Cisco IOS IP SLAs Configuration Guide

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About Cisco IOS and Cisco IOS XE Software Documentation

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This document describes the objectives, audience, conventions, and organization used in Cisco IOS and Cisco IOS XE software documentation, collectively referred to in this document as Cisco IOS documentation. Also included are resources for obtaining technical assistance, additional documentation, and other information from Cisco. This document is organized into the following sections:

Documentation Objectives

Cisco IOS documentation describes the tasks and commands available to configure and maintain Cisco networking devices.

Audience

The Cisco IOS documentation set is i ntended for users who configure and maintain Cisco networking devices (such as routers and switches) but who may not be familiar with the configuration and maintenance tasks, the relationship among tasks, or the Cisco IOS commands necessary to perform particular tasks. The Cisco IOS documentation set is also intended for those users experienced with Cisco IOS who need to know about new features, new configuration options, and new software characteristics in the current Cisco IOS release.

Documentation Conventions

In Cisco IOS documentation, the term *router* may be used to refer to various Cisco products; for example, routers, access servers, and switches. These and other networking devices that support Cisco IOS software are shown interchangeably in examples and are used only for illustrative purposes. An example that shows one product does not necessarily mean that other products are not supported.

This section includes the following topics:

Typographic Conventions

Cisco IOS documentation uses the following typographic conventions:

Convention	Description
^ or Ctrl	Both the ^ symbol and Ctrl represent the Control (Ctrl) key on a keyboard. For example, the key combination **^D** or **Ctrl-D** means that you hold down the Control key while you press the D key. (Keys are indicated in capital letters but are not case sensitive.)
string	A string is a nonquoted set of characters shown in italics. For example, when setting a Simple Network Management Protocol (SNMP) community string to *public*, do not use quotation marks around the string; otherwise, the string will include the quotation marks.

Command Syntax Conventions

Cisco IOS documentation uses the following command syntax conventions:

Convention	Description
bold	Bold text indicates commands and keywords that you enter as shown.
italic	Italic text indicates arguments for which you supply values.
[x]	Square brackets enclose an optional keyword or argument.
|	A vertical line, called a pipe, indicates a choice within a set of keywords or arguments.
[x | y]	Square brackets enclosing keywords or arguments separated by a pipe indicate an optional choice.
{x | y}	Braces enclosing keywords or arguments separated by a pipe indicate a required choice.
[x {y | z}]	Braces and a pipe within square brackets indicate a required choice within an optional element.

Software Conventions

Cisco IOS uses the following program code conventions:

Convention	Description
`Courier font`	Courier font is used for information that is displayed on a PC or terminal screen.
`Bold Courier font`	Bold Courier font indicates text that the user must enter.
< >	Angle brackets enclose text that is not displayed, such as a password. Angle brackets also are used in contexts in which the italic font style is not supported; for example, ASCII text.
!	An exclamation point at the beginning of a line indicates that the text that follows is a comment, not a line of code. An exclamation point is also displayed by Cisco IOS software for certain processes.
[ ]	Square brackets enclose default responses to system prompts.

Reader Alert Conventions

The Cisco IOS documentation set uses the following conventions for reader alerts:

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Documentation Organization

This section describes the Cisco IOS documentation set, how it is organized, and how to access it on Cisco.com. Included are lists of configuration guides, command references, and supplementary references and resources that make up the documentation set. The following topics are included:

Cisco IOS Documentation Set

Cisco IOS documentation consists of the following:

- Release notes and caveats provide information about platform, technology, and feature support for a release and describe severity 1 (catastrophic), severity 2 (severe), and severity 3 (moderate) defects in released Cisco IOS code. Review release notes before other documents to learn whether or not updates have been made to a feature.
- Sets of configuration guides and command references organized by technology and published for each standard Cisco IOS release.
  - Configuration guides—Compilations of documents that provide informational and task-oriented descriptions of Cisco IOS features.
  - Command references—Compilations of command pages that provide detailed information about the commands used in the Cisco IOS features and processes that make up the related configuration guides. For each technology, there is a single command reference that covers all Cisco IOS releases and that is updated at each standard release.
- Lists of all the commands in a specific release and all commands that are new, modified, removed, or replaced in the release.
- Command reference book for **debug** commands. Command pages are listed in alphabetical order.
- Reference book for system messages for all Cisco IOS releases.

Cisco IOS Documentation on Cisco.com

The following sections describe the documentation organization and how to access various document types.

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

New Features List

The New Features List for each release provides a list of all features in the release with hyperlinks to the feature guides in which they are documented.

Feature Guides

Cisco IOS features are documented in feature guides. Feature guides describe one feature or a group of related features that are supported on many different software releases and platforms. Your Cisco IOS software release or platform may not support all the features documented in a feature guide. See the Feature Information table at the end of the feature guide for information about which features in that guide are supported in your software release.

Configuration Guides

Configuration guides are provided by technology and release and comprise a set of individual feature guides relevant to the release and technology.

Command References

Command reference books describe Cisco IOS commands that are supported in many different software releases and on many different platforms. The books are provided by technology. For information about all Cisco IOS commands, use the Command Lookup Tool at http://tools.cisco.com/Support/CLILookup or the *Cisco IOS Master Command List, All Releases*, at http://www.cisco.com/en/US/docs/ios/mcl/all_release/all_mcl.html.

Cisco IOS Supplementary Documents and Resources

Supplementary documents and resources are listed in Table 2 on page xi.

Configuration Guides, Command References, and Supplementary Resources

Table 1 lists, in alphabetical order, Cisco IOS and Cisco IOS XE software configuration guides and command references, including brief descriptions of the contents of the documents. The Cisco IOS command references are comprehensive, meaning that they include commands for both Cisco IOS software and Cisco IOS XE software, for all releases. The configuration guides and command references support many different software releases and platforms. Your Cisco IOS software release or platform may not support all these technologies.

For additional information about configuring and operating specific networking devices, go to the Product Support area of Cisco.com at http://www.cisco.com/web/psa/products/index.html.

Table 2 lists documents and resources that supplement the Cisco IOS software configuration guides and command references. These supplementary resources include release notes and caveats; master command lists; new, modified, removed, and replaced command lists; system messages; and the debug command reference.

Table 1 Cisco IOS and Cisco IOS XE Configuration Guides and Command References

Configuration Guide and Command Reference Titles	Features/Protocols/Technologies
Cisco IOS AppleTalk Configuration Guide *Cisco IOS XE AppleTalk Configuration Guide* *Cisco IOS AppleTalk Command Reference*	AppleTalk protocol.
Cisco IOS Asynchronous Transfer Mode Configuration Guide *Cisco IOS Asynchronous Transfer Mode Command Reference*	LAN ATM, multiprotocol over ATM (MPoA), and WAN ATM.

Table 1 Cisco IOS and Cisco IOS XE Configuration Guides and Command References (continued)

Configuration Guide and Command Reference Titles	Features/Protocols/Technologies
Cisco IOS Bridging and IBM Networking Configuration Guide *Cisco IOS Bridging Command Reference* *Cisco IOS IBM Networking Command Reference*	• Transparent and source-route transparent (SRT) bridging, source-route bridging (SRB), Token Ring Inter-Switch Link (TRISL), and token ring route switch module (TRRSM). • Data-link switching plus (DLSw+), serial tunnel (STUN), block serial tunnel (BSTUN); logical link control, type 2 (LLC2), synchronous data link control (SDLC); IBM Network Media Translation, including Synchronous Data Logical Link Control (SDLLC) and qualified LLC (QLLC); downstream physical unit (DSPU), Systems Network Architecture (SNA) service point, SNA frame relay access, advanced peer-to-peer networking (APPN), native client interface architecture (NCIA) client/server topologies, and IBM Channel Attach.
Cisco IOS Broadband and DSL Configuration Guide *Cisco IOS XE Broadband and DSL Configuration Guide* *Cisco IOS Broadband and DSL Command Reference*	Point-to-Point Protocol (PPP) over ATM (PPPoA) and PPP over Ethernet (PPPoE).
Cisco IOS Carrier Ethernet Configuration Guide *Cisco IOS Carrier Ethernet Command Reference*	Connectivity fault management (CFM), Ethernet Local Management Interface (ELMI), IEEE 802.3ad link bundling, Link Layer Discovery Protocol (LLDP), media endpoint discovery (MED), and operations, administration, and maintenance (OAM).
Cisco IOS Configuration Fundamentals Configuration Guide *Cisco IOS XE Configuration Fundamentals Configuration Guide* *Cisco IOS Configuration Fundamentals Command Reference*	Autoinstall, Setup, Cisco IOS command-line interface (CLI), Cisco IOS file system (IFS), Cisco IOS web browser user interface (UI), basic file transfer services, and file management.
Cisco IOS DECnet Configuration Guide *Cisco IOS XE DECnet Configuration Guide* *Cisco IOS DECnet Command Reference*	DECnet protocol.
Cisco IOS Dial Technologies Configuration Guide *Cisco IOS XE Dial Technologies Configuration Guide* *Cisco IOS Dial Technologies Command Reference*	Asynchronous communications, dial backup, dialer technology, dial-in terminal services and AppleTalk remote access (ARA), large scale dialout, dial-on-demand routing, dialout, modem and resource pooling, ISDN, multilink PPP (MLP), PPP, virtual private dialup network (VPDN).
Cisco IOS Flexible NetFlow Configuration Guide *Cisco IOS Flexible NetFlow Command Reference*	Flexible NetFlow.

Table 1 Cisco IOS and Cisco IOS XE Configuration Guides and Command References (continued)

Configuration Guide and Command Reference Titles	Features/Protocols/Technologies
Cisco IOS H.323 Configuration Guide	Gatekeeper enhancements for managed voice services, Gatekeeper Transaction Message Protocol, gateway codec order preservation and shutdown control, H.323 dual tone multifrequency relay, H.323 version 2 enhancements, Network Address Translation (NAT) support of H.323 v2 Registration, Admission, and Status (RAS) protocol, tokenless call authorization, and VoIP gateway trunk and carrier-based routing.
Cisco IOS High Availability Configuration Guide *Cisco IOS XE High Availability Configuration Guide* *Cisco IOS High Availability Command Reference*	A variety of High Availability (HA) features and technologies that are available for different network segments (from enterprise access to service provider core) to facilitate creation of end-to-end highly available networks. Cisco IOS HA features and technologies can be categorized in three key areas: system-level resiliency, network-level resiliency, and embedded management for resiliency.
Cisco IOS Integrated Session Border Controller Command Reference	A VoIP-enabled device that is deployed at the edge of networks. An SBC is a toolkit of functions, such as signaling interworking, network hiding, security, and quality of service (QoS).
Cisco IOS Intelligent Service Gateway Configuration Guide *Cisco IOS Intelligent Service Gateway Command Reference*	Subscriber identification, service and policy determination, session creation, session policy enforcement, session life-cycle management, accounting for access and service usage, session state monitoring.
Cisco IOS Interface and Hardware Component Configuration Guide *Cisco IOS XE Interface and Hardware Component Configuration Guide* *Cisco IOS Interface and Hardware Component Command Reference*	LAN interfaces, logical interfaces, serial interfaces, virtual interfaces, and interface configuration.
Cisco IOS IP Addressing Services Configuration Guide *Cisco IOS XE Addressing Services Configuration Guide* *Cisco IOS IP Addressing Services Command Reference*	Address Resolution Protocol (ARP), Network Address Translation (NAT), Domain Name System (DNS), Dynamic Host Configuration Protocol (DHCP), and Next Hop Address Resolution Protocol (NHRP).
Cisco IOS IP Application Services Configuration Guide *Cisco IOS XE IP Application Services Configuration Guide* *Cisco IOS IP Application Services Command Reference*	Enhanced Object Tracking (EOT), Gateway Load Balancing Protocol (GLBP), Hot Standby Router Protocol (HSRP), IP Services, Server Load Balancing (SLB), Stream Control Transmission Protocol (SCTP), TCP, Web Cache Communication Protocol (WCCP), User Datagram Protocol (UDP), and Virtual Router Redundancy Protocol (VRRP).
Cisco IOS IP Mobility Configuration Guide *Cisco IOS IP Mobility Command Reference*	Mobile ad hoc networks (MANet) and Cisco mobile networks.
Cisco IOS IP Multicast Configuration Guide *Cisco IOS XE IP Multicast Configuration Guide* *Cisco IOS IP Multicast Command Reference*	Protocol Independent Multicast (PIM) sparse mode (PIM-SM), bidirectional PIM (bidir-PIM), Source Specific Multicast (SSM), Multicast Source Discovery Protocol (MSDP), Internet Group Management Protocol (IGMP), and Multicast VPN (MVPN).

Table 1 Cisco IOS and Cisco IOS XE Configuration Guides and Command References (continued)

Configuration Guide and Command Reference Titles	Features/Protocols/Technologies
Cisco IOS IP Routing Protocols Configuration Guide *Cisco IOS XE IP Routing Protocols Configuration Guide* *Cisco IOS IP Routing Protocols Command Reference*	Border Gateway Protocol (BGP), multiprotocol BGP, multiprotocol BGP extensions for IP multicast, bidirectional forwarding detection (BFD), Enhanced Interior Gateway Routing Protocol (EIGRP), Interior Gateway Routing Protocol (IGRP), Intermediate System-to-Intermediate System (IS-IS), on-demand routing (ODR), Open Shortest Path First (OSPF), and Routing Information Protocol (RIP).
Cisco IOS IP SLAs Configuration Guide *Cisco IOS XE IP SLAs Configuration Guide* *Cisco IOS IP SLAs Command Reference*	Cisco IOS IP Service Level Agreements (IP SLAs).
Cisco IOS IP Switching Configuration Guide *Cisco IOS XE IP Switching Configuration Guide* *Cisco IOS IP Switching Command Reference*	Cisco Express Forwarding, fast switching, and Multicast Distributed Switching (MDS).
Cisco IOS IPv6 Configuration Guide *Cisco IOS XE IPv6 Configuration Guide* *Cisco IOS IPv6 Command Reference*	For IPv6 features, protocols, and technologies, go to the IPv6 "Start Here" document at the following URL: http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-roadmap.html
Cisco IOS ISO CLNS Configuration Guide *Cisco IOS XE ISO CLNS Configuration Guide* *Cisco IOS ISO CLNS Command Reference*	ISO connectionless network service (CLNS).
Cisco IOS LAN Switching Configuration Guide *Cisco IOS XE LAN Switching Configuration Guide* *Cisco IOS LAN Switching Command Reference*	VLANs, Inter-Switch Link (ISL) encapsulation, IEEE 802.10 encapsulation, IEEE 802.1Q encapsulation, and multilayer switching (MLS).
Cisco IOS Mobile Wireless Gateway GPRS Support Node Configuration Guide *Cisco IOS Mobile Wireless Gateway GPRS Support Node Command Reference*	Cisco IOS Gateway GPRS Support Node (GGSN) in a 2.5-generation general packet radio service (GPRS) and 3-generation universal mobile telecommunication system (UMTS) network.
Cisco IOS Mobile Wireless Home Agent Configuration Guide *Cisco IOS Mobile Wireless Home Agent Command Reference*	Cisco Mobile Wireless Home Agent, an anchor point for mobile terminals for which mobile IP or proxy mobile IP services are provided.
Cisco IOS Mobile Wireless Packet Data Serving Node Configuration Guide *Cisco IOS Mobile Wireless Packet Data Serving Node Command Reference*	Cisco Packet Data Serving Node (PDSN), a wireless gateway that is between the mobile infrastructure and standard IP networks and that enables packet data services in a code division multiple access (CDMA) environment.
Cisco IOS Mobile Wireless Radio Access Networking Configuration Guide *Cisco IOS Mobile Wireless Radio Access Networking Command Reference*	Cisco IOS radio access network products.

