Configuring IP SLAs ICMP Path Jitter Operations

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This document describes how to configure an IP Service Level Agreements (SLAs) Internet Control Message Protocol (ICMP) Path Jitter operation to monitor hop-by-hop jitter (inter-packet delay variance). This document also demonstrates how the data gathered using the Path Jitter operations can be displayed and analyzed using Cisco commands.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 at the end of this document.

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

Prerequisites for ICMP Path Jitter Operations

- Before configuring any IP SLAs application, you can use the **show ip sla application** command to verify that the operation type is supported on your software image.
- In contrast with other IP SLAs operations, the IP SLAs Responder does not have to be enabled on either the target device or intermediate devices for Path Jitter operations. However, the operational efficiency may improve if you enable the IP SLAs Responder.

Restrictions for ICMP Path Jitter Operations

- The IP SLAs ICMP Path Jitter operation is ICMP-based. ICMP-based operations can compensate for source processing delay but cannot compensate for target processing delay. For more robust monitoring and verifying, use of the IP SLAs UDP Jitter operation is recommended.
- The jitter values obtained using the ICMP Path Jitter operation are approximates because ICMP does not provide the capability to embed processing times on routers in the packet. If the target router does not place ICMP packets as the highest priority, then the router will not respond properly. ICMP performance also can be affected by the configuration of priority queueing on the router and by ping response.
- The path jitter operation does not support hourly statistics and hop information.
- Unlike other IP SLAs operations, the ICMP Path Jitter operation is not supported in the RTTMON MIB. Path Jitter operations can only be configured using Cisco commands and statistics can only be returned using the **show ip sla** commands.
- The IP SLAs Path Jitter operation does not support the IP SLAs History feature (statistics history buckets) because of the large data volume involved with Jitter operations.
- The following commands, available in Path Jitter configuration mode, do not apply to Path Jitter operations:
  - **history buckets-kept**
  - **history distributions-of-statistics-kept**
  - **history enhanced**
  - **history filter**
  - **history hours-of-statistics-kept**
  - **history lives-kept**
  - **history statistics-distribution-interval**
  - **samples-of-history-kept**
  - **lsr-path**
  - **tos**
  - **threshold**
  - **verify-data**

Information About IP SLAs ICMP Path Jitter Operations

ICMP Path Jitter Operation

The IP SLAs ICMP Path Jitter operation provides hop-by-hop jitter, packet loss, and delay measurement statistics in an IP network. The Path Jitter operation functions differently than the standard UDP Jitter operation, which provides total one-way data and total round-trip data.

The ICMP Path Jitter operation can be used a supplement to the standard UDP Jitter operation. For example, results from the UDP Jitter operation may indicate unexpected delays or high jitter values; the ICMP Path Jitter operation could then be used to troubleshoot the network path and determine if traffic is bottlenecking in a particular segment along the transmission path.

The operation first discovers the hop-by-hop IP route from the source to the destination using a traceroute utility, and then uses ICMP echoes to determine the response times, packet loss and approximate jitter values for each hop along the path. The jitter values obtained using the ICMP Path Jitter operation are approximates because ICMP only provides round trip times.

The ICMP Path Jitter operation functions by tracing the IP path from a source device to a specified destination device, then sending N number of Echo probes to each hop along the traced path, with a time interval of T milliseconds between each Echo probe. The operation as a whole is repeated at a frequency of once every F seconds. The attributes are user-configurable, as shown here:

Path Jitter Operation Parameter	Default	Configured Using:
Number of echo probes (N)	10 echos	**path-jitter** command, **num-packets** option
Time between Echo probes, in milliseconds (T)	20 ms	**path-jitter** command, **interval** option **Note** The operation's frequency is different than the operation's interval.
The frequency of how often the operation is repeated (F)	once every 60 seconds	**frequency** command

How to Configure the IP SLAs ICMP Path Jitter Operation

Configuring the IP SLAs Responder on a Destination Device

Note An IP SLAs Responder is not required on either the target device or intermediate devices for Path Jitter operations. However, operational efficiency may improve if you enable the IP SLAs Responder.

