CLASS-MCAST

     CLASS-L2


Device#show system mode maintenance template default
     System Mode: Normal
     default maintenance-template details:
     router isis 1
     router isis 2


Device#show system mode maintenance template t1
     System Mode: Normal
     Maintenance Template t1 details:

     router isis 1
```

Monitoring Graceful Insertion and Removal

Table 1: Privelege EXEC show commands

Command	Purpose
**show system mode [maintenance [clients	template** *template-name*]]	Displays information about system mode.
show system snapshots [dump *<snapshot-file-name>]*	Displays all the snapshots present on the device in human readable format.
show system snapshots [dump *<snapshot-file-name>]***xml**	Displays all the snapshots present on the device in XML format.
show system snapshots compare *snapshot-name1 snapshot-name2*	Displays differences between snapshots taken before entering maintenance mode and after exiting from the maintenance mode.

Table 2: Global Troubleshooting Commands

Command	Purpose
debug system mode maintenance	Displays information for troubleshooting GIR feature.

Additional References for Graceful Insertion and Removal

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	High Availability Command Reference, Cisco IOS XE Everest 16.6.1.

MIBs

MIB	MIBs Link
All the supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for GIR

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Release	Modification
Cisco IOS XE Everest 16.6.1	This feature was introduced.

Release	Modification
Cisco IOS XE Fuji 16.9.1	The following enhancements have been added to the GIR feature: • Snapshot templates can be used to generate specific snapshots. Protocols belonging to one class within the same custom template will be serviced in parallel. System mode maintenance counters have been added to track several events such as the number of times the switch went into maintenance. • GIR is now supported for the HSRP protocol • GIR is now supported for VRRPv3 protocol.
Cisco IOS XE Gibraltar 16.10.1	GIR is now supported for BGP protocol.