Table 1 Cisco IOS and Cisco IOS XE Configuration Guides and Command References (continued)

Configuration Guide and Command Reference Titles	Features/Protocols/Technologies
Cisco IOS Multiprotocol Label Switching Configuration Guide *Cisco IOS XE Multiprotocol Label Switching Configuration Guide* *Cisco IOS Multiprotocol Label Switching Command Reference*	MPLS Label Distribution Protocol (LDP), MPLS Layer 2 VPNs, MPLS Layer 3 VPNs, MPLS Traffic Engineering (TE), and MPLS Embedded Management (EM) and MIBs.
Cisco IOS Multi-Topology Routing Configuration Guide *Cisco IOS Multi-Topology Routing Command Reference*	Unicast and multicast topology configurations, traffic classification, routing protocol support, and network management support.
Cisco IOS NetFlow Configuration Guide *Cisco IOS XE NetFlow Configuration Guide* *Cisco IOS NetFlow Command Reference*	Network traffic data analysis, aggregation caches, export features.
Cisco IOS Network Management Configuration Guide *Cisco IOS XE Network Management Configuration Guide* *Cisco IOS Network Management Command Reference*	Basic system management; system monitoring and logging; troubleshooting, logging, and fault management; Cisco Discovery Protocol; Cisco IOS Scripting with Tool Control Language (Tcl); Cisco networking services (CNS); DistributedDirector; Embedded Event Manager (EEM); Embedded Resource Manager (ERM); Embedded Syslog Manager (ESM); HTTP; Remote Monitoring (RMON); SNMP; and VPN Device Manager Client for Cisco IOS Software (XSM Configuration).
Cisco IOS Novell IPX Configuration Guide *Cisco IOS XE Novell IPX Configuration Guide* *Cisco IOS Novell IPX Command Reference*	Novell Internetwork Packet Exchange (IPX) protocol.
Cisco IOS Optimized Edge Routing Configuration Guide *Cisco IOS Optimized Edge Routing Command Reference*	Optimized edge routing (OER) monitoring, policy configuration, routing control, logging and reporting, and VPN IPsec/generic routing encapsulation (GRE) tunnel interface optimization.
Cisco IOS Quality of Service Solutions Configuration Guide *Cisco IOS XE Quality of Service Solutions Configuration Guide* *Cisco IOS Quality of Service Solutions Command Reference*	Class-based weighted fair queuing (CBWFQ), custom queuing, distributed traffic shaping (DTS), generic traffic shaping (GTS), IP- to-ATM class of service (CoS), low latency queuing (LLQ), modular QoS CLI (MQC), Network-Based Application Recognition (NBAR), priority queuing, Security Device Manager (SDM), Multilink PPP (MLPPP) for QoS, header compression, AutoQoS, QoS features for voice, Resource Reservation Protocol (RSVP), weighted fair queuing (WFQ), and weighted random early detection (WRED).
Cisco IOS Security Configuration Guide *Cisco IOS XE Security Configuration Guide* *Cisco IOS Security Command Reference*	Access control lists (ACLs), authentication, authorization, and accounting (AAA), firewalls, IP security and encryption, neighbor router authentication, network access security, network data encryption with router authentication, public key infrastructure (PKI), RADIUS, TACACS+, terminal access security, and traffic filters.

Table 1 Cisco IOS and Cisco IOS XE Configuration Guides and Command References (continued)

Configuration Guide and Command Reference Titles	Features/Protocols/Technologies
Cisco IOS Service Selection Gateway Configuration Guide *Cisco IOS Service Selection Gateway Command Reference*	Subscriber authentication, service access, and accounting.
Cisco IOS Software Activation Configuration Guide *Cisco IOS Software Activation Command Reference*	An orchestrated collection of processes and components to activate Cisco IOS software feature sets by obtaining and validating Cisco software licenses.
Cisco IOS Software Modularity Installation and Configuration Guide *Cisco IOS Software Modularity Command Reference*	Installation and basic configuration of software modularity images, including installations on single and dual route processors, installation rollbacks, software modularity binding, software modularity processes and patches.
Cisco IOS Terminal Services Configuration Guide *Cisco IOS Terminal Services Command Reference* *Cisco IOS XE Terminal Services Command Reference*	DEC, local-area transport (LAT), and X.25 packet assembler/disassembler (PAD).
Cisco IOS Virtual Switch Command Reference	Virtual switch redundancy, high availability, and packet handling; converting between standalone and virtual switch modes; virtual switch link (VSL); Virtual Switch Link Protocol (VSLP). **Note** For information about virtual switch configuration, refer to the product-specific software configuration information for the Cisco Catalyst 6500 series switch or for the Metro Ethernet 6500 series switch.
Cisco IOS Voice Configuration Library *Cisco IOS Voice Command Reference*	Cisco IOS support for voice call control protocols, interoperability, physical and virtual interface management, and troubleshooting. The library includes documentation for IP telephony applications.
Cisco IOS VPDN Configuration Guide *Cisco IOS XE VPDN Configuration Guide* *Cisco IOS VPDN Command Reference*	Layer 2 Tunneling Protocol (L2TP) dial-out load balancing and redundancy, L2TP extended failover, L2TP security VPDN, multihop by Dialed Number Identification Service (DNIS), timer and retry enhancements for L2TP and Layer 2 Forwarding (L2F), RADIUS Attribute 82: tunnel assignment ID, shell-based authentication of VPDN users, tunnel authentication via RADIUS on tunnel terminator.
Cisco IOS Wide-Area Networking Configuration Guide *Cisco IOS XE Wide-Area Networking Configuration Guide* *Cisco IOS Wide-Area Networking Command Reference*	Frame Relay, Layer 2 Tunneling Protocol Version 3 (L2TPv3), Link Access Procedure, Balanced (LAPB), Switched Multimegabit Data Service (SMDS), and X.25.
Cisco IOS Wireless LAN Configuration Guide *Cisco IOS Wireless LAN Command Reference*	Broadcast key rotation, IEEE 802.11x support, IEEE 802.1x authenticator, IEEE 802.1x local authentication service for Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling (EAP-FAST), Multiple Basic Service Set ID (BSSID), Wi-Fi Multimedia (WMM) required elements, and Wi-Fi Protected Access (WPA).

Table 2 Cisco IOS Supplementary Documents and Resources

Document Title	Description
Cisco IOS Master Command List, All Releases	Alphabetical list of all the commands documented in all Cisco IOS releases.
Cisco IOS New, Modified, Removed, and Replaced Commands	List of all the new, modified, removed, and replaced commands for a Cisco IOS release.
Cisco IOS Software System Messages	List of Cisco IOS system messages and descriptions. System messages may indicate problems with your system; be informational only; or may help diagnose problems with communications lines, internal hardware, or the system software.
Cisco IOS Debug Command Reference	Alphabetical list of **debug** commands including brief descriptions of use, command syntax, and usage guidelines.
Release Notes and Caveats	Information about new and changed features, system requirements, and other useful information about specific software releases; information about defects in specific Cisco IOS software releases.
MIBs	Files used for network monitoring. To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator at the following URL: http://www.cisco.com/go/mibs
RFCs	Standards documents maintained by the Internet Engineering Task Force (IETF) that Cisco IOS documentation references where applicable. The full text of referenced RFCs may be obtained at the following URL: http://www.rfc-editor.org/

Additional Resources and Documentation Feedback

What's New in Cisco Product Documentation is published monthly and describes all new and revised Cisco technical documentation. The *What's New in Cisco Product Documentation* publication also provides information about obtaining the following resources:

- Technical documentation
- Cisco product security overview
- Product alerts and field notices
- Technical assistance

Cisco IOS technical documentation includes embedded feedback forms where you can rate documents and provide suggestions for improvement. Your feedback helps us improve our documentation.

Using the Command-Line Interface in Cisco IOS and Cisco IOS XE Software

Last updated: August 6, 2008

This document provides basic information about the command-line interface (CLI) in Cisco IOS and Cisco IOS XE software and how you can use some of the CLI features. This document contains the following sections:

For more information about using the CLI, see the "Using the Cisco IOS Command-Line Interface" section of the *Cisco IOS Configuration Fundamentals Configuration Guide*.

For information about the software documentation set, see the "About Cisco IOS and Cisco IOS XE Software Documentation" document.

Initially Configuring a Device

Initially configuring a device varies by platform. For information about performing an initial configuration, see the hardware installation documentation that is provided with the original packaging of the product or go to the Product Support area of Cisco.com at http://www.cisco.com/web/psa/products/index.html.

After you have performed the initial configuration and connected the device to your network, you can configure the device by using the console port or a remote access method, such as Telnet or Secure Shell (SSH), to access the CLI or by using the configuration method provided on the device, such as Security Device Manager.

Changing the Default Settings for a Console or AUX Port

There are only two changes that you can make to a console port and an AUX port:

- Change the port speed with the **config-register 0x** command. Changing the port speed is not recommended. The well-known default speed is 9600.
- Change the behavior of the port; for example, by adding a password or changing the timeout value.

Note The AUX port on the Route Processor (RP) installed in a Cisco ASR1000 series router does not serve any useful customer purpose and should be accessed only under the advisement of a customer support representative.

Using the CLI

This section describes the following topics:

Understanding Command Modes

The CLI command mode structure is hierarchical, and each mode supports a set of specific commands. This section describes the most common of the many modes that exist.

Table 1 lists common command modes with associated CLI prompts, access and exit methods, and a brief description of how each mode is used.

Table 1 CLI Command Modes

Command Mode	Access Method	Prompt	Exit Method	Mode Usage
User EXEC	Log in.	`Router>`	Issue the **logout** or **exit** command.	• Change terminal settings. • Perform basic tests. • Display device status.
Privileged EXEC	From user EXEC mode, issue the **enable** command.	`Router#`	Issue the **disable** command or the **exit** command to return to user EXEC mode.	• Issue **show** and **debug** commands. • Copy images to the device. • Reload the device. • Manage device configuration files. • Manage device file systems.
Global configuration	From privileged EXEC mode, issue the **configure terminal** command.	`Router(config)#`	Issue the **exit** command or the **end** command to return to privileged EXEC mode.	Configure the device.
Interface configuration	From global configuration mode, issue the **interface** command.	`Router(config-if)#`	Issue the **exit** command to return to global configuration mode or the **end** command to return to privileged EXEC mode.	Configure individual interfaces.
Line configuration	From global configuration mode, issue the **line vty** or **line console** command.	`Router(config-line)#`	Issue the **exit** command to return to global configuration mode or the **end** command to return to privileged EXEC mode.	Configure individual terminal lines.

Table 1 CLI Command Modes (continued)

Command Mode	Access Method	Prompt	Exit Method	Mode Usage
ROM monitor	From privileged EXEC mode, issue the **reload** command. Press the **Break** key during the first 60 seconds while the system is booting.	`rommon # >` The # symbol represents the line number and increments at each prompt.	Issue the **continue** command.	• Run as the default operating mode when a valid image cannot be loaded. • Access the fall-back procedure for loading an image when the device lacks a valid image and cannot be booted. • Perform password recovery when a CTRL-Break sequence is issued within 60 seconds of a power-on or reload event.
Diagnostic (available only on the Cisco ASR1000 series router)	The router boots or enters diagnostic mode in the following scenarios. When a Cisco IOS process or processes fail, in most scenarios the router will reload. • A user-configured access policy was configured using the **transport-map** command, which directed the user into diagnostic mode. • The router was accessed using an RP auxiliary port. • A break signal (**Ctrl-C**, **Ctrl-Shift-6**, or the **send break** command) was entered, and the router was configured to enter diagnostic mode when the break signal was received.	`Router(diag)#`	If a Cisco IOS process failure is the reason for entering diagnostic mode, the failure must be resolved and the router must be rebooted to exit diagnostic mode. If the router is in diagnostic mode because of a transport-map configuration, access the router through another port or using a method that is configured to connect to the Cisco IOS CLI. If the RP auxiliary port was used to access the router, use another port for access. Accessing the router through the auxiliary port is not useful for customer purposes.	• Inspect various states on the router, including the Cisco IOS state. • Replace or roll back the configuration. • Provide methods of restarting the Cisco IOS software or other processes. • Reboot hardware, such as the entire router, an RP, an ESP, a SIP, a SPA, or possibly other hardware components. • Transfer files into or off of the router using remote access methods such as FTP, TFTP, and SCP.

EXEC commands are not saved when the software reboots. Commands that you issue in a configuration mode can be saved to the startup configuration. If you save the running configuration to the startup configuration, these commands will execute when the software is rebooted. Global configuration mode is the highest level of configuration mode. From global configuration mode, you can enter a variety of other configuration modes, including protocol-specific modes.

