IP SLAs RTP-Based VoIP Operation

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The IP Service Level Agreements (SLAs) Real-Time Transport Protocol (RTP)-based Voice over IP (VoIP) Operation feature provides the capability to set up and schedule a test call and use Voice gateway digital signal processors (DSPs) to gather network performance-related statistics for the call. Available statistical measurements for VoIP networks include jitter, frame loss, Mean Opinion Score for Conversational Quality (MOS-CQ), and Mean Opinion Score for Listening Quality (MOS-LQ).

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 RTP-Based VoIP Operation" section on page 21.

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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Prerequisites for the IP SLAs RTP-Based VoIP Operation

- Both the source and destination routers must be running Cisco IOS Release 12.4(4)T or later releases.
- Both the source and destination routers must be running a Cisco IOS image with the Cisco IOS IP Voice or higher grade feature package.
- The source router must have a network module with a c5510 or c549 DSP. The destination router need not have a network module with a DSP.
- The IP SLAs Responder must be enabled on the destination gateway.

Restrictions for the IP SLAs RTP-Based VoIP Operation

- The IP SLAs RTP-based VoIP operation gathers statistical information only from the DSP of the source router.
- For source-to-destination measurements, the RTP-based VoIP operation does not obtain statistical information from DSPs.
- Depending on the type of DSP, the statistics measured by the IP SLAs RTP-based VoIP operation will vary. For more information, see the "Statistics Measured by the IP SLAs RTP-Based VoIP Operation" section on page 3.
- The voice port used by the IP SLAs RTP-based VoIP operation will not be available for other calls.

Information About the IP SLAs RTP-Based VoIP Operation

To configure an IP SLAs RTP-based VoIP operation, you should understand the following concepts:

Benefits of the IP SLAs RTP-Based VoIP Operation

The IP SLAs RTP-Based VoIP Operation feature provides the following key benefits:

- End-to-end performance measurements using DSPs for determining voice quality in VoIP networks.
- Proactive threshold violation monitoring through Simple Network Management Protocol (SNMP) trap notifications and syslog messages.

Statistics Measured by the IP SLAs RTP-Based VoIP Operation

The IP SLAs RTP-based VoIP operation provides an enhanced capability to measure voice quality using DSP-based calculations to determine MOS scores. For customer scenarios where the destination gateway does not have DSP hardware, statistical information is gathered only from the DSP of the source gateway. In this case, the RTP data stream is looped back from the destination to the source gateway.

The statistics gathered by the IP SLAs RTP-based VoIP operation will vary depending on the type of DSP module (see Table 1 and Table 2).

Table 1 Statistics Gathered by the RTP-Based VoIP Operation for c549 DSPs

Statistics	Description
Interarrival jitter (destination-to-source and source-to-destination)	Interarrival jitter is the mean deviation (smoothed absolute value) of the difference in packet spacing for a pair of packets. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement. For more information about interarrival jitter, see RFC 3550 (*RTP: A Transport Protocol for Real-Time Applications*).
Estimated R factor (destination-to-source and source-to-destination)	Estimated transmission rating factor R. This value is based on one-way transmission delay and standard default values. No values are obtained from the DSP to calculate the estimated transmission rating factor R. For more information about the estimated R factor, see International Telecommunication Union Telecommunication Standardization Sector (ITU-T) Recommendation G.107 (*The E-model, a computational model for use in transmission planning*).
MOS-CQ (destination-to-source and source-to-destination)	Mean Opinion Score for Conversational Quality. This value is obtained by conversion of the estimated R factor to Mean Opinion Score (MOS) using ITU-T Recommendation G.107 conversion tables. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement.
Round-trip time (RTT) latency	Round-trip time latency for an RTP packet to travel from the source to the destination and back to the source.
Packet loss (destination-to-source and source-to-destination)	Number of packets lost. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement.
Packets missing in action (source-to-destination)	Number of missing packets. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement.
One-way latency (destination-to-source and source-to-destination)	Average, minimum, and maximum latency values. These values are measured by sending RTP packets to IP SLAs Responder. The RTP data stream is then looped back from the destination to the source gateway.

