IP SLAs—Analyzing IP Service Levels Using the ICMP Path Echo Operation

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This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) Internet Control Message Protocol (ICMP) Path Echo operation to monitor end-to-end and hop-by-hop response time between a Cisco router and devices using IP. ICMP Path Echo is useful for determining network availability and for troubleshooting network connectivity issues. IP SLAs is a portfolio of technology embedded in most devices that run Cisco IOS software, which allows Cisco customers to analyze IP service levels for IP applications and services, to increase productivity, to lower operational costs, and to reduce the frequency of network outages. IP SLAs uses active traffic monitoring—the generation of traffic in a continuous, reliable, and predictable manner—for measuring network performance. The results of the ICMP Path Echo operation can be displayed and analyzed to determine how ICMP is performing.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for the IP SLAs ICMP Path Echo Operation" section on page 13.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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CISCO SYSTEMS

Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Prerequisites for the IP SLAs ICMP Path Echo Operation

Before configuring the IP SLAs ICMP Path Echo operation you should be familiar with the "Cisco IOS IP SLAs Overview" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

Restrictions for the IP SLAs ICMP Path Echo Operation

We recommend using a Cisco networking device as the destination device although any networking device that supports RFC 862, Echo protocol, can be used.
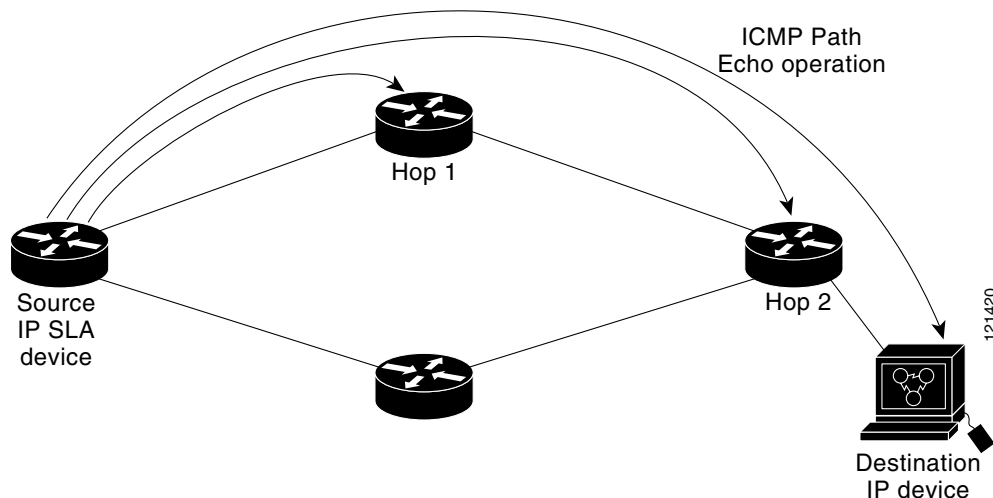
Information About the IP SLAs ICMP Path Echo Operation

To perform the tasks required to monitor ICMP Path Echo performance using IP SLA, you should understand the following concept:

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ICMP Path Echo Operation

The IP SLAs ICMP Path Echo operation records statistics for each hop along the path that the IP SLAs operation takes to reach its destination. The ICMP Path Echo operation determines this hop-by-hop response time between a Cisco router and any IP device on the network by discovering the path using the traceroute facility.

In Figure 1 the source IP SLAs device uses traceroute to discover the path to the destination IP device. A ping is then used to measure the response time between the source IP SLAs device and each subsequent hop in the path to the destination IP device.

Figure 1 **ICMP Path Echo Operation**

Using the statistics recorded for the response times and availability, the ICMP Path Echo operation can identify a hop in the path that is causing a bottleneck.