ROM monitor mode is a separate mode that is used when the software cannot load properly. If a valid software image is not found when the software boots or if the configuration file is corrupted at startup, the software might enter ROM monitor mode. Use the question symbol (?) to view the commands that you can use while the device is in ROM monitor mode.

```
rommon 1 > ?
alias               set and display aliases command
boot                boot up an external process
confreg             configuration register utility
cont                continue executing a downloaded image
context             display the context of a loaded image
cookie              display contents of cookie PROM in hex
.
.
.
rommon 2 >
```

The following example shows how the command prompt changes to indicate a different command mode:

```
Router> enable
Router# configure terminal
Router(config)# interface ethernet 1/1
Router(config-if)# ethernet
Router(config-line)# exit
Router(config)# end
Router#
```

Note A keyboard alternative to the **end** command is Ctrl-Z.

Using the Interactive Help Feature

The CLI includes an interactive Help feature. Table 2 describes how to use the Help feature.

Table 2 CLI Interactive Help Commands

Command	Purpose
help	Provides a brief description of the help feature in any command mode.
?	Lists all commands available for a particular command mode.
*partial command***?**	Provides a list of commands that begin with the character string (no space between the command and the question mark).
partial command<**Tab**>	Completes a partial command name (no space between the command and <Tab>).
command **?**	Lists the keywords, arguments, or both associated with the command (space between the command and the question mark).
command keyword **?**	Lists the arguments that are associated with the keyword (space between the keyword and the question mark).

The following examples show how to use the help commands:

help

```
Router> help

Help may be requested at any point in a command by entering a question mark '?'.  If
nothing matches, the help list will be empty and you must backup until entering a '?'
shows the available options.

Two styles of help are provided:

1. Full help is available when you are ready to enter a command argument (e.g. 'show ?')
and describes each possible argument.

2. Partial help is provided when an abbreviated argument is entered and you want to know
what arguments match the input (e.g. 'show pr?'.)
```

?

```
Router# ?
Exec commands:
  access-enable        Create a temporary access-List entry
  access-profile       Apply user-profile to interface
  access-template      Create a temporary access-List entry
  alps                 ALPS exec commands
  archive              manage archive files
<snip>
```

***partial command*?**

```
Router(config)# zo?
zone  zone-pair
```

***partial command*<Tab>**

```
Router(config)# we<Tab> webvpn
```

***command* ?**

```
Router(config-if)# pppoe ?
  enable        Enable pppoe
  max-sessions  Maximum PPPOE sessions
```

***command keyword* ?**

```
Router(config-if)# pppoe enable ?
  group  attach a BBA group
  <cr>
```

Understanding Command Syntax

Command syntax is the format in which a command should be entered in the CLI. Commands include the name of the command, keywords, and arguments. Keywords are alphanumeric strings that are used literally. Arguments are placeholders for values that a user must supply. Keywords and arguments may be required or optional.

Specific conventions convey information about syntax and command elements. Table 3 describes these conventions.

Table 3 CLI Syntax Conventions

Symbol/Text	Function	Notes
< > (angle brackets)	Indicate that the option is an argument.	Sometimes arguments are displayed without angle brackets.
A.B.C.D.	Indicates that you must enter a dotted decimal IP address.	Angle brackets (< >) are not always used to indicate that an IP address is an argument.
WORD (all capital letters)	Indicates that you must enter one word.	Angle brackets (< >) are not always used to indicate that a WORD is an argument.
LINE (all capital letters)	Indicates that you must enter more than one word.	Angle brackets (< >) are not always used to indicate that a LINE is an argument.
<cr> (carriage return)	Indicates the end of the list of available keywords and arguments, and also indicates when keywords and arguments are optional. When <cr> is the only option, you have reached the end of the branch or the end of the command if the command has only one branch.	—

The following examples show syntax conventions:

```
Router(config)# ethernet cfm domain ?
  WORD  domain name
Router(config)# ethernet cfm domain dname ?
  level
Router(config)# ethernet cfm domain dname level ?
  <0-7>  maintenance level number
Router(config)# ethernet cfm domain dname level 7 ?
  <cr>
Router(config)# snmp-server file-transfer access-group 10 ?
  protocol  protocol options
  <cr>
Router(config)# logging host ?
  Hostname or A.B.C.D  IP address of the syslog server
  ipv6                 Configure IPv6 syslog server
Router(config)# snmp-server file-transfer access-group 10 ?
  protocol  protocol options
  <cr>
```

Understanding Enable and Enable Secret Passwords

Some privileged EXEC commands are used for actions that impact the system, and it is recommended that you set a password for these commands to prevent unauthorized use. Two types of passwords, enable (not encrypted) and enable secret (encrypted), can be set. The following commands set these passwords and are issued in global configuration mode:

- **enable** *password*
- **enable secret** *password*

Using an enable secret password is recommended because it is encrypted and more secure than the enable password. When you use an enable secret password, text is encrypted (unreadable) before it is written to the config.text file. When you use an enable password, the text is written as entered (readable) to the config.text file.

Each type of password is case sensitive, can contain from 1 to 25 uppercase and lowercase alphanumeric characters, and can start with a number. Spaces are also valid password characters; for example, "two words" is a valid password. Leading spaces are ignored, but trailing spaces are recognized.

Note Both password commands have numeric keywords that are single integer values. If you choose a number for the first character of your password followed by a space, the system will read the number as if it were the numeric keyword and not as part of your password.

When both passwords are set, the enable secret password takes precedence over the enable password.

To remove a password, use the **no** form of the commands: **no enable** *password* or **no enable secret** *password*.

For more information about password recovery procedures for Cisco products, see http://www.cisco.com/en/US/products/sw/iosswrel/ps1831/products_tech_note09186a00801746e6.shtml.

Using the Command History Feature

The CLI command history feature saves the commands you enter during a session in a command history buffer. The default number of commands saved is 10, but the number is configurable within the range of 0 to 256. This command history feature is particularly useful for recalling long or complex commands.

To change the number of commands saved in the history buffer for a terminal session, issue the **terminal history size** command:

```
Router# terminal history size num
```

A command history buffer is also available in line configuration mode with the same default and configuration options. To set the command history buffer size for a terminal session in line configuration mode, issue the **history** command:

```
Router(config-line)# history [size num]
```

To recall commands from the history buffer, use the following methods:

- Press Ctrl-P or the up arrow key—Recalls commands beginning with the most recent command. Repeat the key sequence to recall successively older commands.

- Press Ctrl-N or the down arrow key—Recalls the most recent commands in the history buffer after they have been recalled using Ctrl-P or the up arrow key. Repeat the key sequence to recall successively more recent commands.

Note The arrow keys function only on ANSI-compatible terminals such as the VT100.

- Issue the **show history** command in user EXEC or privileged EXEC mode—Lists the most recent commands that you entered. The number of commands that are displayed is determined by the setting of the **terminal history size** and **history** commands.

  The CLI command history feature is enabled by default. To disable this feature for a terminal session, issue the **terminal no history** command in user EXEC or privileged EXEC mode or the **no history** command in line configuration mode.

Abbreviating Commands

Typing a complete command name is not always required for the command to execute. The CLI recognizes an abbreviated command when the abbreviation contains enough characters to uniquely identify the command. For example, the **show version** command can be abbreviated as **sh ver**. It cannot be abbreviated as **s ver** because **s** could mean **show**, **set**, or **systat**. The **sh v** abbreviation also is not valid because the **show** command has **vrrp** as a keyword in addition to **version**. (Command and keyword examples from Cisco IOS Release 12.4(13)T.)

Using Aliases for CLI Commands

To save time and the repetition of entering the same command multiple times, you can use a command alias. An alias can be configured to do anything that can be done at the command line, but an alias cannot move between modes, type in passwords, or perform any interactive functions.

Table 4 shows the default command aliases.

Table 4 Default Command Aliases

Command Alias	Original Command
h	help
lo	logout
p	ping
s	show
u or **un**	undebug
w	where

To create a command alias, issue the **alias** command in global configuration mode. The syntax of the command is **alias** *mode command-alias original-command*. Following are some examples:

- Router(config)# **alias exec prt partition**—privileged EXEC mode
- Router(config)# **alias configure sb source-bridge**—global configuration mode
- Router(config)# **alias interface rl rate-limit**—interface configuration mode

To view both default and user-created aliases, issue the **show alias** command.

For more information about the **alias** command, see http://www.cisco.com/en/US/docs/ios/fundamentals/command/reference/cf_book.html.

Using the no and default Forms of Commands

Most configuration commands have a **no** form that is used to reset a command to its default value or disable a feature or function. For example, the **ip routing** command is enabled by default. To disable this command, you would issue the **no ip routing** command. To re-enable IP routing, you would issue the **ip routing** command.

Configuration commands may also have a **default** form, which returns the command settings to their default values. For commands that are disabled by default, using the **default** form has the same effect as using the **no** form of the command. For commands that are enabled by default and have default settings, the **default** form enables the command and returns the settings to their default values.

The **no** and **default** forms of commands are described in the command pages of command references.

Using the debug Command

A **debug** command produces extensive output that helps you troubleshoot problems in your network. These commands are available for many features and functions within Cisco IOS and Cisco IOS XE software. Some **debug** commands are **debug all**, **debug aaa accounting**, and **debug mpls packets**. To use **debug** commands during a Telnet session with a device, you must first enter the **terminal monitor** command. To turn off debugging completely, you must enter the **undebug all** command.

For more information about **debug** commands, see the *Cisco IOS Debug Command Reference* at http://www.cisco.com/en/US/docs/ios/debug/command/reference/db_book.html.

Caution Debugging is a high priority and high CPU utilization process that can render your device unusable. Use **debug** commands only to troubleshoot specific problems. The best times to run debugging are during periods of low network traffic and when few users are interacting with the network. Debugging during these periods decreases the likelihood that the **debug** command processing overhead will affect network performance or user access or response times.

Filtering Output Using Output Modifiers

Many commands produce lengthy output that may use several screens to display. Using output modifiers, you can filter this output to show only the information that you want to see.

Three output modifiers are available and are described as follows:

- **begin** *regular expression*—Displays the first line in which a match of the regular expression is found and all lines that follow.
- **include** *regular expression*—Displays all lines in which a match of the regular expression is found.
- **exclude** *regular expression*—Displays all lines except those in which a match of the regular expression is found.

To use one of these output modifiers, type the command followed by the pipe symbol (|), the modifier, and the regular expression that you want to search for or filter. A regular expression is a case-sensitive alphanumeric pattern. It can be a single character or number, a phrase, or a more complex string.

The following example illustrates how to filter output of the **show interface** command to display only lines that include the expression "protocol."

```
Router# show interface | include protocol

FastEthernet0/0 is up, line protocol is up
Serial4/0 is up, line protocol is up
Serial4/1 is up, line protocol is up
Serial4/2 is administratively down, line protocol is down
Serial4/3 is administratively down, line protocol is down
```

Understanding CLI Error Messages

You may encounter some error messages while using the CLI. Table 5 shows the common CLI error messages.

Table 5 Common CLI Error Messages

Error Message	Meaning	How to Get Help
% Ambiguous command: "show con"	You did not enter enough characters for the command to be recognized.	Reenter the command followed by a space and a question mark (?). The keywords that you are allowed to enter for the command appear.
% Incomplete command.	You did not enter all the keywords or values required by the command.	Reenter the command followed by a space and a question mark (?). The keywords that you are allowed to enter for the command appear.
% Invalid input detected at "^" marker.	You entered the command incorrectly. The caret (^) marks the point of the error.	Enter a question mark (?) to display all the commands that are available in this command mode. The keywords that you are allowed to enter for the command appear.

For more system error messages, see the following documents:

- *Cisco IOS Release 12.2SR System Message Guide*
- *Cisco IOS System Messages, Volume 1 of 2* (Cisco IOS Release 12.4)
- *Cisco IOS System Messages, Volume 2 of 2* (Cisco IOS Release 12.4)

Saving Changes to a Configuration

To save changes that you made to the configuration of a device, you must issue the **copy running-config startup-config** command or the **copy system:running-config nvram:startup-config** command. When you issue these commands, the configuration changes that you made are saved to the startup configuration and saved when the software reloads or power to the device is turned off or interrupted. The following example shows the syntax of the **copy running-config startup-config** command:

```
Router# copy running-config startup-config
Destination filename [startup-config]?
```

You press Enter to accept the startup-config filename (the default), or type a new filename and then press Enter to accept that name. The following output is displayed indicating that the configuration was saved:

```
Building configuration...
[OK]
Router#
```

On most platforms, the configuration is saved to NVRAM. On platforms with a Class A flash file system, the configuration is saved to the location specified by the CONFIG_FILE environment variable. The CONFIG_FILE variable defaults to NVRAM.

Additional Information

- "Using the Cisco IOS Command-Line Interface" section of the *Cisco IOS Configuration Fundamentals Configuration Guide*:

  http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_cli-basics.html

  or

  "Using Cisco IOS XE Software" chapter of the *Cisco ASR1000 Series Aggregation Services Routers Software Configuration Guide*:

  http://www.cisco.com/en/US/docs/routers/asr1000/configuration/guide/chassis/using_cli.html
- Cisco Product Support Resources

  http://www.cisco.com/web/psa/products/index.html
- Support area on Cisco.com (also search for documentation by task or product)

  http://www.cisco.com/en/US/support/index.html
- *White Paper: Cisco IOS Reference Guide*

  http://www.cisco.com/en/US/products/sw/iosswrel/ps1828/products_white_paper09186a008018305e.shtml
- Software Download Center (downloads; tools; licensing, registration, advisory, and general information) (requires Cisco.com User ID and password)

  http://www.cisco.com/kobayashi/sw-center/
- Error Message Decoder, a tool to help you research and resolve error messages for Cisco IOS software

  http://www.cisco.com/pcgi-bin/Support/Errordecoder/index.cgi

- Command Lookup Tool, a tool to help you find detailed descriptions of Cisco IOS commands (requires Cisco.com user ID and password)

  http://tools.cisco.com/Support/CLILookup

- Output Interpreter, a troubleshooting tool that analyzes command output of supported **show** commands

  https://www.cisco.com/pcgi-bin/Support/OutputInterpreter/home.pl\

Cisco IOS IP SLAs Features Roadmap

First Published: November 30, 2005
Last Updated: August 1, 2006

This roadmap lists the features documented in the Cisco IOS IP SLAs configuration guide and maps them to the modules in which they appear.

Feature and Release Support

Table 1 lists Cisco IOS IP SLAs feature support for Cisco IOS Releases 12.3T and 12.4.

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*.

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.

