IP SLAs for MPLS Psuedo Wire via VCCV

This module describes how to configure IP Service Level Agreements (SLAs) for MPLS Pseudo Wire (PWE3) via Virtual Circuit Connectivity Verification (VCCV) to schedule pseudo-wire ping operations and provide monitoring and alerts for round trip time (RTT), failure, and connection threshold violations via SNMP Traps.

- Finding Feature Information, on page 1
- Restrictions for IP SLAs for MPLS Pseudo Wire via VCCV, on page 1
- Information About IP SLAs for MPLS Pseudo Wire via VCCV, on page 1
- How to Configure IP SLAs for MPLS Pseudo Wire via VCCM, on page 3
- Configuration Examples for IP SLAs for MPLS Pseudo Wire via VCCM, on page 6
- Additional References, on page 7
- Feature Information for IP SLAs for MPLS PWE3 via VCCM, on page 9

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for IP SLAs for MPLS Pseudo Wire via VCCV

LSP discovery is not supported for IP SLAs VCCV operations.

Information About IP SLAs for MPLS Pseudo Wire via VCCV

IP SLAs VCCV Operation

The IP SLAs VCCV operation supports Virtual Circuit Connectivity Verification (VCCV) for Pseudo-Wire Emulation Edge-to-Edge (PWE3) services across MPLS networks. The IP SLAs VCCV operation type is

based on the **ping mpls pseudowire** command, which checks MPLS LSP connectivity across an Any Transport over MPLS (AToM) virtual circuit (VC) by sending a series of pseudo-wire ping operations to the specified destination PE router.

When MPLS LSP connectivity checking is performed through an IP SLAs VCCV operation (rather than through the **ping mpls** command with the **pseudowire** keyword), you can use the IP SLA proactive threshold monitoring and multioperation scheduling capabilities:

The LSP discovery option does not support the IP SLAs VCCV operation.

Proactive Threshold Monitoring for the LSP Health Monitor

Proactive threshold monitoring support for the LSP Health Monitor feature provides the capability for triggering SNMP trap notifications and syslog messages when user-defined reaction conditions (such as a connection loss or timeout) are met. Configuring threshold monitoring for an LSP Health Monitor operation is similar to configuring threshold monitoring for a standard IP SLAs operation.

LSP Discovery Option Enabled

If the LSP discovery option for an LSP Health Monitor operation is enabled, SNMP trap notifications can be generated when one of the following events occurs:

- LSP discovery for a particular BGP next hop neighbor fails.
- Operational status of an LSP discovery group changes.

Possible reasons for which LSP discovery can fail for a particular BGP next hop neighbor are as follows:

- Expiration of time allowed for a BGP next hop neighbor to respond to an LSP discovery request.
- Return code is “Broken” or “Unexplorable” for all paths leading to the BGP next hop neighbor.

The table below describes the conditions for which the operational status of an LSP discovery group can change. Whenever an individual IP SLAs LSP ping operation of an LSP discovery group is executed, a return code is generated. Depending on the value of the return code and the current status of the LSP discovery group, the group status can change.

Table 1: Conditions for Which an LSP Discovery Group Status Changes

Individual IP SLAs Operation Return Code	Current Group Status = UP	Current Group Status = PARTIAL	Current Group Status = DOWN
OK	No group status change.	If return codes for all paths in the group are OK, then the group status changes to UP.	Group status changes to PARTIAL.
Broken or Unexplorable	Group status changes to PARTIAL.	If return codes for all paths in the group are Broken or Unexplorable, then the group status changes to DOWN.	No group status change.

The return code for an individual IP SLAs LSP ping operation can be one of the following:

- OK--Indicates that the LSP is working properly. The customer VPN traffic will be sent across this path.

- Broken--Indicates that the LSP is broken. Customer VPN traffic will not be sent across this path and may be discarded.
- Unexplorable--Indicates that not all the paths to this PE neighbor have been discovered. This may be due to a disruption along the LSP or because the number of 127/8 IP addresses used for LSP selection has been exhausted.

The status of an LSP discovery group can be one of the following:

- UNKNOWN--Indicates that group status has not yet been determined and that the paths belonging to the group are in the process of being tested for the first time. Once this initial test is complete, the group status will change to UP, PARTIAL, or DOWN.
- UP--Indicates that all the paths within the group are active and no operation failures have been detected.
- PARTIAL--Indicates that an operation failure has been detected for one or more, but not all, of the paths within the group.
- DOWN--Indicates that an operation failure has been detected for all the paths within the group.