The networking device to be used as the responder must be a Cisco device and you must have connectivity to that device through the network.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla responder**
4. **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 responder** **Example:** **Example:** Router(config)# ip sla responder	(Optional) Temporarily enables IP SLAs Responder functionality on a Cisco device in response to control messages from source. • Control is enabled by default.
Step 4	**exit** **Example:** Router(config)# exit	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring an ICMP Path Jitter Operation on the Source Device

Perform only one of the following procedures in this section:

Configuring a Basic ICMP Path Jitter Operation

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla** *operation-number*
4. **path-jitter** {*destination-ip-address* | *destination-hostname*} [**source-ip** {*ip-address* | *hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**]
5. **frequency** *seconds*
6. **end**

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 10`	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
Step 4	**path-jitter** {*destination-ip-address*	*destination-hostname*} [**source-ip** {*ip-address*	*hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**] **Example:** `Router(config-ip-sla)# path-jitter 172.31.1.129 source-ip 10.2.30.1 num-packets 12 interval 22`	Defines an ICMP Path Jitter operation and enters IP SLA Path Jitter configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-ip-sla-pathJitter)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**end** **Example:** `Router(config-ip-sla-pathJitter)# end`	Exits to privileged EXEC mode.

Example

In the following example, the **targetOnly** keyword is used to bypass the hop-by-hop measurements. With this version of the command, echo probes will be sent to the destination only.

```
Router(config)# ip sla 1
Router(config-ip-sla)# path-jitter 172.17.246.20 num-packets 50 interval 30 targetOnly
```

Configuring an ICMP Path Jitter Operation with Additional Parameters

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla** *operation-number*
4. **path-jitter** {*destination-ip-address* | *destination-hostname*} [**source-ip** {*ip-address* | *hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**]
5. **frequency** *seconds*
6. **owner** *owner-id*
7. **request-data-size** *bytes*
8. **tag** *text*
9. **timeout** *milliseconds*
10. **vrf** *vrf-name*
11. **end**

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 10`	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
Step 4	**path-jitter** {*destination-ip-address*	*destination-hostname*} [**source-ip** {*ip-address*	*hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**]	Defines an ICMP Path Jitter operation and enters IP SLA Path Jitter configuration mode.

Command or Action	Purpose

Example:
 	
`Router(config-ip-sla)# path-jitter 172.31.1.129`
`source-ip 10.2.30.1 num-packets 12 interval 22`	

Step 5 **frequency** *seconds* **Example:** `Router(config-ip-sla-pathJitter)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6 **owner** *owner-id* **Example:** `Router(config-ip-sla-pathJitter)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.

Step 7   **request-data-size** *bytes*
 	
Example:
 	
`Router(config-ip-sla-pathJitter)# request-data-size`
`64`
	(Optional) Sets the protocol data size in the payload of an IP SLAs operation's request packet.

Step 8   **tag** *text*
 	
Example:
 	
`Router(config-ip-sla-pathJitter)# tag`
`TelnetPollServer1`
	(Optional) Creates a user-specified identifier for an IP SLAs operation.

Step 9 **timeout** *milliseconds* **Example:** `Router(config-ip-sla-pathJitter)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 10 **vrf** *vrf-name* **Example:** `Router(config-ip-sla-pathJitter)# vrf vpn-A`	(Optional) Allows monitoring within Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) using IP SLAs operations.
Step 11 **end** **Example:** `Router(config-ip-sla-pathJitter)# end`	Exits to privileged EXEC mode.

Scheduling IP SLAs Operations

Note

- All IP SLAs operations to be scheduled must be already configured.
- The frequency of all operations scheduled in a multioperation group must be the same.
- List of one or more operation ID numbers to be added to a multioperation group is limited to a maximum of 125 characters, including commas (,).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:

   - **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**]
   - **ip sla group schedule** *group-operation-number operation-id-numbers* **schedule-period** *schedule-period-range* [**ageout** *seconds*] [**frequency** *group-operation-frequency*] [**life**{**forever** | *seconds*}] [**start-time**{*hh:mm*[*:ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh:mm:ss*}]

4. **exit**
5. **show ip sla group schedule**
6. **show ip sla configuration**

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	Do one of the following: - **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**] - **ip sla group schedule** *group-operation-number operation-id-numbers* **schedule-period** *schedule-period-range* [**ageout** *seconds*] [**frequency** *group-operation-frequency*] [**life**{**forever**	*seconds*}] [**start-time**{*hh:mm*[*:ss*] [*month day*	*day month*]	**pending**	**now**	**after** *hh:mm:ss*}]	For individual IP SLAs operations only: Configures the scheduling parameters for an individual IP SLAs operation. or For multioperation scheduler only: Specifies an IP SLAs operation group number and the range of operation numbers to be scheduled in global configuration mode.