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

Table 1 Supported Cisco IOS IP SLAs Features

Release	Feature Name	Feature Description	Where Documented
12.3(14)T	IP SLAs DHCP Operation	The Cisco IOS IP SLAs Dynamic Host Control Protocol (DHCP) operation allows you to schedule and measure the network response time between a Cisco device and a DHCP server to obtain an IP address.	"IP SLAs—Analyzing IP Service Levels Using the DHCP Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsdhcp.htm
	IP SLAs DLSw+ Operation	The Cisco IOS IP SLAs Data Link Switching Plus (DLSw+) operation allows you to schedule and measure the DLSw+ protocol stack and network response time between DLSw+ peers	"IP SLAs—Analyzing IP Service Levels Using the DLSw+ Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsdlsw.htm
	IP SLAs DNS Operation	The Cisco IOS IP SLAs Domain Name System (DNS) operation allows you to measure the difference between the time taken to send a DNS request and receive a reply.	"IP SLAs—Analyzing IP Service Levels Using the DNS Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsdns.htm
	IP SLAs FTP Operation	The Cisco IOS IP SLAs File Transfer Protocol (FTP) operation allows you to measure the network response time between a Cisco device and an FTP server to retrieve a file.	"IP SLAs—Analyzing IP Service Levels Using the FTP Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsftp.htm
	IP SLAs HTTP Operation	The Cisco IOS IP SLAs Hypertext Transfer Protocol (HTTP) operation allows you to measure the network response time between a Cisco device and an HTTP server to retrieve a web page.	"IP SLAs—Analyzing IP Service Levels Using the HTTP Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hshttp.htm
	IP SLAs ICMP Echo Operation	The Cisco IOS IP SLAs Internet Control Message Protocol (ICMP) echo operation allows you to measure end-to-end network response time between a Cisco device and other devices using IP.	"IP SLAs—Analyzing IP Service Levels Using the ICMP Echo Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsicmp.htm

Table 1 Supported Cisco IOS IP SLAs Features (continued)

Release	Feature Name	Feature Description	Where Documented
12.3(14)T (continued)	IP SLAs ICMP Path Echo Operation	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.	"IP SLAs—Analyzing IP Service Levels Using the ICMP Path Echo Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hspaecho.htm
	IP SLAs Multioperation Scheduler	The IP SLAs Multioperation Scheduler feature provides a highly scalable infrastructure for Cisco IOS IP SLAs by allowing you to schedule multiple IP SLAs operations using a single command.	"IP SLAs—Multiple Operation Scheduling" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsmulti.htm
	IP SLAs Path Jitter Operation	The Cisco IOS IP SLAs Internet Control Message Protocol (ICMP) path jitter operation allows you to measure hop-by-hop jitter (inter-packet delay variance).	"IP SLAs—Analyzing IP Service Levels Using the ICMP Path Jitter Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hspthjit.htm
	IP SLAs Proactive Threshold Monitoring	Cisco IOS IP SLAs proactive threshold monitoring capability allows you to configure an IP SLAs operation to react to certain measured network conditions.	"IP SLAs—Proactive Threshold Monitoring" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsthresh.htm
	IP SLAs TCP Connect Operation	The Cisco IOS IP SLAs Transmission Control Protocol (TCP) connect operation allows you to measure the network response time taken to perform a TCP Connect operation between a Cisco device and other devices using IP.	"IP SLAs—Analyzing IP Service Levels Using the TCP Connect Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hstcpc.htm
	IP SLAs UDP Echo Operation	The Cisco IOS IP SLAs User Datagram Protocol (UDP) echo operation allows you to measure end-to-end network response time between a Cisco device and other devices using IP	"IP SLAs—Analyzing IP Service Levels Using the UDP Echo Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsudpe.htm

Table 1 Supported Cisco IOS IP SLAs Features (continued)

Release	Feature Name	Feature Description	Where Documented
12.3(14)T (continued)	IP SLAs UDP Jitter Operation	The Cisco IOS IP SLAs User Datagram Protocol (UDP) jitter operation allows you to measure round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic.	"IP SLAs—Analyzing IP Service Levels Using the UDP Jitter Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsjitter.htm
	IP SLAs VoIP Call Setup (Post Dial Delay) Monitoring	The Cisco IOS IP SLAs Voice over IP (VoIP) call setup operation allows you to measure network response time for setting up a VoIP call.	"IP SLAs—Analyzing IP Service Levels Using the VoIP Call Setup Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hspddly.htm
	IP SLAs VoIP Gatekeeper Delay Monitoring	The Cisco IOS IP SLAs Voice over IP (VoIP) gatekeeper registration delay operation allows you to measure the average, median, or aggregated network response time of registration attempts from a VoIP gateway to a VoIP gatekeeper device.	"IP SLAs—Analyzing IP Service Levels Using the VoIP Gatekeeper Registration Delay Operation" http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/hsgkdly.htm

Cisco IOS IP SLAs Overview

First Published: May 2, 2005
Last Updated: December 8, 2005

This module describes Cisco IOS IP Service Level Agreements (SLAs). Cisco IOS IP SLAs is a core part of the Cisco IOS Software portfolio 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. Cisco IOS IP SLAs uses active traffic monitoring—the generation of traffic in a continuous, reliable, and predictable manner—for measuring network performance. Using Cisco IOS IP SLAs, service provider customers can measure and provide service level agreements, and enterprise customers can verify service levels, verify outsourced service level agreements, and understand network performance. Cisco IOS IP SLAs can perform network assessments, verify quality of service (QOS), ease the deployment of new services, and assist administrators with network troubleshooting. Cisco IOS IP SLAs can be accessed using the Cisco IOS command-line interface (CLI) or Simple Network Management Protocol (SNMP) through the Cisco Round-Trip Time Monitor (RTTMON) and SYSLOG Management Information Bases (MIBs).

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.

Contents

CISCO SYSTEMS

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Prerequisites for Cisco IOS IP SLAs

Knowledge of general networking protocols and your specific network design is assumed. Familiarity with network management applications is useful.

Information About Cisco IOS IP SLAs

To implement general configuration and scheduling of Cisco IOS IP SLAs, you should understand the following concepts:

Cisco IOS IP SLAs Technology Overview

Cisco IOS IP SLAs uses active traffic monitoring—the generation of traffic in a continuous, reliable, and predictable manner—for measuring network performance. Cisco IOS IP SLAs sends data across the network to measure performance between multiple network locations or across multiple network paths. It simulates network data and IP services, and collects network performance information in real time. The information collected includes data about response time, one-way latency, jitter (interpacket delay variance), packet loss, voice quality scoring, network resource availability, application performance, and server response time. Cisco IOS IP SLAs originated from the technology previously known as Service Assurance Agent (SAA). Cisco IOS IP SLAs performs active monitoring by generating and analyzing traffic to measure performance either between Cisco IOS devices or from a Cisco IOS device to a remote IP device such as a network application server. Measurement statistics provided by the various Cisco IOS IP SLAs operations can be used for troubleshooting, for problem analysis, and for designing network topologies.

Using Cisco IOS IP SLAs, service provider customers can measure and provide service level agreements, and enterprise customers can verify service levels, verify outsourced service level agreements, and understand network performance for new or existing IP services and applications. Cisco IOS IP SLAs uses unique service level assurance metrics and methodology to provide highly accurate, precise service level assurance measurements.

Depending on the specific Cisco IOS IP SLAs operation, statistics of delay, packet loss, jitter, packet sequence, connectivity, path, server response time, and download time are monitored within the Cisco device and stored in both CLI and SNMP MIBs. The packets have configurable IP and application layer options such as source and destination IP address, User Datagram Protocol (UDP)/TCP port numbers, a type of service (ToS) byte (including Differentiated Services Code Point [DSCP] and IP Prefix bits), Virtual Private Network (VPN) routing/forwarding instance (VRF), and URL web address.

Being Layer-2 transport independent, Cisco IOS IP SLAs can be configured end-to-end over disparate networks to best reflect the metrics that an end-user is likely to experience. Cisco IOS IP SLAs collects a unique subset of the following performance metrics:

- Delay (both round-trip and one-way)
- Jitter (directional)
- Packet loss (directional)
- Packet sequencing (packet ordering)
- Path (per hop)
- Connectivity (directional)
- Server or website download time
- Voice quality scores

Because Cisco IOS IP SLAs is accessible using SNMP, it also can be used by performance monitoring applications like CiscoWorks Internetwork Performance Monitor (IPM) and other third-party Cisco partner performance management products. More details about network management products that use Cisco IOS IP SLAs can be found at the following URL:

http://www.cisco.com/go/ipsla

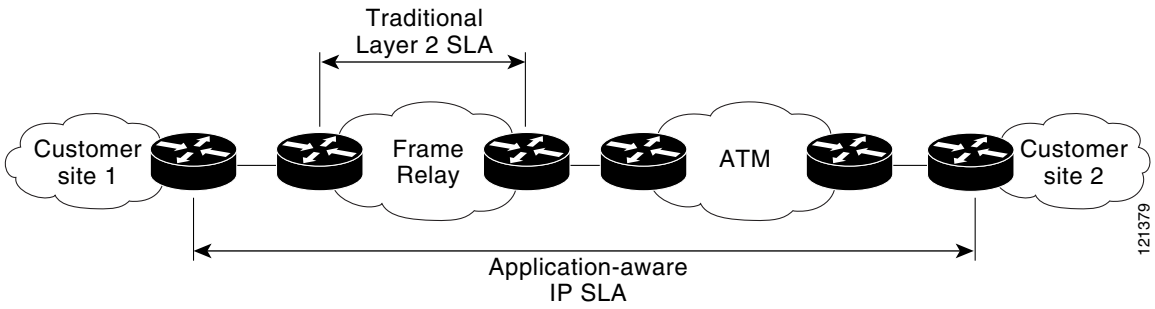
SNMP notifications based on the data gathered by an Cisco IOS IP SLAs operation allow the router to receive alerts when performance drops below a specified level and when problems are corrected. Cisco IOS IP SLAs uses the Cisco RTTMON MIB for interaction between external Network Management System (NMS) applications and the Cisco IOS IP SLAs operations running on the Cisco devices. For a complete description of the object variables referenced by the Cisco IOS IP SLAs feature, refer to the text of the CISCO-RTTMON-MIB.my file, available from the Cisco MIB website.

Service Level Agreements

Internet commerce has grown significantly in the past few years as the technology has advanced to provide faster, more reliable access to the Internet. Many companies now need online access and conduct most of their business online and any loss of service can affect the profitability of the company. Internet service providers (ISPs) and even internal IT departments now offer a defined level of service—a service level agreement—to provide their customers with a degree of predictability.

The latest performance requirements for business-critical applications, voice over IP (VoIP) networks, audio and visual conferencing, and VPNs are creating internal pressures on converged IP networks to become optimized for performance levels. Network administrators are increasingly required to support service level agreements that support application solutions. Figure 1 shows how Cisco IOS IP SLAs has taken the traditional concept of Layer 2 service level agreements and applied a broader scope to support end-to-end performance measurement, including support of applications.

Figure 1 Scope of Traditional Service Level Agreement Versus Cisco IOS IP SLAs



Cisco IOS IP SLAs provides the following improvements over a traditional service level agreement:

- End-to-end measurements—The ability to measure performance from one end of the network to the other allows a broader reach and more accurate representation of the end-user experience.
- Sophistication—Statistics such as delay, jitter, packet sequence, Layer 3 connectivity, and path and download time that are broken down into bidirectional and round-trip numbers provide more data than just the bandwidth of a Layer 2 link.
- Accuracy—Applications that are sensitive to slight changes in network performance require the precision of the sub-millisecond measurement of Cisco IOS IP SLAs.
- Ease of deployment—Leveraging the existing Cisco devices in a large network makes Cisco IOS IP SLAs easier and cheaper to implement than the physical probes often required with traditional service level agreements.
- Application-aware monitoring—Cisco IOS IP SLAs can simulate and measure performance statistics generated by applications running over Layer 3 through Layer 7. Traditional service level agreements can only measure Layer 2 performance.
- Pervasiveness—Cisco IOS IP SLAs support exists in Cisco networking devices ranging from low-end to high-end routers and switches. This wide range of deployment gives Cisco IOS IP SLAs more flexibility over traditional service level agreements.

When you know the performance expectations for different levels of traffic from the core of your network to the edge of your network, you can confidently build an end-to-end application-aware service level agreement.

Benefits of Cisco IOS IP SLAs

- Cisco IOS IP SLAs monitoring
  - Provides service level agreement monitoring, measurement, and verification.
- Network performance monitoring
  - Measures the jitter, latency, or packet loss in the network.
  - Provides continuous, reliable, and predictable measurements.
- IP service network health assessment
  - Verifies that the existing QoS is sufficient for new IP services.
- Edge-to-edge network availability monitoring

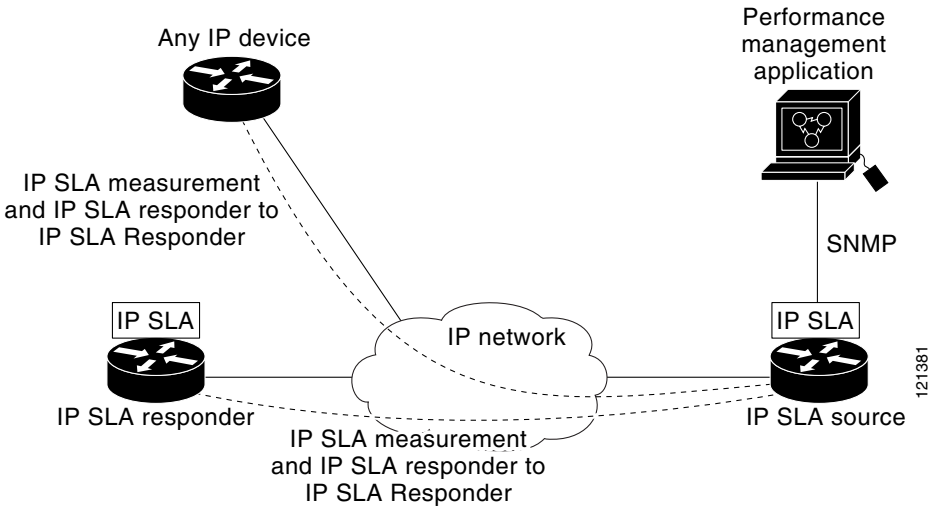
  - Provides proactive verification and connectivity testing of network resources (for example, indicates the network availability of an NFS server used to store business critical data from a remote site).
- Troubleshooting of network operation
  - Provides consistent, reliable measurement that immediately identifies problems and saves troubleshooting time.
- Voice over IP (VoIP) performance monitoring
- Multiprotocol Label Switching (MPLS) performance monitoring and network verification

Network Performance Measurement Using Cisco IOS IP SLAs

Cisco IOS IP SLAs is a core part of the Cisco IOS Software portfolio. Using Cisco IOS IP SLAs, a network engineer can monitor the performance between any area in the network: core, distribution, and edge. Monitoring can be done anytime, anywhere, without deploying a physical probe.