How to Configure the IP SLAs ICMP Path Echo Operation

This section contains the following procedure:

Configuring and Scheduling an ICMP Path Echo Operation

To monitor ICMP Path Echo performance on a device, use the IP SLAs ICMP Path Echo operation. An ICMP Path Echo operation measures end-to-end and hop-by-hop response time between a Cisco router and devices using IP. ICMP Path Echo is useful for determining network availability and for troubleshooting network connectivity issues. This operation does not require the IP SLAs Responder to be enabled.

Perform one of the following procedures in this section, depending on whether you want to configure and schedule a basic ICMP Path Echo operation or configure and schedule an ICMP Path Echo operation with optional parameters:

Configuring and Scheduling a Basic ICMP Path Echo Operation on the Source Device

Perform this task to enable and schedule an ICMP Path Echo operation without any optional parameters.

Note For information on scheduling a group of operations, see the "IP SLAs—Multiple Operation Scheduling" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type pathEcho protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}]
5. **frequency** *seconds*
6. **exit**
7. **ip sla monitor schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh*:*mm*[:*ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh*:*mm*:*ss*] [**ageout** *seconds*] [**recurring**]
8. **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 monitor** *operation-id* **Example:** `Router(config)# ip sla monitor 7`	Specifies an ID number for the operation being configured, and enters IP SLA Monitor configuration mode.
Step 4	**type pathEcho protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}] **Example:** `Router(config-sla-monitor)# type pathEcho protocol ipIcmpEcho 172.29.139.134`	Defines a Path Echo operation and enters IP SLA Monitor Path Echo configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-pathEcho)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-pathEcho)# exit`	Exits IP SLA Monitor Path Echo configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 7	`ip sla monitor 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 monitor schedule 10 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.

Step 8	`exit`
	
	Example:
	`Router(config)# exit`
		(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Example

The following example shows the configuration of the IP SLAs ICMP Path Echo operation number 7 that will start in 30 seconds and run for 5 minutes.

```
ip sla monitor 7
 type pathEcho protocol ipIcmpEcho 172.29.139.134
 frequency 30
!
ip sla monitor schedule 7 start-time after 00:00:30 life 300
```

What to Do Next

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.

Configuring and Scheduling an ICMP Path Echo Operation with Optional Parameters on the Source Device

Perform this task to enable an ICMP Path Echo operation on the source device and configure some optional IP SLAs parameters.

Note For information on scheduling a group of operations, see the "IP SLAs—Multiple Operation Scheduling" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type pathEcho protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}]
5. **buckets-of-history-kept** *size*
6. **distributions-of-statistics-kept** *size*

7. **enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*]

8. **filter-for-history** {**none** | **all** | **overThreshold** | **failures**}

9. **frequency** *seconds*

10. **hours-of-statistics-kept** *hours*

11. **lives-of-history-kept** *lives*

12. **owner** *owner-id*

13. **paths-of-statistics-kept** *size*

14. **request-data-size** *bytes*

15. **samples-of-history-kept** *samples*

16. **statistics-distribution-interval** *milliseconds*

17. **tag** *text*

18. **threshold** *milliseconds*

19. **timeout** *milliseconds*

20. **tos** *number*

21. **verify-data**

22. **vrf** *vrf-name*

23. **exit**

24. **ip sla monitor schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh*:*mm*[:*ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh*:*mm*:*ss*] [**ageout** *seconds*] [**recurring**]

25. **exit**

26. **show ip sla monitor configuration** [*operation-number*]

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 monitor** *operation-id* **Example:** Router(config)# ip sla monitor 7	Specifies an ID number for the operation being configured, and enters IP SLA Monitor configuration mode.