Table 2 Statistics Gathered by the RTP-Based VoIP Operation for c5510 DSPs

Statistics	Description
Interarrival jitter (destination-to-source and source-to-destination)	Interarrival jitter is the mean deviation (smoothed absolute value) of the difference in packet spacing for a pair of packets. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement. For more information on how this value is calculated, see RFC 1889 (*RTP: A Transport Protocol for Real-Time Applications*).
Estimated R factor (destination-to-source and source-to-destination)	Estimated transmission rating factor R. This value is based on one-way transmission delay and standard default values, as well as values obtained from the DSP. For more information about how to calculate the estimated R factor, see International Telecommunication Union Telecommunication Standardization Sector (ITU-T) Recommendation G.107 (*The E-model, a computational model for use in transmission planning*).
MOS-CQ (destination-to-source and source-to-destination)	Mean Opinion Score for Conversational Quality. This value is obtained by conversion of the estimated R factor to Mean Opinion Score (MOS) using ITU-T Recommendation G.107 conversion tables. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement.
Round-trip time (RTT) latency	Round-trip time latency for an RTP packet to travel from the source to the destination and back to the source.
Packet loss (destination-to-source and source-to-destination)	Number of packets lost. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement.
Packets missing in action (source-to-destination)	Number of missing packets. The source-to-destination value is measured by sending RTP packets to the IP SLAs Responder. No values are obtained from the DSP for this measurement.
One-way latency (destination-to-source and source-to-destination)	Average, minimum, and maximum latency values. These values are measured by sending RTP packets to IP SLAs Responder. The RTP data stream is then looped back from the destination to the source gateway.
Frame loss (destination-to-source)	Number of DSP frame loss events. A frame loss can occur due to such events as packet loss, late packets, or a jitter buffer error.
MOS-LQ (destination-to-source)	Mean Opinion Score for Listening Quality.

How to Configure an IP SLAs RTP-Based VoIP Operation

This section contains the following task:

Configuring an IP SLAs RTP-Based VoIP Operation

Perform this task to configure and schedule an IP SLAs RTP-based VoIP operation.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla** *operation-number*
4. **voip rtp** {*destination-ip-address* | *destination-hostname*} **source-ip** {*ip-address* | *hostname*} **source-voice-port** {*slot* [*/subunit*/*port*:*ds0-group-number*]} [**codec** *codec-type*] [**duration** *seconds*] [**advantage-factor** *value*]
5. **frequency** *seconds*
6. **history** *history-parameter*
7. **owner** *text*
8. **tag** *text*
9. **threshold** *milliseconds*
10. **timeout** *milliseconds*
11. **exit**
12. **ip sla reaction-configuration** *operation-number* **react** *monitored-element* [**action-type** *option*] [**threshold-type** {**average** [*number-of-measurements*] | **consecutive** [*occurrences*] | **immediate** | **never** | **xofy** [*x-value y-value*]}] [**threshold-value** *upper-threshold lower-threshold*]
13. **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**]
14. **exit**
15. **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** *operation-number* **Example:** `Router(config)# ip sla 1`	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
Step 4	**voip rtp** {*destination-ip-address* | *destination-hostname*} **source-ip** {*ip-address* | *hostname*} **source-voice-port** {*slot* [**/***subunit***/***port***:***ds0-group-number*]} [**codec** *codec-type*] [**duration** *seconds*] [**advantage-factor** *value*] **Example:** `Router(config-ip-sla)# voip rtp 10.2.3.4 source-ip 10.5.6.7 source-voice-port 1/0:1 codec g711alaw duration 30 advantage-factor 5`	Enters IP SLAs VoIP RTP configuration mode and configures the IP SLAs operation as an RTP-based VoIP operation.
Step 5	**frequency** *seconds* **Example:** `Router(config-ip-sla-voip-rtp)# frequency 90`	(Optional) Sets the rate at which a specified IP SLAs operation repeats. The default frequency value is 60 seconds.
Step 6	**history** *history-parameter* **Example:** `Router(config-ip-sla-voip-rtp)# history buckets-kept 25`	(Optional) Specifies the parameters used for gathering statistical history information for an IP SLAs operation.
Step 7	**owner** *text* **Example:** `Router(config-ip-sla-voip-rtp)# owner 10.16.1.1 cwb.cisco.com John Doe RTP 555-1212`	(Optional) Configures the SNMP owner of an IP SLAs operation.
Step 8	**tag** *text* **Example:** `Router(config-ip-sla-voip-rtp)# tag testoperation`	(Optional) Creates a user-specified identifier for an IP SLAs operation.