Cisco IOS IP SLAs uses generated traffic to measure network performance between two networking devices such as routers. Figure 2 shows how Cisco IOS IP SLAs starts when the Cisco IOS IP SLAs device sends a generated packet to the destination device. After the destination device receives the packet, and depending on the type of Cisco IOS IP SLAs operation, the device will respond with time-stamp information for the source to make the calculation on performance metrics. A Cisco IOS IP SLAs operation performs a network measurement from the source device to a destination in the network using a specific protocol such as UDP.

Figure 2 Cisco IOS IP SLAs Operations



To implement Cisco IOS IP SLAs network performance measurement you need to perform these tasks:

1. Enable the Cisco IOS IP SLAs Responder, if appropriate.
2. Configure the required Cisco IOS IP SLAs operation type.
3. Configure any options available for the specified Cisco IOS IP SLAs operation type.
4. Configure threshold conditions, if required.

5. Schedule the operation to run, then let the operation run for a period of time to gather statistics.
6. Display and interpret the results of the operation using Cisco IOS CLI or an NMS system with SNMP.

Conceptual information about the Cisco IOS IP SLAs Responder and Cisco IOS IP SLAs control protocol, the various Cisco IOS IP SLAs operation types, thresholding options, and scheduling options is contained in this document. For configuration details and information about options for each operation type and how to display and interpret the operation results, see the individual Cisco IOS IP SLAs operation-specific chapters. The "Where to Go Next" section on page 9 provides links to each individual Cisco IOS IP SLAs operation-specific chapter.

Cisco IOS IP SLAs Operation Types

Table 1 shows the various types of Cisco IOS IP SLAs operations, what each operation measures, and for what purpose the operation is used. Most of the operations are described in more detail with configuration tasks and examples in other chapters. For links to these chapters, see the "Where to Go Next" section on page 9.

Table 1 Types of Cisco IOS IP SLAs Operation

Cisco IOS IP SLAs Operation	Measurements	Key Monitoring Application
UDP Jitter[1]	Measures round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity testing of networks that carry UDP traffic, such as voice. **Note** One-way delay requires time synchronization between source and target routers.	• Voice and data network performance • General IP performance **Note** This is the most commonly used Cisco IOS IP SLAs operation.
ICMP Path Jitter	Measures hop-by-hop jitter, packet loss, and delay measurement statistics in an IP network.	• Voice and data network performance • General IP performance
UDP Jitter for VoIP	Measures round-trip delay, one-way delay, one-way jitter, and one-way packet loss for VoIP traffic. Codec simulation G.711 u-law, G.711 a-law, and G.729A. MOS and ICPIF voice quality scoring capability. **Note** One-way delay requires time synchronization between source and target routers.	• VoIP network and performance
UDP Echo[2]	Measures round-trip delay of UDP traffic.	• Server and IP application performance • Connectivity testing
ICMP Echo[3]	Measures round-trip delay for the full path.	• IP performance • Connectivity measurement

Table 1 Types of Cisco IOS IP SLAs Operation (continued)

Cisco IOS IP SLAs Operation	Measurements	Key Monitoring Application
ICMP Path Echo[4]	Measures round-trip delay and hop-by-hop round-trip delay.	• Connectivity measurement • Identify bottlenecks in the path
HTTP	Measures round-trip time to retrieve a web page.	• Web server performance
TCP Connect	Measures the time taken to connect to a target device with TCP.	• Server and application performance
FTP	Measures round-trip time to transfer a file.	• FTP server performance
Dynamic Host Configuration Protocol (DHCP)	Measures round-trip time to get an IP address from a DHCP server.	• DHCP server response time
Domain Name System (DNS)	Measures DNS lookup time.	• Web or DNS server performance
Data Link Switching Plus (DLSw+)	Measures peer tunnel response time.	• Response time between DLSw+ peers
Frame Relay	Measures circuit availability, round-trip delay, and frame delivery ratio. **Note** This operation does not have SNMP support.	• WAN service level agreement performance

1. Cisco IOS IP SLAs has the capability to make a UDP Jitter operation run within a specific Layer 3 MPLS VPN.
2. Cisco IOS IP SLAs has the capability to make a UDP Echo operation run within a specific Layer 3 MPLS VPN.
3. Cisco IOS IP SLAs has the capability to make an ICMP Echo operation run within a specific Layer 3 MPLS VPN.
4. Cisco IOS IP SLAs has the capability to make an ICMP Path Echo operation run within a specific Layer 3 MPLS VPN.

Cisco IOS IP SLAs Responder and IP SLAs Control Protocol

The Cisco IOS IP SLAs Responder is a component embedded in the destination Cisco routing device that allows the system to anticipate and respond to Cisco IOS IP SLAs request packets. The Cisco IOS IP SLAs Responder provides an enormous advantage with accurate measurements without the need for dedicated probes and additional statistics not available via standard ICMP-based measurements. The patented Cisco IOS IP SLAs Control Protocol is used by the Cisco IOS IP SLAs Responder providing a mechanism through which the responder can be notified on which port it should listen and respond. Only a Cisco IOS device can be a source for a destination IP SLAs Responder.

Figure 2 shows where the Cisco IOS IP SLAs Responder fits in relation to the IP network. The Cisco IOS IP SLAs Responder listens on a specific port for control protocol messages sent by a Cisco IOS IP SLAs operation. Upon receipt of the control message, the responder will enable the specified UDP or TCP port for the specified duration. During this time, the responder accepts the requests and responds to them. The responder disables the port after it responds to the Cisco IOS IP SLAs packet, or when the specified time expires. For added security, MD5 authentication for control messages is available.

Enabling the Cisco IOS IP SLAs Responder on the destination device is not required for all Cisco IOS IP SLAs operations. For example, if services that are already provided by the destination router (such as Telnet or HTTP) are chosen, the Cisco IOS IP SLAs Responder need not be enabled. For non-Cisco devices, the Cisco IOS IP SLAs Responder cannot be configured and Cisco IOS IP SLAs can send operational packets only to services native to those devices.

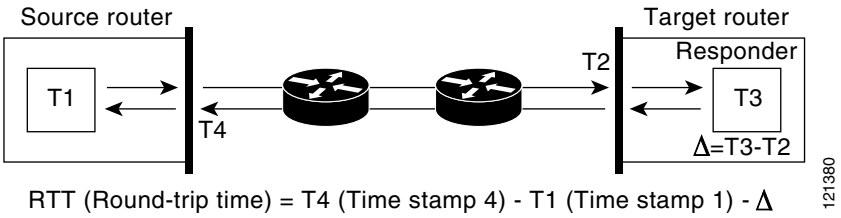
Response Time Computation for Cisco IOS IP SLAs

Routers may take tens of milliseconds to process incoming packets, due to other high priority processes. This delay affects the response times because the reply to test packets might be sitting on queue while waiting to be processed. In this situation, the response times would not accurately represent true network delays. Cisco IOS IP SLAs minimizes these processing delays on the source router as well as on the target router (if Cisco IOS IP SLAs Responder is being used), in order to determine true round-trip times. Cisco IOS IP SLAs test packets use time stamping to minimize the processing delays.

When enabled, the Cisco IOS IP SLAs Responder allows the target device to take two time stamps both when the packet arrives on the interface at interrupt level and again just as it is leaving, eliminating the processing time. This time stamping is made with a granularity of sub-millisecond (ms). At times of high network activity, an ICMP ping test often shows a long and inaccurate response time, while an Cisco IOS IP SLAs test shows an accurate response time due to the time stamping on the responder.

Figure 3 demonstrates how the responder works. Four time stamps are taken to make the calculation for round-trip time. At the target router, with the responder functionality enabled time stamp 2 (TS2) is subtracted from time stamp 3 (TS3) to produce the time spent processing the test packet as represented by delta. This delta value is then subtracted from the overall round-trip time. Notice that the same principle is applied by Cisco IOS IP SLAs on the source router where the incoming time stamp 4 (TS4) is also taken at the interrupt level to allow for greater accuracy.

Figure 3 Cisco IOS IP SLAs Responder Time Stamping



An additional benefit of the two time stamps at the target router is the ability to track one-way delay, jitter, and directional packet loss. Because much network behavior is asynchronous, it is critical to have these statistics. However, to capture one-way delay measurements the configuration of both the source router and target router with Network Time Protocol (NTP) is required. Both the source and target need to be synchronized to the same clock source. One-way jitter measurements do not require clock synchronization.

Cisco IOS IP SLAs Operation Scheduling

After an Cisco IOS IP SLAs operation has been configured, you must schedule the operation to begin capturing statistics and collecting error information. When scheduling an operation, it can start immediately or start at a certain month, day, and hour. There is a pending option to set the operation to

start at a later time. The pending option is also an internal state of the operation visible through SNMP. The pending state is also used when an operation is a reaction (threshold) operation waiting to be triggered. You can schedule a single Cisco IOS IP SLAs operation or a group of operations at one time.

Multioperations scheduling allows you to schedule multiple Cisco IOS IP SLAs operations using a single command through the Cisco IOS CLI or the CISCO RTTMON-MIB. This feature allows you to control the amount of IP SLAs monitoring traffic by scheduling the operations to run at evenly distributed times. This distribution of IP SLAs operations helps minimize the CPU utilization and thereby enhances the scalability of the network.

For more details about the IP SLAs multioperations scheduling functionality, see the "IP SLAs—Multiple Operation Scheduling" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

Cisco IOS IP SLAs Operation Threshold Monitoring

To support successful service level agreement monitoring or to proactively measure network performance, threshold functionality becomes essential. Consistent reliable measurements immediately identify issues and can save troubleshooting time. To confidently roll out a service level agreement you need to have mechanisms that notify you immediately of any possible violation. Cisco IOS IP SLAs can send SNMP traps that are triggered by events such as the following:

- Connection loss
- Timeout
- Round-trip time threshold
- Average jitter threshold
- One-way packet loss
- One-way jitter
- One-way mean opinion score (MOS)
- One-way latency

Alternately, an Cisco IOS IP SLAs threshold violation can trigger another Cisco IOS IP SLAs operation for further analysis. For example, the frequency could be increased or an ICMP path echo or ICMP path jitter operation could be initiated for troubleshooting.

Determining the type of threshold and the level to set can be complex, and it depends on the type of IP service being used in the network. For more details on using thresholds with Cisco IOS IP SLAs operations, see the "IP SLAs—Proactive Threshold Monitoring" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

Where to Go Next

- To implement the UDP Jitter operation, proceed to the "IP SLAs—Analyzing IP Service Levels Using the UDP Jitter Operation" chapter.
- To implement the UDP Jitter operation for VoIP applications, proceed to the "IP SLAs—Analyzing Service Levels Using the VoIP UDP Jitter Operation" chapter.
- To implement the VoIP Gatekeeper Registration Delay operation, proceed to the "IP SLAs VoIP Gatekeeper Registration Delay Monitoring" chapter.

- To implement the VoIP Call Setup operation, proceed to the "IP SLAs VoIP Call Setup (Post-Dial Delay) Monitoring" chapter.
- To implement the UDP Echo operation, see the "IP SLAs—Analyzing IP Service Levels Using the UDP Echo Operation" chapter.
- To implement the HTTP operation, see the "IP SLAs—Analyzing IP Service Levels Using the HTTP Operation" chapter.
- To implement the TCP Connect operation, see the "IP SLAs—Analyzing IP Service Levels Using the TCP Connect Operation" chapter.
- To implement the ICMP Echo operation, see the "IP SLAs—Analyzing IP Service Levels Using the ICMP Echo Operation" chapter.
- To implement the ICMP Path Echo operation, see the "IP SLAs—Analyzing IP Service Levels Using the ICMP Path Echo Operation" chapter.
- To implement the ICMP Path Jitter operation, proceed to the "IP SLAs—Analyzing IP Service Levels Using the ICMP Path Jitter Operation" chapter.
- To implement the FTP operation, see the "IP SLAs—Analyzing IP Service Levels Using the FTP Operation" chapter.
- To implement the DNS Connect operation, see the "IP SLAs—Analyzing IP Service Levels Using the DNS Operation" chapter.
- To implement the DHCP operation, see the "IP SLAs—Analyzing IP Service Levels Using the DHCP Operation" chapter.
- To implement the DLSW+ operation, see the "IP SLAs—Analyzing IP Service Levels Using the DLSW+ Operation" chapter.
- For details about the IP SLAs multiple operations scheduling functionality, see the "IP SLAs—Multiple Operation Scheduling" chapter.
- For details on using thresholds with IP SLAs operations, see the "IP SLAs—Proactive Threshold Monitoring" chapter.

Additional References

The following sections provide references related to Cisco IOS IP SLAs.

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
ITU-T G.711 u-law and G.711 a-law	*Pulse code modulation (PCM) of voice frequencies*
ITU-T G.729A	*Reduced complexity 8 kbit/s CS-ACELP speech codec*

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
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
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

IP SLAs—Analyzing IP Service Levels Using the UDP Jitter Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This document describes how to use the Cisco IOS IP Service Level Agreements (SLAs) UDP jitter operation to analyze round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic.

Cisco IOS IP SLAs is an embedded feature set in Cisco IOS software that allows you to analyze IP service levels for IP applications and services, to increase productivity, to lower operational costs, and to reduce occurrences of network congestion or outages. IP SLAs uses active traffic monitoring—the generation of traffic in a continuous, reliable, and predictable manner—for measuring network performance. The accuracy of measured data is enhanced by enabling the IP SLAs Responder, available in Cisco routers, on the destination device. This module also demonstrates how the data gathered using the UDP jitter operation can be displayed and analyzed using the Cisco IOS command-line interface (CLI).