Secondary Frequency Option

With the introduction of the LSP Health Monitor feature, a new threshold monitoring parameter has been added that allows you to specify a secondary frequency. If the secondary frequency option is configured and a failure (such as a connection loss or timeout) is detected for a particular path, the frequency at which the path is remeasured will increase to the secondary frequency value (testing at a faster rate). When the configured reaction condition is met (such as N consecutive connection losses or N consecutive timeouts), an SNMP trap and syslog message can be sent and the measurement frequency will return to its original frequency value.

How to Configure IP SLAs for MPLS Pseudo Wire via VCCM

Manually Configuring and Scheduling an IP SLAs VCCV Operation

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla** *operation-number*
4. **mpls lsp ping pseudowire** *peer-ipaddr vc-id* [**source-ipaddr** *source-ipaddr*]
5. **exp** *exp-bits*
6. **frequency** *seconds*
7. **request-data-size** *bytes*
8. **secondary-frequency** {**both** | **connection-loss** | **timeout**} *frequency*
9. **tag** *text*
10. **threshold** *milliseconds*
11. **timeout** *milliseconds*
12. **exit**

13. **ip sla reaction-configuration** *operation-number* [**react** *monitored-element*] [**threshold-type** {**never** | **immediate** | **consecutive** [*consecutive-occurrences*] | **xofy** [*x-value y-value*] | **average** [*number-of-probes*]}] [**threshold-value** *upper-threshold lower-threshold*] [**action-type** {**none** | **trapOnly** | **triggerOnly** | **trapAndTrigger**}]
14. **ip sla logging traps**
15. **ip sla schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh* **:** *mm*[**:** *ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh* **:** *mm* **:** *ss*}] [**ageout** *seconds*] [**recurring**]
16. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *operation-number* **Example:** `Router(config)# ip sla 777`	Begins configuring an IP SLAs operation and enters IP SLA configuration mode.
Step 4	**mpls lsp ping pseudowire** *peer-ipaddr vc-id* [**source-ipaddr** *source-ipaddr*] **Example:** `Router(config-ip-sla)# mpls lsp ping pseudowire 192.168.1.103 123 source-ipaddr 192.168.1.102`	Configures the IP SLAs operation as an LSP pseudo-wire ping and enters VCCV configuration mode.
Step 5	**exp** *exp-bits* **Example:** **Example:** `Router(config-sla-vccv)# exp 5`	(Optional) Specifies the experimental field value in the header for an echo request packet of an IP SLAs operation.
Step 6	**frequency** *seconds* **Example:** `Router(config-sla-vccv)# frequency 120`	(Optional) Specifies the rate at which a specified IP SLAs operation repeats.

	Command or Action	Purpose
Step 7	**request-data-size** *bytes* **Example:** `Router(config-sla-vccv)# request-data-size 200`	(Optional) Specifies the protocol data size for a request packet of an IP SLAs operation.
Step 8	**secondary-frequency** {**both** | **connection-loss** | **timeout**} *frequency* **Example:** `Router(config-sla-vccv)# secondary-frequency connection-loss 10`	(Optional) Sets the faster measurement frequency (secondary frequency) to which an IP SLAs operation should change when a reaction condition occurs.
Step 9	**tag** *text* **Example:** `Router(config-sla-vccv)# tag testgroup`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 10	**threshold** *milliseconds* **Example:** **Example:** `Router(config-sla-vccv)# threshold 6000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 11	**timeout** *milliseconds* **Example:** `Router(config-sla-vccv)# timeout 7000`	(Optional) Specifies the amount of time the IP SLAs operation waits for a response from its request packet.
Step 12	**exit** **Example:** `Router(config-sla-vccv)# exit`	Exits VCCV configuration mode and returns to global configuration mode.
Step 13	**ip sla reaction-configuration** *operation-number* [**react** *monitored-element*] [**threshold-type** {**never** | **immediate** | **consecutive** [*consecutive-occurrences*] | **xofy** [*x-value y-value*] | **average** [*number-of-probes*]}] [**threshold-value** *upper-threshold lower-threshold*] [**action-type** {**none** | **trapOnly** | **triggerOnly** | **trapAndTrigger**}] **Example:** `Router(config)# ip sla reaction-configuration 777 react connectionLoss threshold-type consecutive 3 action-type traponly`	(Optional) Configures certain actions to occur based on events under the control of Cisco IOS IP SLAs.

	Command or Action	Purpose
Step 14	**ip sla logging traps** **Example:** `Router(config)# ip sla logging traps`	(Optional) Enables the generation of SNMP system logging messages specific to IP SLAs trap notifications.
Step 15	**ip sla schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh* **:** *mm*[**:** *ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh* **:** *mm* **:** *ss*}] [**ageout** *seconds*] [**recurring**] **Example:** `Router(config)# ip sla schedule 777 life forever start-time now`	Configures the scheduling parameters for an IP SLAs operation.
Step 16	**exit** **Example:** `Router(config)# exit`	Exits global configuration submode and returns to privileged EXEC mode.