	Command or Action	Purpose
Step 9	**threshold** *milliseconds* **Example:** `Router(config-ip-sla-voip-rtp)# threshold 10000`	(Optional) Sets the rising threshold (hysteresis) that generates a reaction event and stores history information for an IP SLAs operation.
Step 10	**timeout** *milliseconds* **Example:** `Router(config-ip-sla-voip-rtp)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 11	**exit** **Example:** `Router(config-ip-sla-voip-rtp)# exit`	Exits IP SLAs VoIP RTP configuration submode and returns to global configuration mode.
Step 12	**ip sla reaction-configuration** *operation-number* **react** *monitored-element* [**action-type** *option*] [**threshold-type** {**average** [*number-of-measurements*] | **consecutive** [*occurrences*] | **immediate** | **never** | **xofy** [*x-value y-value*]}] [**threshold-value** *upper-threshold lower-threshold*] **Example:** `Router(config)# ip sla reaction-configuration 1 react frameLossDS action-type traponly threshold-type consecutive 3`	(Optional) Configures certain actions to occur based on events under the control of Cisco IOS IP SLAs.
Step 13	**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 1 start-time now life forever`	Specifies the scheduling parameters for an IP SLAs operation.
Step 14	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 15	**show ip sla configuration** [*operation-number*] **Example:** `Router# show ip sla configuration 10`	(Optional) Displays configuration values including all defaults for all IP SLAs operations or a specified operation.

Troubleshooting Tips

Use the **debug ip sla trace** and **debug ip sla 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 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 the IP SLAs RTP-Based VoIP Operation

This section provides the following configuration example:

- Configuring an IP SLAs RTP-Based VoIP Operation: Example, page 8

Configuring an IP SLAs RTP-Based VoIP Operation: Example

The following example shows how to configure an IP SLAs RTP-based VoIP operation:

```
ip sla 1
 voip rtp 10.2.3.4 source-ip 10.5.6.7 source-voice-port 1/0:1 codec g711alaw duration 30
advantage-factor 5
!
ip sla reaction-configuration 1 react FrameLossDS action-type traponly threshold-type
consecutive 3
!
ip sla schedule 1 start-time now life forever
```

Use the **show ip sla statistics** command in privileged EXEC mode to display the current operational status and statistics for an IP SLAs operation. Use the **show ip sla statistics aggregated** command in privileged EXEC mode to display the aggregated hourly status and statistics for an IP SLAs operation.

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 the IP SLAs RTP-Based VoIP Operation feature.

Related Documents

Related Topic	Document Title
Cisco IOS IP SLAs UDP-based VoIP operations for VoIP networks	"IP SLAs—Analyzing VoIP Service Levels Using the VoIP Jitter Operation" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4
Cisco IOS IP SLAs command line interface enhancements for Cisco IOS Releases 12.4 and 12.4T	*Cisco IOS IP Service Level Agreements Command Line Interface*, Cisco white paper http://www.cisco.com/en/US/products/ps6602/products_white_paper0900aecd8022c2cc.shtml
Cisco IOS IP SLAs configuration tasks	*Cisco IOS IP SLAs Configuration Guide*, Release 12.4
Cisco IOS IP SLAs commands	*Cisco IOS IP SLAs Command Reference*, Release 12.4T

Standards

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

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 Technical Support website contains thousands of 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/techsupport

Command Reference

This section documents new commands only.