Note A VoIP-specific implementation of the UDP jitter operation is available to measure performance by simulating specific voice codecs and returned voice quality scores. For more information, see the "IP SLAs—Analyzing Service Levels Using the VoIP UDP Jitter Operation" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

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 UDP Jitter Operation" section on page 14.

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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Contents

Information About the IP SLAs UDP Jitter Operation

To perform the tasks required to verify service levels using the IP SLAs UDP jitter operation, you should understand the following concept:

IP SLAs UDP Jitter Operation

The IP SLAs UDP jitter operation was primarily designed to diagnose network suitability for real-time traffic applications such as voice over IP (VoIP), video over IP, or real-time conferencing.

Jitter means inter-packet delay variance. When multiple packets are sent consecutively from source to destination, for example, 10 ms apart, and if the network is behaving ideally, the destination should be receiving them 10 ms apart. But if there are delays in the network (like queuing, arriving through alternate routes, and so on) the arrival delay between packets might be greater than or less than 10 ms. Using this example, a positive jitter value indicates that the packets arrived greater than 10 ms apart. If the packets arrive 12 ms apart, then positive jitter is 2 ms; if the packets arrive 8 ms apart, then negative jitter is 2 ms. For delay-sensitive networks like VoIP, positive jitter values are undesirable, and a jitter value of 0 is ideal.

However, the IP SLAs UDP jitter operation does more than just monitor jitter. As the UDP jitter operation includes the data returned by the IP SLAs UDP operation, the UDP jitter operation can be used as a multipurpose data gathering operation. The packets IP SLAs generates carry packet sending sequence and receiving sequence information, and sending and receiving time stamps from the source and the operational target. Based on these, UDP jitter operations are capable of measuring the following:

- Per-direction jitter (source to destination and destination to source)
- Per-direction packet-loss
- Per-direction delay (one-way delay)
- Round-trip delay (average round-trip time)

As the paths for the sending and receiving of data may be different (asymmetric), the per-direction data allow you to more readily identify where congestion or other problems are occurring in the network.

The UDP jitter operation functions by generating synthetic (simulated) UDP traffic. The UDP jitter operation sends N UDP packets, each of size S, sent T milliseconds apart, from a source router to a target router, at a given frequency of F. By default, ten packet-frames (N), each with a payload size of 10 bytes (S) are generated every 10 ms (T), and the operation is repeated every 60 seconds (F). Each of these parameters are user-configurable, so as to best simulate the IP service you are providing, or want to provide.

How to Configure the IP SLAs UDP Jitter Operation

This section contains the following procedures:

Configuring the IP SLAs Responder on the Destination Device

Before configuring a UDP jitter operation on the source device, the IP SLAs Responder must be enabled on the target device (the operational target). The IP SLAs Responder is available only on Cisco IOS software-based devices.

Perform this task to enable the IP SLAs Responder.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor 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 monitor responder** **Example:** `Router(config)# ip sla monitor responder`	Enables the IP SLAs Responder.
Step 4	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring and Scheduling a UDP Jitter Operation on the Source Device

The IP SLAs operations function by generating synthetic (simulated) network traffic. A single IP SLAs operation (for example, IP SLAs operation 10) will repeat at a given frequency for the lifetime of the operation.

A single UDP jitter operation consists of *N* UDP packets, each of size *S*, sent *T* milliseconds apart, from a source router to a target router, at a given frequency of *F*. By default, ten packets (*N*), each with an RTP payload size of 32 bytes (*S*), are generated every 20 ms (*T*), and the operation is repeated every 60 seconds (*F*). Each of these parameters are user-configurable, as shown in Table 1.

Table 1 UDP Jitter Operation Parameters

UDP Jitter Operation Parameter	Default	Configured Using:
Number of packets (N)	10 packets	**type jitter dest-ipaddr** command, **num-packets** option
Payload size per packet (S)	32 bytes	**request-data-size** command
Time between packets, in milliseconds (T)	20 ms	**type jitter dest-ipaddr** command, **interval** option
Elapsed time before the operation repeats, in seconds (F)	60 seconds	**frequency** (IP SLA) command

Prerequisites

Use of the UDP jitter operation requires that the IP SLAs Responder be enabled on the target Cisco device. To enable the Responder, perform the task in the "Configuring the IP SLAs Responder on the Destination Device" section on page 3

Time synchronization, such as that provided by NTP, is required between the source and the target device in order to provide accurate one-way delay (latency) measurements. To configure NTP on the source and target devices, perform the tasks in the "Performing Basic System Management" chapter of the *Cisco IOS Configuration Fundamentals* Configuration Guide, Release 12.2. Time synchronization is not required for the one-way jitter and packet loss measurements, however. If the time is not synchronized between the source and target devices, one-way jitter and packet loss data will be returned, but values of "0" will be returned for the one-way delay measurements provided by the UDP jitter operation.

Before configuring any IP SLAs application, you can use the **show ip sla monitor application** command to verify that the operation type is supported on your software image.

Configuring and Scheduling a Basic UDP Jitter Operation on the Source Device

Perform the following steps to configure and schedule a basic UDP jitter operation.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type jitter dest-ipaddr** {*hostname* | *ip-address*} **dest-port** *port-number* [**num-packets** *number-of-packets*] [**interval** *inter-packet-interval*]

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**
9. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type jitter dest-ipaddr** {*hostname* | *ip-address*} **dest-port** *port-number* [**source-ipaddr** {*name* | *ip-address*}] [**source-port** *port-number*] [**num-packets** *number-of-packets*] [**interval** *inter-packet-interval*] [**control** {**enable** | **disable**}] **Example:** `Router(config-sla-monitor)# type jitter dest-ipaddr 172.29.139.134 dest-port 5000`	Configures the IP SLAs operation as a UDP jitter operation and enters UDP jitter configuration submode. • Use the **dest-ipaddr** keyword to specify the IP address or IP hostname of the destination for the UDP jitter operation. • Use the **dest-port** keyword and associated option to specify the destination port number, in the range from 1 to 65535. • All other keywords and arguments are optional. See the command reference document for more information. The default number of packets (**num-packets**) sent is 10. The default **interval** between packets is 20 milliseconds. • The **control disable** keyword combination should only be used if you are disabling the IP SLAs control protocol on both the source and target routers. The IP SLAs control protocol is enabled by default. • After entering this command, the command-line interface (CLI) enters IP SLA monitor jitter configuration mode to allow you to specify optional characteristics for the operation.

	Command or Action	Purpose
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-jitter)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-jitter)# exit`	Exits UDP jitter configuration submode and returns to global configuration mode.
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 5 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.
Step 9	**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 example shows the configuration of the IP SLAs UDP jitter operation number 10 that will start in 5 minutes and run for 5 minutes.

```
ip sla monitor 1
 type jitter dest-ipaddr 172.29.139.134 dest-port 5000 num-packets 20
 frequency 30
ip sla monitor schedule 1 life 300 start-time after 00:05:00
```

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.

If you with configure and schedule a UDP jitter operation with additional characteristics, perform the task in the "Configuring and Scheduling a UDP Jitter Operation with Additional Characteristics" section on page 7.

Configuring and Scheduling a UDP Jitter Operation with Additional Characteristics

Perform this task to configure and schedule a UDP jitter operation with additional parameters.

Restrictions

The IP SLAs UDP jitter operation does not support the IP SLAs History feature (statistics history buckets) because of the large data volume involved with UDP jitter operations. This means that the following commands are not supported for UDP jitter operations: **buckets-of-history-kept**, **filter-for-history**, **lives-of-history-kept**, **samples-of-history-kept**, and **show ip sla monitor history**.

The MIB used by IP SLAs (CISCO-RTTMON-MIB) limits the hours-of-statistics kept for the UDP jitter operation to two hours. Configuring a larger value using the **hours-of-statistics** *hours* global configuration change will not increase the value beyond two hours.

However, the Data Collection MIB can be used to collect historical data for the operation. See the CISCO-DATA-COLLECTION-MIB (available from http://www.cisco.com/go/mibs).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type jitter dest-ipaddr** {*hostname* | *ip-address*} **dest-port** *port-number* [**source-ipaddr** {*name* | *ip-address*}] [**source-port** *port-number*] [**num-packets** *number-of-packets*] [**interval** *inter-packet-interval*] [**control** {**enable** | **disable**}]
5. **dest-ipaddr** *ip-address*
6. **dest-port** *port-number*
7. **distributions-of-statistics-kept** *size*
8. **enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*]
9. **frequency** *seconds*
10. **hours-of-statistics-kept** *hours*
11. **owner** *owner-id*
12. **request-data-size** *bytes*
13. **statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*

17. **tos** *number*
18. **verify-data**
19. **vrf** *vrf-name*
20. **exit**
21. **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**]
22. **exit**
23. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type jitter dest-ipaddr** {*hostname* | *ip-address*} **dest-port** *port-number* [**source-ipaddr** {*name* | *ip-address*}] [**source-port** *port-number*] [**num-packets** *number-of-packets*] [**interval** *inter-packet-interval*] [**control** {**enable** | **disable**}] **Example:** `Router(config-sla-monitor)# type jitter dest-ipaddr 172.29.139.134 dest-port 5000`	Configures the IP SLAs operation as a UDP jitter operation and enters UDP jitter configuration submode. • Use the **dest-ipaddr** keyword to specify the IP address or IP hostname of the destination for the UDP jitter operation. • Use the **dest-port** keyword and associated option to specify the destination port number, in the range from 1 to 65535. • All other keywords and arguments are optional. See the command reference document for more information. The default number of packets (**num-packets**) sent is 10. The default **interval** between packets is 20 milliseconds. • The **control disable** keyword combination should only be used if you are disabling the IP SLAs control protocol on both the source and target routers. The IP SLAs control protocol is enabled by default. • After entering this command, the command-line interface (CLI) enters IP SLA monitor jitter configuration mode to allow you to specify optional characteristics for the operation.

	Command or Action	Purpose
Step 5	**dest-ipaddr** *ip-address* **Example:** `Router(config-sla-monitor-jitter)# dest-ipaddr 172.29.139.135`	(Optional) Specifies the destination IP address for the IP SLAs operation. • Use of this command will overwrite the IP address specified in the syntax of the **type jitter** command. • This command allows you to change the target device for the operation without disabling and reenabling the operation type.
Step 6	**dest-port** *port-number* **Example:** `Router(config-sla-monitor-jitter)# dest-port 5001`	(Optional) Specifies the destination port number for the IP SLAs operation. • Use of this command will overwrite the port number specified in the syntax of the **type jitter** command. • This command allows you to change the target port for the operation without disabling and reenabling the operation type.
Step 7	**distributions-of-statistics-kept** *size* **Example:** `Router(config-sla-monitor-jitter)# distributions-of-statistics-kept 5`	(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.
Step 8	**enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*] **Example:** `Router(config-sla-monitor-jitter)# enhanced-history interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.
Step 9	**frequency** *seconds* **Example:** `Router(config-sla-monitor-jitter)# 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-jitter)# hours-of-statistics-kept 4`	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 11	**owner** *owner-id* **Example:** `Router(config-sla-monitor-jitter)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 12	**request-data-size** *bytes* **Example:** `Router(config-sla-monitor-jitter)# request-data-size 64`	(Optional) Sets the protocol data size in the payload of an IP SLAs operation's request packet.

	Command or Action	Purpose
Step 13	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-jitter)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 14	**tag** *text* **Example:** `Router(config-sla-monitor-jitter)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-jitter)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-jitter)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	**tos** *number* **Example:** `Router(config-sla-monitor-jitter)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.
Step 18	**verify-data** **Example:** `Router(config-sla-monitor-jitter)# verify-data`	(Optional) Causes an IP SLAs operation to check each reply packet for data corruption.
Step 19	**vrf** *vrf-name* **Example:** `Router(config-sla-monitor-jitter)# vrf vpn-A`	(Optional) Allows monitoring within Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) using IP SLAs operations.
Step 20	**exit** **Example:** `Router(config-sla-monitor-jitter)# exit`	Exits UDP jitter configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 21	**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 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 22	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 23	**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

In the following example, two operations are configured as UDP jitter operations, with operation 2 starting five seconds operation 1. Both operations will run indefinitely.

```
!
ip sla monitor 1
 type jitter dest-ipaddr 20.0.10.3 dest-port 65051 num-packets 20
 request-data-size 160
 tos 128
 frequency 30
ip sla monitor schedule 1 start-time after 00:05:00
ip sla monitor 2
 type jitter dest-ipaddr 20.0.10.3 dest-port 65052 num-packets 20 interval 10
 request-data-size 20
 tos 64
 frequency 30
ip sla monitor schedule 2 start-time after 00:05:05
!
```

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 Example for the IP SLAs UDP Jitter Operation

This section provides the following configuration example:

- Configuring a UDP Jitter Operation: Example, page 12

Configuring a UDP Jitter Operation: Example

In the following example, two operations are configured as UDP jitter operations, with operation 2 starting five seconds after the first operation. Both operations will run indefinitely.

```
ip sla monitor 1
 type jitter dest-ipaddr 20.0.10.3 dest-port 65051 num-packets 20
 request-data-size 160
 tos 128
 frequency 30
ip sla monitor schedule 1 start-time after 00:05:00
ip sla monitor 2
 type jitter dest-ipaddr 20.0.10.3 dest-port 65052 num-packets 20 interval 10
 request-data-size 20
 tos 64
 frequency 30
ip sla monitor schedule 2 start-time after 00:05:05
```

On the target (destination) device:

```
ip sla monitor responder
```

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 configuring IP SLAs UDP Jitter operations.

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 features in this document.	—

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
No specific RFCs are supported by the features in this document.	—

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 UDP Jitter Operation

Table 2 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 2 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 2 Feature Information for the IP SLAs UDP Jitter Operation

Feature Name	Releases	Feature Information
IP SLAs UDP Jitter Operation	12.3(14)T	The Cisco IOS IP SLAs User Datagram Protocol (UDP) jitter operation allows you to measure round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic.

IP SLAs—Analyzing Service Levels Using the VoIP UDP Jitter Operation

First Published: May 2, 2005
Last Updated: March 20, 2007

This document describes how to use the Cisco IOS IP Service Level Agreements (SLAs) UDP jitter operation to proactively monitor Voice over IP (VoIP) quality levels in your network, allowing you to guarantee VoIP quality levels to your users. The IP SLAs VoIP UDP jitter operation accurately simulates VoIP traffic using common codecs, and calculates consistent voice quality scores (MOS and ICPIF) between Cisco IOS devices in the network.