Command or Action	Purpose
Example: Router(config)# ip sla schedule 10 start-time now life forever **Example:** Router(config)# ip sla group schedule 1 3,4,6-9	
Step 4 **exit** **Example:** Router(config)# exit	Exits to privileged EXEC mode.
Step 5 **show ip sla group schedule** **Example:** Router# show ip sla group schedule	(Optional) Displays the IP SLAs group schedule details.
Step 6 **show ip sla configuration** **Example:** Router# show ip sla configuration	(Optional) Displays the IP SLAs configuration details.

Troubleshooting Tips

- If the IP SLAs operation is not running and generating statistics, add the **verify-data** command to the configuration of the operation (while configuring in IP SLA configuration mode) to enable data verification. When enabled, each operation response is checked for corruption. Use the **verify-data** command with caution during normal operations because it generates unnecessary overhead.
- Use the **debugipsla trace** and **debug ip sla error** commands to help troubleshoot issues with an IP SLAs operation.

What to Do Next

To add proactive threshold conditions and reactive triggering for generating traps, or for starting another operation, to an IP SLAs operation, see the "Configuring Proactive Threshold Monitoring" section.

To view and interpret the results of an IP SLAs operation use the **show ip sla statistics** command. 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 ICMP Path Jitter Operations

Example Configuring a Path Jitter Operation

The following example shows the output when the ICMP Path Jitter operation is configured. Because the path jitter operation does not support hourly statistics and hop information, the output for the **show ip sla statistics** command for the path jitter operation displays only the statistics for the first hop.

The following example shows the output when the ICMP Path Jitter operation is configured.

```
Router# configure terminal
Router(config)# ip sla 15011
Router(config-sla-monitor)# path-jitter 10.222.1.100 source-ip 10.222.3.100 num-packets 20
Router(config-sla-monitor-pathJitter)# frequency 30
Router(config-sla-monitor-pathJitter)# exit
Router(config)# ip sla schedule 15011 life forever start-time now
Router(config)# exit
Router# show ip sla statistics 15011
Round Trip Time (RTT) for       Index 15011
        Latest RTT: 1 milliseconds
Latest operation start time: 15:37:35.443 EDT Mon Jun 16 2008
Latest operation return code: OK
---- Path Jitter Statistics ----
Hop IP 10.222.3.252:
Round Trip Time milliseconds:
        Latest RTT: 1 ms
        Number of RTT: 20
        RTT Min/Avg/Max: 1/1/3 ms
Jitter time milliseconds:
        Number of jitter: 2
        Jitter Min/Avg/Max: 2/2/2 ms
Packet Values:
        Packet Loss (Timeouts): 0
        Out of Sequence: 0
        Discarded Samples: 0
Operation time to live: Forever
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Cisco IOS IP SLAs commands	*Cisco IOS IP SLAs Command Reference*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by features in this document.	--

MIBs

MIBs	MIBs Link
MIB support for the Path Jitter operation is not provided.	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

RFCs	Title
RFC 1889[1]	*RTP: A Transport Protocol for Real-Time Applications* ; see the section Estimating the Interarrival Jitter

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 ICMP Path Jitter Operations

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 http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

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1 Support for the listed RFC is not claimed; listed as a reference only.

Table 1: Feature Information for the IP SLAs ICMP Path Jitter Operation

Feature Name	Releases	Feature Information
IP SLAs Path Jitter Operation	Cisco IOS XE Release 2.1	The Cisco IOS XE IP SLAs Internet Control Message Protocol (ICMP) path jitter operation allows you to measure hop-by-hop jitter (inter-packet delay variance).