- **ip sla reaction-configuration**
- **voip rtp**

ip sla reaction-configuration

To configure certain actions to occur based on events under the control of Cisco IOS IP Service Level Agreements (SLAs), use the **ip sla reaction-configuration** command in global configuration mode. To clear all reaction configuration for a specified IP SLAs operation, use the **no** form of this command.

ip sla reaction-configuration *operation-number* **react** *monitored-element* [**action-type** *option*] [**threshold-type** {**average** [*number-of-measurements*] | **consecutive** [*occurrences*] | **immediate** | **never** | **xofy** [*x-value y-value*]}] [**threshold-value** *upper-threshold lower-threshold*]

no ip sla reaction-configuration *operation-number*

Syntax Description

operation-number	Number of the IP SLAs operation for which reactions are to be configured.
react *monitored-element*	(Optional) Specifies the element to be monitored for violations. **Note** The elements available for monitoring will vary depending on the type of IP SLAs operation you are running. Keyword options for the *monitored-element* argument are as follows: • **connectionLoss**—Specifies that a reaction should occur if there is a one-way connection loss for the monitored operation. The **threshold-value** keyword does not apply to this monitored element. • **frameLossDS**—Specifies that a reaction should occur if the one-way destination-to-source digital signal processor (DSP) frame loss value violates the upper threshold or lower threshold. • **iaJitterDS**—Specifies that a reaction should occur if the one-way destination-to-source interarrival jitter value violates the upper threshold or lower threshold. • **iaJitterSD**—Specifies that a reaction should occur if the one-way source-to-destination interarrival jitter value violates the upper threshold or lower threshold. • **icpif**—Specifies that a reaction should occur if the one-way Calculated Planning Impairment Factor (ICPIF) value violates the upper threshold or lower threshold. • **jitterAvg**—Specifies that a reaction should occur if the average round-trip jitter value violates the upper threshold or lower threshold. • **jitterDSAvg**—Specifies that a reaction should occur if the average one-way destination-to-source jitter value violates the upper threshold or lower threshold. • **jitterSDAvg**—Specifies that a reaction should occur if the average one-way source-to-destination jitter value violates the upper threshold or lower threshold.

react *monitored-element* (continued)	• **latencyDSAvg**—Specifies that a reaction should occur if the average one-way destination-to-source latency value violates the upper threshold or lower threshold. • **latencySDAvg**—Specifies that a reaction should occur if the average one-way source-to-destination latency value violates the upper threshold or lower threshold. • **maxOflatencyDS**—Specifies that a reaction should occur if the one-way maximum latency destination-to-source threshold is violated. • **maxOflatencySD**—Specifies that a reaction should occur if the one-way maximum latency source-to-destination threshold is violated. • **maxOfNegativeDS**—Specifies that a reaction should occur if the one-way maximum negative jitter destination-to-source threshold is violated. • **maxOfNegativeSD**—Specifies that a reaction should occur if the one-way maximum negative jitter source-to-destination threshold is violated. • **maxOfPositiveDS**—Specifies that a reaction should occur if the one-way maximum positive jitter destination-to-source threshold is violated. • **maxOfPositiveSD**—Specifies that a reaction should occur if the one-way maximum positive jitter source-to-destination threshold is violated. • **mos**—Specifies that a reaction should occur if the one-way Mean Opinion Score (MOS) value violates the upper threshold or lower threshold. • **moscqds—**Specifies that a reaction should occur if the one-way destination-to-source Mean Opinion Score for Conversational Quality (MOS-CQ) value violates the upper threshold or lower threshold. • **moscqsd—**Specifies that a reaction should occur if the one-way source-to-destination Mean Opinion Score for Conversational Quality (MOS-CQ) value violates the upper threshold or lower threshold. • **moslqds—**Specifies that a reaction should occur if the one-way destination-to-source Mean Opinion Score for Listening Quality (MOS-LQ) value violates the upper threshold or lower threshold. • **packetLateArrival**—Specifies that a reaction should occur if the one-way number of late packets violates the upper threshold or lower threshold.