Troubleshooting Tips

Use the **debug ip sla trace** and **debug ip sla error** commands to help troubleshoot issues with an individual IP SLAs PWE3 service via VCCV operation.

What to Do Next

To display the results of an individual IP SLAs operation use the **show ip sla statistics** and **show ip sla statistics aggregated** commands. Checking the output for fields that correspond to criteria in your service level agreement will help you determine whether the service metrics are acceptable.

Configuration Examples for IP SLAs for MPLS Pseudo Wire via VCCM

Example Manually Configuring an IP SLAs VCCV Operation

The following example shows how to manually configure an IP SLAs VCCV operation in conjunction with the proactive threshold monitoring and multioperation scheduling capabilities of the LSP Health Monitor.

In this example, a VC with the identifier 123 has already been established between the PE device and its peer at IP address 192.168.1.103.

IP SLAs VCCV operation 777 is configured with operation parameters and reaction conditions, and it is scheduled to begin immediately and run indefinitely.

```
ip sla 777
 mpls lsp ping pseudowire 192.168.1.103 123
```

```
  exp 5
  frequency 120
  secondary-frequency timeout 30
  tag testgroup
  threshold 6000
  timeout 7000
  exit
!
 ip sla reaction-configuration 777 react rtt threshold-value 6000 3000 threshold-type
immediate 3 action-type traponly
 ip sla reaction-configuration 777 react connectionLoss threshold-type immediate action-type
 traponly
 ip sla reaction-configuration 777 react timeout threshold-type consecutive 3 action-type
traponly
 ip sla logging traps
!
 ip sla schedule 777 life forever start-time now
 exit
```

RTT Thresholds

The **threshold** command configures 6000 milliseconds as the amount of time for a rising threshold to be declared on the monitored pseudo-wire. The first **ip sla reaction-configuration** command specifies that an SNMP logging trap is to be sent immediately if the round-trip time violates the upper threshold of 6000 milliseconds or the lower threshold of 3000 milliseconds.

Connection Loss

The second **ip sla reaction-configuration** command specifies that an SNMP logging trap is to be sent immediately if a connection loss occurs for the monitored pseudo-wire.

Response Timeout

The **timeout** command configures 7000 seconds as the amount of time that VCCV operation 777 waits for a response from its request packet before a timeout is declared. The **secondary-frequency** command specifies that, if a timeout occurs, the measurement frequency of the operation repeats is to be increased from 120 seconds (the initial measurement frequency specified using the **frequency** command) to a faster rate of 30 seconds. The third **ip sla reaction-configuration** command specifies that an SNMP logging trap is to be sent if three consecutive timeouts occur.

Additional References

Related Documents

Related Topic	Document Title
MPLS LSP discovery management tool	"MPLS EM-MPLS LSP Multipath Tree Trace" chapter of the *Multiprotocol Label Switching Configuration Guide*
Configuring standard IP access lists	"Access Control Lists" chapter of the *Security Configuration Guide: Securing the Data Plane* guide
Multioperation scheduling for IP SLAs	"Configuring Multioperation Scheduling of IP SLAs Operations" chapter of the *Cisco IOS P SLAs Configuration Guide*

Related Topic	Document Title
Proactive threshold monitoring for IP SLAs	" Configuring Proactive Threshold Monitoring of IP SLAs Operations" chapter of the *Cisco IOS IP SLAs Configuration Guide*
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Cisco IOS IP SLAs commands	Cisco IOS IP SLAs Command Reference

Standards

Standard	Title
draft-ietf-mpls-lsp-ping-09.txt	Detecting MPLS Data Plane Failures
draft-ietf-mpls-oam-frmwk-03.txt	A Framework for MPLS Operations and Management (OAM)
draft-ietf-mpls-oam-requirements-06.txt	OAM Requirements for MPLS Networks

MIBs

MIB	MIBs Link
CISCO-RTTMON-MIB	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

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for IP SLAs for MPLS PWE3 via VCCM

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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: IP SLAs for MPLS PWE3 via VCCM

Feature Name	Releases	Feature Information
IP SLAs for MPLS Pseudo Wire (PWE3) via VCCM	12(33)SB 12.2(33)SRC 15.0(1)S Cisco IOS XE 3.1.0SG	The IP SLAs VCCV operation was added to support Virtual Circuit Connectivity Verification (VCCV) for Pseudo-Wire Emulation Edge-to-Edge (PWE3) services across MPLS networks.