Cisco IOS IP SLAs is an embedded feature set in Cisco IOS software that allows you to analyze IP service levels for IP applications and services, to increase productivity, to lower operational costs, and to reduce occurrences of network congestion or outages. IP SLAs uses active traffic monitoring for measuring network performance. The accuracy of measured data is enhanced by enabling the IP SLAs Responder, available in Cisco routers, on the destination device.

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 VoIP UDP Jitter Operation" section on page 17.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

Contents

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Prerequisites for IP SLAs VoIP UDP Jitter Operations

To use this feature, your networking devices on both ends of the connection must support Cisco IOS IP SLAs. Cisco IOS IP SLAs is an integrated feature set in Cisco IOS software.

Restrictions for IP SLAs VoIP UDP Jitter Operations

This feature uses UDP traffic to generate approximate Voice over IP scores. It does not provide support for the Real-Time Transport Protocol (RTP).

Note The term "Voice" in this document should be taken to mean any Internet telephony applications. The term "Voice over IP" can include the transmission of multimedia (both voice and video) over IP networks.

ICPIF and MOS values provided by this feature, while consistent within IP SLAs, are estimates only and are intended only for relative comparisons. The values may not match values determined using other methods.

Note Predictions of customer opinion (such as those listed for the E-Model transmission rating factor R and derived Mean Opinion Scores) determined by any method are intended only for transmission planning and analysis purposes and should not be interpreted as reflecting actual customer opinions.

Information About IP SLAs VoIP UDP Jitter Operations

To use the IP SLAs VoIP UDP Operation feature, you should understand the following concepts:

The Calculated Planning Impairment Factor (ICPIF)

The ICPIF originated in the 1996 version of ITU-T recommendation G.113, "Transmission impairments," as part of the formula *Icpif = Itot – A*. ICPIF is actually an acronym for "(Impairment) Calculated Planning Impairment Factor," but should be taken to simply mean the "calculated planning impairment factor." The ICPIF attempts to quantify, for comparison and planning purposes, the key impairments to voice quality that are encountered in the network.

The ICPIF is the sum of measured impairment factors (total impairments, or *Itot*) minus a user-defined access Advantage Factor (*A*) that is intended to represent the user's expectations, based on how the call was placed (for example, a mobile call versus a land-line call). In its expanded form, the full formula is expressed as:

$Icpif = Io + Iq + Idte + Idd + Ie – A$

where

- *Io* represents impairments caused by non-optimal loudness rating,
- *Iq* represents impairments caused by PCM quantizing distortion,
- *Idte* represents impairments caused by talker echo,
- *Idd* represents impairments caused by one-way transmission times (one-way delay),
- *Ie* represents impairments caused by equipment effects, such as the type of codec used for the call and packet loss, and
- *A* represents an access Advantage Factor (also called the user Expectation Factor) that compensates for the fact that users may accept some degradation in quality in return for ease of access.

ICPIF values are expressed in a typical range of 5 (very low impairment) to 55 (very high impairment). ICPIF values numerically less than 20 are generally considered "adequate." While intended to be an objective measure of voice quality, the ICPIF value is also used to predict the subjective effect of combinations of impairments. Table 1, taken from G.113 (02/96), shows how sample ICPIF values are expected to correspond to subjective quality judgement.

Table 1 Quality Levels as a Function of Total Impairment Factor ICPIF

Upper Limit for ICPIF	Speech Communication Quality
5	Very good
10	Good
20	Adequate
30	Limiting case
45	Exceptional limiting case
55	Customers likely to react strongly (complaints, change of network operator)

For further details on the ICPIF, see the 1996 version of the G.113 specification.

Note The latest version of the ITU-T G.113 Recommendation (2001), no longer includes the ICPIF model. Instead, it refers implementers to G.107: "The Impairment Factor method, used by the E-model of ITU-T G.107, is now recommended. The earlier method that used Quantization Distortion Units is no longer recommended."

The full E-Model (also called the ITU-T Transmission Rating Model), expressed as $R = Ro - Is - Id - Ie + A$, provides the potential for more accurate measurements of call quality by refining the definitions of impairment factors (see the 2003 version of the G.107 for details). Though the ICPIF shares terms for impairments with the E-Model, the two models should not be confused.

The IP SLAs VoIP UDP Operation feature takes advantage of observed correspondences between the ICPIF, transmission rating factor R, and MOS values, but does not yet support the E-Model.

IP SLAs uses a simplified ICPIF formula, defined in more detail later in this document.

Mean Opinion Scores (MOS)

The quality of transmitted speech is a subjective response of the listener. Each codec used for transmission of Voice over IP provides a certain level of quality. A common benchmark used to determine the quality of sound produced by specific codecs is MOS. With MOS, a wide range of listeners have judged the quality of voice samples sent using particular codecs, on a scale of 1 (poor quality) to 5 (excellent quality). The opinion scores are averaged to provide the mean for each sample. Table 2 shows MOS ratings and the corresponding description of quality for each value.

Table 2 MOS Ratings

Score	Quality	Description of Quality Impairment
5	Excellent	Imperceptible
4	Good	Just perceptible, but not annoying
3	Fair	Perceptible and slightly annoying
2	Poor	Annoying but not objectionable
1	Bad	Very annoying and objectionable

As the MOS ratings for codecs and other transmission impairments are known, an estimated MOS can be computed and displayed based on measured impairments. This estimated value is designated as MOS-CQE (Mean Opinion Score; Conversational Quality, Estimated) by the ITU in order to distinguish it from objective or subjective MOS values (see P.800.1 for details).

Voice Performance Monitoring Using IP SLAs

One of the key metrics in measuring voice and video quality over an IP network is jitter. Jitter is the name used to indicate the variation in delay between arriving packets (inter-packet delay variance). Jitter affects voice quality by causing uneven gaps in the speech pattern of the person talking. Other key performance parameters for voice and video transmission over IP networks include latency (delay) and packet loss. IP SLAs is an embedded active monitoring feature of Cisco IOS software that provides a means for simulating and measuring these parameters in order to ensure your network is meeting or exceeding service-level agreements with your users.

IP SLAs provides a UDP jitter operation, which consists of UDP probe packets sent across the network from an origin device to a specific destination (called the operational target). This synthetic traffic is used to record the amount of jitter for the connection, as well as the round-trip time, per-direction packet loss, and one-way delay time (one-way latency). (The term “synthetic traffic” indicates that the network traffic is simulated; that is, the traffic is generated by IP SLAs.) Data, in the form of collected statistics, can

be displayed for multiple tests over a user-defined period of time, allowing you to see, for example, how the network performs at different times of the day, or over the course of a week. The jitter probe has the advantage of utilizing the IP SLAs Responder to provide minimal latency at the receiving end.

The IP SLAs VoIP UDP jitter operation modifies the standard UDP jitter operation by adding the capability to return MOS and ICPIF scores in the data collected by the operation, in addition to the metrics already gathered by the UDP jitter operation. This VoIP-specific implementation provides even more useful information in determining the performance of your VoIP network, thereby improving your ability to perform network assessment, troubleshooting, and health monitoring.

Codec Simulation Within IP SLAs

The IP SLAs VoIP UDP jitter operation computes statistics by sending *n* UDP packets, each of size **s**, sent **t** milliseconds apart, from a given source router to a given target router, at a given frequency **f**. The target router must be running the IP SLAs Responder in order to process the probe operations.

To generate MOS and ICPIF scores, you specify the codec type used for the connection when configuring the VoIP UDP jitter operation. Based on the type of codec you configure for the operation, the number of packets (**n**), the size of each payload (**s**), the inter-packet time interval (**t**), and the operational frequency (**f**) will be auto-configured with default values. (See Table 3 for specifics.) However, you are given the option, if needed, to manually configure these parameters in the syntax of the **type jitter dest-ipaddr** command.

Table 3 shows the default parameters that are configured for the operation by codec.

Table 3 Default VoIP UDP Jitter Operation Parameters by Codec

Codec	Default Request Size (Packet Payload) (s)	Default Interval Between Packets (t)	Default Number of Packets (n)	Frequency of Probe Operations (f)
G.711 mu-Law (g711ulaw)	160 + 12 RTP bytes	20 ms	1000	Once every 1 minute
G.711 A-Law (g711alaw)	160 + 12 RTP bytes	20 ms	1000	Once every 1 minute
G.729A (g729a)	20 + 12 RTP bytes	20 ms	1000	Once every 1 minute

For example, if you configure the VoIP UDP jitter operation to use the characteristics for the g711ulaw codec, by default a probe operation will be sent once a minute (**f**). Each probe operation would consist of 1000 packets (**n**), with each packet containing 180 bytes of synthetic data (**s**), sent 20 milliseconds apart (**t**).

The IP SLAs ICPIF Value

ICPIF value computation with Cisco IOS software is based primarily on the two main factors that can impair voice quality: delayed packets and lost packets. Because packet delay and packet loss can be measured by IP SLAs, the full ICPIF formula, $Icpif = Io + Iq + Idte + Idd + Ie - A$, is simplified by assuming the values of *Io*, *Iq*, and *Idte* are zero, resulting in the following formula:

Total Impairment Factor (Icpif) = Delay Impairment Factor (Idd) + Equipment Impairment Factor (Ie) – Expectation/Advantage Factor (A)

This means that the ICPIF value is computed by adding a Delay Impairment Factor, which is based on a measurement of delayed packets, and an Equipment Impairment Factor, which is based on a measurement of lost packets. From this sum of the total impairments measured in the network, an impairment variable (the Expectation Factor) is subtracted to yield the ICPIF.

This is the same formula used by Cisco Gateways to calculate the ICPIF for received VoIP data streams.

The Delay Impairment Factor

The Delay Impairment Factor (*Idd*) is a number based on two values. One value is fixed and is derived using the static values (as defined in the ITU standards) for Codec Delay, Look Ahead Delay, and Digital Signal Processing (DSP) Delay. The second value is variable and is based on the measured one-way delay (round-trip time measurement divided by 2). The one-way delay value is mapped to a number using a mapping table that is based on a G.107 (2002 version) analytic expression. Table 4 shows sample correspondences between the one-way delay measured by IP SLAs and Delay Impairment Factor values.

Table 4 Sample Correspondence of One-Way Delay to ICPIF Delay Impairment

One-Way Delay (ms)	Delay Impairment Factor
50	1
100	2
150	4
200	7

The Equipment Impairment Factor

The Equipment Impairment Factor (*Ie*) is a number based on the amount of measured packet loss. The amount of measured packet loss, expressed as a percentage of total number of packets sent, corresponds an Equipment Impairment Factor that is defined by codec. Table 5 shows sample correspondences between the packet loss measured by IP SLAs and Equipment Impairment Factor values.

Table 5 Sample Correspondence of Measured Packet Loss to ICPIF Equipment Impairment

Packet Loss (as a percentage of total number of packets sent)	Equipment Impairment Factor for PCM (G.711) Codecs	Equipment Impairment Factor for the CS-ACELP (G.729A) Codec
2%	12	20
4%	22	30
6%	28	38
8%	32	42

The Expectation Factor

The Expectation Factor, also called the Advantage Factor (*A*), is intended to represent the fact that users may accept some degradation in quality in return for ease of access. For example, a mobile phone user in a hard-to-reach location may have an expectation that the connection quality will not be as good as a traditional land-line connection. This variable is also called the Advantage Dactor (short for Access Advantage Factor) because it attempts to balance an increased access advantage against a decline in voice quality.

Table 6, adapted from ITU-T Rec. G.113, defines a set of provisional maximum values for *A* in terms of the service provided.

Table 6 Advantage Factor Recommended Maximum Values

Communication Service	Advantage / Expectation Factor: Maximum value of A
Conventional wire-line (land-line)	0
Mobility (cellular connections) within a building	5
Mobility within a Geographical area or moving in a vehicle	10
Access to hard-to-reach location; (for example, via multi-hop satellite connections)	20

These values are only suggestions. To be meaningful, the use of the factor *A* and its selected value in a specific application should be used consistently in any planning model you adopt. However, the values in Table 6 should be considered as the absolute upper limits for *A*.

The default Advantage Factor for IP SLAs VoIP UDP jitter operations is always zero.

The IP SLAs MOS Value

IP SLAs uses an observed correspondence between ICPIF and MOS values to estimate an MOS value. Usage of the abbreviation MOS within the context of this feature should be taken to represent the MOS-CQE (Mean Opinion Score; Conversational Quality, Estimated).

The E model, as defined in G.107 (03/2003), predicts the subjective quality that is experienced by an average listener by combining the impairment caused by transmission parameters (such as loss and delay) into a single rating, the transmission rating factor R (the R Factor). This rating, expressed in a scale of 0 (worst) to 100 (best) can be used to predict subjective user reactions, such as the MOS. Specifically, the MOS can be obtained from the R Factor with a converting formula. Conversely, a modified inverted form can be used to calculate R Factors from MOS values.

There is also a relationship between the ICPIF value and the R Factor. IP SLAs takes advantage of this correspondence by deriving the approximate MOS score from an estimated R Factor, which, in turn, is derived from the ICPIF score. Table 7 shows the resulting MOS values that will be generated for corresponding ICPIF values.

Table 7 Correspondence of ICPIF Values to MOS Values

ICPIF Range	MOS	Quality Category
0 – 3	5	Best
4 – 13	4	High
14 – 23	3	Medium
24 – 33	2	Low
34 – 43	1	Poor

IP SLAs will always express the estimated MOS value as a number in the range of 1 to 5, with 5 being the best quality. A MOS value of 0 (zero) indicates that MOS data could not be generated for the operation.

How to Configure the IP SLAs VoIP UDP Jitter Operation

To return VoIP scores with IP SLAs VoIP UDP jitter operation statistics, perform the following task:

- Configuring the IP SLAs VoIP UDP Jitter Operation

Configuring the IP SLAs VoIP UDP Jitter Operation

The VoIP-specific implementation of the IP SLAs UDP jitter operation contains different configuration options than the standard UDP jitter operation. As soon as you specify the **codec** keyword in the **type jitter dest-ipaddr** command syntax, you are configuring the VoIP-specific implementation of the jitter operation.