react *monitored-element* (continued)	• **packetLoss**—Specifies that a reaction should occur if the packet loss value violates the upper threshold or lower threshold. The path of the packets is unknown. • **packetLossDS**—Specifies that a reaction should occur if the one-way destination-to-source packet loss value violates the upper threshold or lower threshold. • **packetLossSD**—Specifies that a reaction should occur if the one-way source-to-destination packet loss value violates the upper threshold or lower threshold. • **packetMIA**—Specifies that a reaction should occur if the one-way number of missing packets violates the upper threshold or lower threshold. • **packetOutOfSequence**—Specifies that a reaction should occur if the one-way number of packets out of sequence violates the upper threshold or lower threshold. • **rFactorDS**—Specifies that a reaction should occur if the one-way destination-to-source estimated transmission rating factor R violates the upper threshold or lower threshold. • **rFactorSD**—Specifies that a reaction should occur if the one-way source-to-destination estimated transmission rating factor R violates the upper threshold or lower threshold. • **rtt**—Specifies that a reaction should occur if the round-trip time violates the upper threshold or lower threshold. • **successivePacketLoss**—Specifies that a reaction should occur if the one-way number of successively dropped packets violates the upper threshold or lower threshold. • **timeout**—Specifies that a reaction should occur if there is a one-way timeout for the monitored operation. The **threshold-value** keyword does not apply to this monitored element. • **verifyError**—Specifies that a reaction should occur if there is a one-way error verification violation. The **threshold-value** keyword does not apply to this monitored element.

action-type *option*	(Optional) Specifies what action or combination of actions the operation performs when threshold events occur. If the **threshold-type never** keywords are defined, the **action-type** keyword is disabled. The *option* argument can be one of the following keywords: • **none**—No action is taken. This option is the default value. • **trapAndTrigger**—Trigger a Simple Network Management Protocol (SNMP) trap and start another IP SLAs operation when the violation conditions are met, as defined in the **trapOnly** and **triggerOnly** options. • **trapOnly**—Send an SNMP logging trap when the specified violation type occurs for the monitored element. IP SLAs logging traps are enabled using the **ip sla logging traps** command. • **triggerOnly**—Have one or more target operation's operational state make the transition from pending to active when the violation conditions are met. The target operations to be triggered are specified using the **ip sla reaction-trigger** command. A target operation will continue until its life expires, as specified by the target operation's configured lifetime value. A triggered target operation must finish its life before it can be triggered again.
threshold-type average [*number-of-measurements*]	(Optional) When the average of a specified number of measurements for the monitored element exceeds the upper threshold or when the average of a specified number of measurements for the monitored element drops below the lower threshold, perform the action defined by the **action-type** keyword. For example, if the upper threshold for **react rtt threshold-type average 3** is configured as 5000 ms and the last three results of the operation are 6000, 6000, and 5000 ms, the average would be 6000 + 6000 + 5000 = 17000/3 = 5667, thus violating the 5000 ms upper threshold. The default number of 5 averaged measurements can be changed using the *number-of-measurements* argument. The valid range is from 1 to 16. This syntax is not available if the **connectionLoss**, **timeout**, or **verifyError** keyword is specified as the monitored element, because upper and lower thresholds do not apply to these options.
threshold-type consecutive [*occurrences*]	(Optional) When the reaction conditions (such as threshold violations) for the monitored element are met consecutively for a specified number of times, perform the action defined by the **action-type** keyword. The default number of 5 consecutive occurrences can be changed using the *occurrences* argument. The valid range is from 1 to 16. The *occurrences* value will appear in the output of the **show ip sla reaction-configuration** command as the "Threshold Count" value.
threshold-type immediate	(Optional) When the reaction conditions (such as threshold violations) for the monitored element are met, immediately perform the action defined by the **action-type** keyword.
threshold-type never	(Optional) Do not calculate threshold violations. This is the default threshold type.

threshold-type xofy [*x-value y-value*]	(Optional) When the reaction conditions (such as threshold violations) for the monitored element are met *x* number of times within the last *y* number of measurements ("x of y"), perform the action defined by the **action-type** keyword. The default is 5 for both the x and y values (**xofy 5 5**). The valid range for each value is from 1 to 16. The *x-value* will appear in the output of the **show ip sla reaction-configuration** command as the "Threshold Count" value, and the *y-value* will appear as the "Threshold Count2" value.
threshold-value *upper-threshold lower-threshold*	(Optional) Specifies the upper-threshold and lower-threshold values of the applicable monitored elements. See Table 3 in the "Usage Guidelines" section for a list of the default values. **Note** For MOS threshold values (**react mos**), the number is expressed in three digits representing ones, tenths, and hundredths. For example, to express a MOS threshold of 3.20, enter **320**. The valid range is from 100 (1.00) to 500 (5.00).