	Command or Action	Purpose
Step 4	**type pathEcho protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}] **Example:** Router(config-sla-monitor)# type pathEcho protocol ipIcmpEcho 172.29.139.134	Defines a Path Echo operation and enters IP SLA Monitor Path Echo configuration mode.
Step 5	**buckets-of-history-kept** *size* **Example:** Router(config-sla-monitor-pathEcho)# buckets-of-history-kept 25	(Optional) Sets the number of history buckets that are kept during the lifetime of an IP SLAs operation.
Step 6	**distributions-of-statistics-kept** *size* **Example:** Router(config-sla-monitor-pathEcho)# distributions-of-statistics-kept 5	(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.
Step 7	**enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*] **Example:** Router(config-sla-monitor-pathEcho)# enhanced-history interval 900 buckets 100	(Optional) Enables enhanced history gathering for an IP SLAs operation.
Step 8	**filter-for-history** {**none** | **all** | **overThreshold** | **failures**} **Example:** Router(config-sla-monitor-pathEcho)# filter-for-history failures	(Optional) Defines the type of information kept in the history table for an IP SLAs operation.
Step 9	**frequency** *seconds* **Example:** Router(config-sla-monitor-pathEcho)# frequency 30	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 10	**hours-of-statistics-kept** *hours* **Example:** Router(config-sla-monitor-pathEcho)# hours-of-statistics-kept 4	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 11	**lives-of-history-kept** *lives* **Example:** Router(config-sla-monitor-pathEcho)# lives-of-history-kept 5	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.

	Command or Action	Purpose
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-pathEcho)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**paths-of-statistics-kept** *size* **Example:** `Router(config-sla-monitor-pathEcho)# paths-of-statistics-kept 3`	(Optional) Sets the number of paths for which statistics are maintained per hour for an IP SLAs operation.
Step 14	**request-data-size** *bytes* **Example:** `Router(config-sla-monitor-pathEcho)# request-data-size 64`	(Optional) Sets the protocol data size in the payload of an IP SLAs operation's request packet.
Step 15	**samples-of-history-kept** *samples* **Example:** `Router(config-sla-monitor-pathEcho)# samples-of-history-kept 10`	(Optional) Sets the number of entries kept in the history table per bucket for an IP SLAs operation.
Step 16	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-pathEcho)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 17	**tag** *text* **Example:** `Router(config-sla-monitor-pathEcho)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 18	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-pathEcho)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 19	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-pathEcho)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 20	**tos** *number* **Example:** `Router(config-sla-monitor-pathEcho)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.

	Command or Action	Purpose
Step 21	**verify-data** **Example:** Router(config-sla-monitor-pathEcho)# verify-data	(Optional) Causes an IP SLAs operation to check each reply packet for data corruption.
Step 22	**vrf** *vrf-name* **Example:** Router(config-sla-monitor-pathEcho)# vrf vpn-A	(Optional) Allows monitoring within Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) using IP SLAs operations.
Step 23	**exit** **Example:** Router(config-sla-monitor-pathEcho)# exit	Exits Path Echo configuration submode and returns to global configuration mode.
Step 24	**ip sla monitor 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 monitor schedule 10 start-time now life forever	Configures the scheduling parameters for an individual IP SLAs operation.
Step 25	**exit** **Example:** Router(config)# exit	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 26	**show ip sla monitor configuration** [*operation-number*] **Example:** Router# show ip sla monitor configuration 10	(Optional) Displays configuration values including all defaults for all IP SLAs operations or a specified operation.

Examples

The following sample output shows the configuration of all the IP SLAs parameters (including defaults) for the ICMP Path Echo operation number 7.

```
Router# show ip sla monitor configuration 7

Complete configuration Table (includes defaults)
Entry number: 7
Owner: jdoe
Tag: SGN-RO
Type of operation to perform: pathEcho
Target address: 172.29.139.134
Source address: 172.29.139.132
Request size (ARR data portion): 28
Operation timeout (milliseconds): 1000
Type Of Service parameters: 256
Verify data: No
Loose Source Routing: Disabled
Vrf Name:
LSR Path:
```

```
Operation frequency (seconds): 30
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): 300
Entry Ageout (seconds): never
Recurring (Starting Everyday): FALSE
Status of entry (SNMP RowStatus): Active
Threshold (milliseconds): 5000
Number of statistic hours kept: 2
Number of statistic paths kept: 5
Number of statistic hops kept: 16
Number of statistic distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
Number of history Samples kept: 16
History Filter Type: None
```

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 monitor 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 **debug ip sla monitor trace** and **debug ip sla monitor error** commands to help troubleshoot issues with an IP SLAs operation.