Defaults

No IP SLAs reactions are generated.
Error verification is disabled.
Connection loss and timeout logging are disabled.

Note See Table 3 in the "Usage Guidelines" section for a list of the default upper and lower thresholds for specific monitored elements.

Command Modes

Global configuration

Command History

Release	Modification
12.4(4)T	This command was introduced. This command replaces the **ip sla monitor reaction-configuration** command. The following keywords for the *monitored-element* argument were added to support the IP SLAs RTP-based VoIP operation: • **frameLossDS** • **iaJitterDS** • **moscqds** • **moslqds** • **rFactorDS**
12.4(6)T	The following keywords for the *monitored-element* argument were added to support the IP SLAs ICMP jitter and IP SLAs RTP-based VoIP operations: • **iaJitterSD** • **latencyDSAvg** • **latencySDAvg** • **maxOflatencyDS** • **maxOflatencySD** • **moscqsd** • **packetLoss** • **rFactorSD** • **successivePacketLoss**

Usage Guidelines

You can configure the **ip sla reaction-configuration** command multiple times to allow reactions for multiple monitored elements (for example, configuring thresholds for destination-to-source packet loss and MOS) for the same operation. However, entering the **no ip sla reaction-configuration** *operation-number* command will clear all reaction configuration for the specified operation. In other words, disabling of granular reaction elements (for example, entering the **no ip sla reaction-configuration** *operation-number* **react** *monitored-element* command) is not supported, so as to provide backwards compatibility with the earlier version of this command.

SNMP traps for IP SLAs are supported by the CISCO-RTTMON-MIB and CISCO-SYSLOG-MIB. The **ip sla logging traps** command is used to enable the generation of SNMP traps specific to IP SLAs threshold violations.

You can check the configuration of the IP SLAs reaction configuration using the **show ip sla reaction-configuration** command.

Note Keywords are not case sensitive and are shown in mixed case for readability only.

Table 3 lists the default upper and lower thresholds for specific monitored elements.

Table 3 Default Threshold Values for Monitored Elements

Monitored Element Keyword	Upper Threshold	Lower Threshold
frameLossDS	1000 frames	1000 frames
iaJitterDS	20 ms	20 ms
iaJitterSD	20 ms	20 ms
icpif	93 (score)	93 (score)
jitterAvg	100 ms	100 ms
jitterDSAvg	100 ms	100 ms
jitterSDAvg	100 ms	100 ms
latencyDSAvg	5000 ms	3000 ms
latencySDAvg	5000 ms	3000 ms
maxOflatencyDS	5000 ms	3000 ms
maxOflatencySD	5000 ms	3000 ms
maxOfNegativeDS	10000 ms	10000 ms
maxOfNegativeSD	10000 ms	10000 ms
maxOfPositiveDS	10000 ms	10000 ms
maxOfPositiveSD	10000 ms	10000 ms
mos	500 (score)	100 (score)
moscqds	410 (score)	310 (score)
moscqsd	410 (score)	310 (score)
moslqds	410 (score)	310 (score)
packetLateArrival	10000 packets	10000 packets
packetLoss	10000 packets	10000 packets
packetLossDS	10000 packets	10000 packets
packetLossSD	10000 packets	10000 packets
packetMIA	10000 packets	10000 packets
packetOutOfSequence	10000 packets	10000 packets
rFactorDS	80	60
rFactorSD	80	60
rtt	5000 ms	3000 ms
successivePacketLoss	10000 packets	10000 packets

Examples

In the following example, IP SLAs operation 10 (a UDP jitter operation) is configured to send an SNMP logging trap when the MOS value exceeds 4.9 (best quality) or falls below 2.5 (poor quality):

```
ip sla reaction-configuration 10 react mos threshold-type immediate threshold-value 490
250 action-type trapOnly
```

Related Commands

Command	Description
ip sla	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
ip sla logging traps	Enables the generation of system logging SNMP notifications (traps) specific to IP SLAs thresholds.
ip sla reaction-trigger	Defines a second IP SLAs operation to make the transition from a pending state to an active state when one of the trigger action-type options are defined with the **ip sla reaction-configuration** global configuration command.
show ip sla reaction-configuration	Displays the current configuration for IP SLAs reactions.
show ip sla reaction-trigger	Displays the configured state of triggered IP SLAs operations.
timeout	Sets the amount of time the IP SLAs operation waits for a response from its request packet.

voip rtp

To configure a Cisco IOS IP Service Level Agreement (SLAs) RTP-based Voice over IP (VoIP) operation, use the **voip rtp** command in IP SLA configuration mode.

voip rtp {*destination-ip-address* | *destination-hostname*} **source-ip** {*ip-address* | *hostname*} **source-voice-port** {*slot* [*/subunit/port*:*ds0-group-number*]} [**codec** *codec-type*] [**duration** *seconds*] [**advantage-factor** *value*]

Syntax Description

destination-ip-address | *destination-hostname*	Destination IP address or hostname.
source-ip {*ip-address* | *hostname*}	Specifies the source IP address or hostname.
source-voice-port	Specifies the source voice port.
slot	Source slot number.
/subunit	Source subunit number. A slash must precede this value.
/port	Source port number. A slash must precede this value.
:*ds0-group-number*	Source DS0 group number. A colon must precede this value.
codec *codec-type*	(Optional) Enables the generation of estimated voice quality scores in the form of Calculated Planning Impairment Factor (ICPIF) and Mean Opinion Score (MOS) values. The codec type should match the encoding algorithm you are using for VoIP transmissions. The following codec type keywords are available: • **g711alaw**—The G.711 A-Law codec (64 kbps transmission) • **g711ulaw**—The G.711 muHmm-Law codec (64 kbps transmission) • **g729a**—The G.729A codec (8 kbps transmission) Default codec type is the G.729A codec.
duration *seconds*	(Optional) Specifies the duration (in seconds) of the test call. The default is 20 seconds.
advantage-factor *value*	(Optional) Specifies the expectation factor to be used for ICPIF calculations. This value is subtracted from the measured impairments to yield the final ICPIF value (and corresponding MOS value). The valid range is from 0 to 20. The default is 0.

Command Default

No IP SLAs operation type is configured for the operation being configured.

Command Modes

IP SLA configuration (config-ip-sla)

Command History

Release	Modification
12.4(4)T	This command was introduced.

Usage Guidelines

You must configure the type of IP SLAs operation (such as User Datagram Protocol [UDP] jitter or Internet Control Message Protocol [ICMP] echo) before you can configure any of the other parameters of the operation. To change the operation type of an existing IP SLAs operation, you must first delete the IP SLAs operation (using the **no ip sla** global configuration command) and then reconfigure the operation with the new operation type.

Examples

The following example shows how to configure an IP SLAs RTP-based VoIP operation:

```
ip sla 1
 voip rtp 10.2.3.4 source-ip 10.5.6.7 source-voice-port 1/0:1 codec g711alaw duration 30
advantage-factor 5
 exit
!
ip sla reaction-configuration 1 react FrameLossDS threshold-type consecutive 3 action-type
traponly
!
ip sla schedule 1 start-time now life forever
```

Related Commands

Command	Description
ip sla	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode

Feature Information for the IP SLAs RTP-Based VoIP Operation

Table 4 lists the feature release history for this feature.

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 4 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 4 Feature Information for the IP SLAs RTP-Based VoIP Operation

Feature Name	Releases	Feature Information
IP SLAs RTP-Based VoIP Operation	12.4(4)T	The Cisco IOS IP Service Level Agreements (SLAs) Internet Control Message Protocol (ICMP) jitter operation provides the capability to generate a stream of ICMP packets to gather network performance-related statistics. Available statistical measurements for the IP SLAs ICMP jitter operation include latency, round-trip time, jitter (interpacket delay variance), and packet loss between a Cisco device (source) and any other IP device (destination).
IP SLAs RTP-Based VoIP Operation Enhancements	12.4(6)T	New statistical measurement options for the source-to-destination data path were added.