What to Do Next

To view and interpret the results of an IP SLAs operation use the **show ip sla monitor 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.
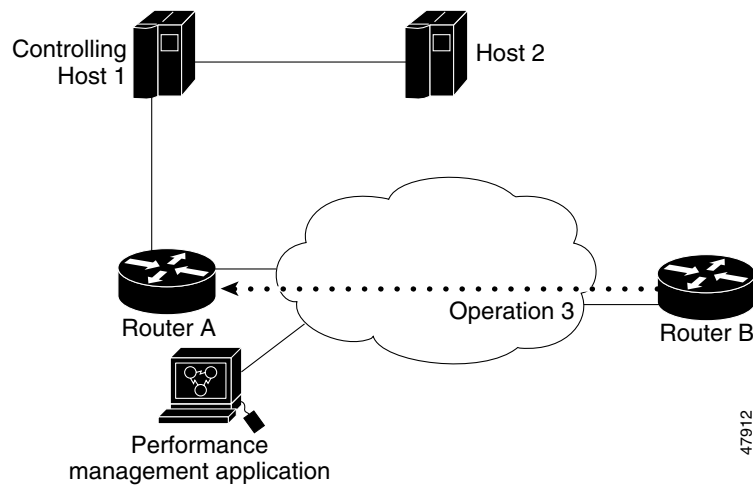
Configuration Examples for the IP SLAs ICMP Path Echo Operation

This section contains the following example:

Configuring an ICMP Path Echo Operation: Example

The following example shows how to configure an IP SLAs operation type of ICMP Path Echo that will start after 30 seconds and run for 5 minutes. Figure 2 depicts the ICMP Path Echo operation.

Figure 2   ICMP Path Echo Operation

This example sets a Path Echo operation from Router B to Router A using IP/ICMP. The operation attempts to execute three times in 25 seconds (first attempt at 0 seconds).

Router B Configuration

```
ip sla monitor 3
 type pathEcho protocol ipIcmpEcho 172.29.139.134
 frequency 10
 tag SGN-RO
 timeout 1000
ip sla monitor schedule 3 life 25
```

Where to Go Next

- If you want to configure multiple Cisco IOS IP SLAs operations at once, see the "IP SLAs—Multiple Operation Scheduling" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

- If you want to configure threshold parameters for an IP SLAs operation, see the "IP SLAs—Proactive Threshold Monitoring" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

- If you want to configure other types of IP SLAs operations, see the "Where to Go Next" section of the "Cisco IOS IP SLAs Overview" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

Additional References

The following sections provide references related to monitoring ICMP Path Echo operations using IP SLA.

Related Documents

Related Topic	Document Title
Overview of Cisco IOS IP SLAs	"Cisco IOS IP SLAs Overview" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4
Cisco IOS IP SLAs commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples	*Cisco IOS IP SLAs Command Reference*, Release 12.4

Standards

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

MIBs

MIBs	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

RFCs	Title
RFC 862	*Echo Protocol*

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Feature Information for the IP SLAs ICMP Path Echo Operation

Table 1 lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Release 12.3(14)T or a later release appear in the table. *Not all features may be supported in your Cisco IOS software release*.

For information on a feature in this technology that is not documented here, see the "Cisco IOS IP SLAs Features Roadmap."

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Cisco IOS software images are specific to a Cisco IOS software release, a feature set, and a platform. Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Note Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for the IP SLAs ICMP Path Echo Operation

Feature Name	Releases	Feature Information
IP SLAs ICMP Path Echo Operation	12.3(14)T	The Cisco IOS IP SLAs Internet Control Message Protocol (ICMP) path echo operation allows you to measure end-to-end and hop-by-hop network response time between a Cisco device and other devices using IP.