Restrictions

Currently, IP SLAs supports only the following speech codecs (compression methods):

- G.711 A Law (g711alaw: 64 kbps PCM compression method)
- G.711 mu Law (g711ulaw: 64 kbps PCM compression method)
- G.729A (g729a: 8 kbps CS-ACELP compression method)

The following commands, available in UDP jitter configuration mode, are not valid for UDP jitter (codec) operations:

- **distributions-of-statistics-kept**
- **statistics-distribution-interval**
- **request-data-size**

Note The **show ip sla monitor configuration** command will list the values for the "Number of statistic distribution buckets kept" and "Statistic distribution interval (milliseconds)," but these values do not apply to jitter (codec) operations.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type jitter dest-ipaddr** {*hostname* | *ip-address*} **dest-port** *port-number* **codec** *codec-type* [**codec-numpackets** *number-of-packets*] [**codec-size** *number-of-bytes*] [**codec-interval** *milliseconds*] [**advantage-factor** *value*] [**source-ipaddr** {*hostname* | *ip-address*}] [**source-port** *port-number*] [**control** {**enable** | **disable**}]
5. **dest-ipaddr** *ip-address*
6. **dest-port** *port-number*

7. **enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*]
8. **frequency** *seconds*
9. **hours-of-statistics-kept** *hours*
10. **owner** *owner-id*
11. **tag** *text*
12. **threshold** *milliseconds*
13. **timeout** *milliseconds*
14. **tos** *number*
15. **verify-data**
16. **vrf** *vrf-name*
17. **exit**
18. **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**]
19. **exit**
20. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

	Command or Action	Purpose
Step 4	**type jitter dest-ipaddr** {*hostname* | *ip-address*} **dest-port** *port-number* **codec** *codec-type* [**codec-numpackets** *number-of-packets*] [**codec-size** *number-of-bytes*] [**codec-interval** *milliseconds*] [**advantage-factor** *value*] [**source-ipaddr** {*hostname* | *ip-address*}] [**source-port** *port-number*] [**control** {**enable** | **disable**}] **Example:** `Router(config-sla-monitor)# type jitter dest-ipaddr 209.165.200.225 dest-port 16384 codec g711alaw advantage-factor 10`	Configures the operation as a jitter (codec) operation that will generate VoIP scores in addition to latency, jitter, and packet loss statistics. • For the *codec-type* argument, use one of the following keywords: – **g711alaw**—64 kbps PCM compression method – **g711ulaw**—64 kbps PCM compression method – **g729a**—8 kbps CS-ACELP compression method • Specifying the codec-type will configure the appropriate default values for the **codec-interval**, **codec-size**, and **codec-numpacket** options. You should not specify values for the interval, size, and number of packet options unless you have a specific reason to override the defaults (for example, approximating a different codec). • The value you specify for the **advantage-factor** will be subtracted from the measured impairment values. You can use this option to correct the ICPIF and MOS values for network conditions. The default advantage factor (expectation factor) is 0. • When configuring a jitter operation that uses a codec type, the **dest-port** should be an even numbered port in the range 16384 to 32766 or 49152 to 65534. • Do not use the **control** keyword with this command. The **control disable** keyword combination will disable IP SLAs control packets and cause the operation to malfunction. The default is **control enable**. • After entering this command, the command-line interface (CLI) enters IP SLA monitor jitter configuration mode to allow you to specify optional characteristics for the operation.
Step 5	**dest-ipaddr** *ip-address* **Example:** `Router(config-sla-monitor-jitter)# dest-ipaddr 172.29.139.135`	(Optional) Specifies the destination IP address for the IP SLAs operation. • Use of this command will overwrite the IP address specified in the syntax of the **type jitter** command. • This command allows you to change the target device for the operation without disabling and reenabling the operation type.
Step 6	**dest-port** *port-number* **Example:** `Router(config-sla-monitor-jitter)# dest-port 5001`	(Optional) Specifies the destination port number for the IP SLAs operation. • Use of this command will overwrite the port number specified in the syntax of the **type jitter** command. • This command allows you to change the target port for the operation without disabling and reenabling the operation type.

	Command or Action	Purpose
Step 7	**enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*] **Example:** `Router(config-sla-monitor-jitter)# enhanced-history interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.
Step 8	**frequency** *seconds* **Example:** `Router(config-sla-monitor-jitter)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 9	**hours-of-statistics-kept** *hours* **Example:** `Router(config-sla-monitor-jitter)# hours-of-statistics-kept 4`	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 10	**owner** *owner-id* **Example:** `Router(config-sla-monitor-jitter)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 11	**tag** *text* **Example:** `Router(config-sla-monitor-jitter)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 12	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-jitter)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 13	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-jitter)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 14	**tos** *number* **Example:** `Router(config-sla-monitor-jitter)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.
Step 15	**verify-data** **Example:** `Router(config-sla-monitor-jitter)# verify-data`	(Optional) Causes an IP SLAs operation to check each reply packet for data corruption.
Step 16	**vrf** *vrf-name* **Example:** `Router(config-sla-monitor-jitter)# vrf vpn-A`	(Optional) Allows monitoring within Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) using IP SLAs operations.

	Command or Action	Purpose
Step 17	**exit** **Example:** `Router(config-sla-monitor-jitter)# exit`	Exits UDP jitter configuration submode and returns to global configuration mode.
Step 18	**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 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 19	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 20	**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.

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 IP SLAs VoIP UDP Jitter Operations

In the following examples, a VoIP UDP jitter (codec) operation is configured, then output from the corresponding show commands is given. This example assumes that the IP SLAs Responder is enabled on the device at 209.165.200.225.

- IP SLAs VoIP UDP Operation Configuration: Example, page 13
- IP SLAs VoIP UDP Operation Statistics Output: Example, page 14

IP SLAs VoIP UDP Operation Configuration: Example

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line.  End with the end command.
Router(config)# ip sla monitor 10
Router(config-sla)# type jitter dest-ipaddr 209.165.200.225 dest-port 16384 codec g711alaw
advantage-factor 2
Router(config-sla-jitter)# owner admin_bofh
Router(config-sla-jitter)# exit
Router(config)# ip sla monitor schedule 10 start-time now
Router(config)# exit
Router#
Router# show running-config | begin ip sla monitor 10

ip sla monitor 10
 type jitter dest-ipaddr 209.165.200.225 dest-port 16384 codec g711alaw advantage-factor 2
 owner admin_bofh
ip sla schedule 10 start-time now
 .
 .
 .
Router# show ip sla monitor configuration 10

Entry number: 10
Owner: admin_bofh
Tag:
Type of operation to perform: jitter
Target address: 209.165.200.225
Source address: 0.0.0.0
Target port: 16384
Source port: 0
Operation timeout (milliseconds): 5000
Codec Type: g711alaw
Codec Number Of Packets: 1000
Codec Packet Size: 172
Codec Interval (milliseconds): 20
Advantage Factor: 2
Type Of Service parameters: 0x0
Verify data: No
Vrf Name:
Control Packets: enabled
Operation frequency (seconds): 60
Next Scheduled Start Time: Start Time already passed
Life (seconds): 3600
Entry Ageout (seconds): never
Status of entry (SNMP RowStatus): Active
Connection loss reaction enabled: No
Timeout reaction enabled: No
Verify error enabled: No
Threshold reaction type: Never
Threshold (milliseconds): 5000
Threshold Falling (milliseconds): 3000
Threshold Count: 5
Threshold Count2: 5
Reaction Type: None
Number of statistic hours kept: 2
Number of statistic distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Enhanced History:
```

When a codec type is configured for a jitter operation, the standard jitter "Request size (ARR data portion)," "Number of packets," and "Interval (milliseconds)" parameters will not be displayed in the **show ip sla monitor configuration** command output. Instead, values for "Codec Packet Size," "Codec Number of Packets," and "Codec Interval (milliseconds)" are displayed.

IP SLAs VoIP UDP Operation Statistics Output: Example

Use the **show ip sla monitor statistics** command and the **show ip sla monitor collection-statistics** command to show Voice scores (ICPIF and MOS values) for the jitter (codec) operation.

```
Router# show ip sla monitor statistics 10

Entry number: 10
Modification time: 12:57:45.690 UTC Sun Oct 26 2003
Number of operations attempted: 1
Number of operations skipped: 0
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE
Timeout occurred: FALSE
Over thresholds occurred: FALSE
Latest RTT (milliseconds): 19
Latest operation start time: 12:57:45.723 Sun Oct 26 2003
Latest operation return code: OK
!
Voice Scores:
ICPIF:  20          MOS Score:  3.20
!
RTT Values:
NumOfRTT: 10     RTTAvg: 19      RTTMin: 19     RTTMax: 20
RTTSum:  191    RTTSum2: 3649
Packet Loss Values:
PacketLossSD: 0 PacketLossDS: 0
PacketOutOfSequence: 0  PacketMIA: 0    PacketLateArrival: 0
InternalError: 0        Busies: 0
Jitter Values:
NumOfJitterSamples: 9
MinOfPositivesSD: 0     MaxOfPositivesSD: 0
NumOfPositivesSD: 0     SumOfPositivesSD: 0     Sum2PositivesSD: 0
MinOfNegativesSD: 0     MaxOfNegativesSD: 0
NumOfNegativesSD: 0     SumOfNegativesSD: 0     Sum2NegativesSD: 0
MinOfPositivesDS: 1     MaxOfPositivesDS: 1
NumOfPositivesDS: 1     SumOfPositivesDS: 1     Sum2PositivesDS: 1
MinOfNegativesDS: 1     MaxOfNegativesDS: 1
NumOfNegativesDS: 1     SumOfNegativesDS: 1     Sum2NegativesDS: 1
Interarrival jitterout: 0       Interarrival jitterin: 0
One Way Values:
NumOfOW: 0
OWMinSD: 0      OWMaxSD: 0      OWSumSD: 0      OWSum2SD: 0
OWMinDS: 0      OWMaxDS: 0      OWSumDS: 0      OWSum2DS: 0

Router# show ip sla monitor collection-statistics 10
Entry number: 10
Start Time Index: 12:57:45.931 UTC Sun Oct 26 2003
Number of successful operations: 60
Number of operations over threshold: 0
Number of failed operations due to a Disconnect: 0
Number of failed operations due to a Timeout: 0
Number of failed operations due to a Busy: 0
Number of failed operations due to a No Connection: 0
```

```
Number of failed operations due to an Internal Error: 0
Number of failed operations due to a Sequence Error: 0
Number of failed operations due to a Verify Error: 0

Voice Scores:
MinOfICPIF: 10   MaxOfICPIF: 20   MinOfMos: 3.20   MaxOfMos: 3.80

RTT Values:
NumOfRTT: 600   RTTAvg: 20      RTTMin: 19      RTTMax: 22
RTTSum: 12100   RTTSum2: 244292
Packet Loss Values:
PacketLossSD: 0 PacketLossDS: 0
PacketOutOfSequence: 0  PacketMIA: 0    PacketLateArrival: 0
InternalError: 0        Busies: 0

Jitter Values:
NumOfJitterSamples: 540
MinOfPositivesSD: 1     MaxOfPositivesSD: 1
NumOfPositivesSD: 26    SumOfPositivesSD: 26    Sum2PositivesSD: 26
MinOfNegativesSD: 1     MaxOfNegativesSD: 1
NumOfNegativesSD: 19    SumOfNegativesSD: 19    Sum2NegativesSD: 19
MinOfPositivesDS: 1     MaxOfPositivesDS: 1
NumOfPositivesDS: 43    SumOfPositivesDS: 43    Sum2PositivesDS: 43
MinOfNegativesDS: 1     MaxOfNegativesDS: 2
NumOfNegativesDS: 43    SumOfNegativesDS: 44    Sum2NegativesDS: 46
Interarrival jitterout: 0       Interarrival jitterin: 0

One Way Values:
NumOfOW: 0
OWMinSD: 0      OWMaxSD: 0      OWSumSD: 0      OWSum2SD: 0
OWMinDS: 0      OWMaxDS: 0      OWSumDS: 0      OWSum2DS: 0
```

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 VoIP UDP Jitter Operation feature.

Related Documents

Related Topic	Document Title
Voice over IP (VoIP) codecs	"Understanding Codecs: Complexity, Hardware Support, MOS, and Negotiation" http://www.cisco.com/warp/public/788/voip/codec_complexity.html
Jitter in Packet Voice Networks	"Understanding Jitter in Packet Voice Networks (Cisco IOS Platforms)" http://www.cisco.com/warp/public/788/voice-qos/jitter_packet_voice.html
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
PSTN Fallback for Voice Gateways	"SIP: Measurement-Based Call Admission Control for SIP" http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ftcacsip.htm

Standards

Standard	Title
ITU-T Recommendation G.107 (2003)	*The E-model, a computation model for use in transmission planning*
ITU-T Recommendation G.113 (1996)	*Transmission impairments*
ITU-T Recommendation G.113 (2001)	*Transmission impairments due to speech processing*
ITU-T Recommendation G.711 (1998)	*Pulse code modulation (PCM) of voice frequencies* (also known as the G.711 Voice Codec)
ITU-T Recommendation G.729 Annex A (1996)	*Reduced complexity 8 kbit/s CS-ACELP speech codec* (also known as the G.729/A/B Speech Codec)
ITU-T Recommendation P.800.1 (2003)	Mean Opinion Score (MOS) terminology

Full support for these standards is not claimed.

ITU Telecommunication Standards ("ITU-T Recommendations In Force") can be obtained from http://www.itu.ch. Summary definitions are available from a variety of internet sources.

MIBs

MIB	MIB 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[1]	Title
RFC 768	*User Datagram Protocol*
RFC 1889	*RTP: A Transport Protocol for Real-Time Applications*

1. Full support by this feature for listed RFCs is not claimed.

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/en/US/support/index.html

Feature Information for the IP SLAs VoIP UDP Jitter Operation

Table 8 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.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 8 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 8 Feature Information for the IP SLAs VoIP UDP Jitter Operation

Feature Name	Releases	Feature Information
IP SLAs UDP Jitter Operation	12.3(14)T	The Cisco IOS IP SLAs User Datagram Protocol (UDP) jitter operation allows you to measure round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic.

Glossary

codec—In the context of IP Telephony, a codec is a compression and decompression algorithm used to transfer voice and video data more efficiently. Voice codec types are typically referred to using the ITU recommendation number that defines the algorithm (for example, "G.711" instead of "PCM").

CS-ACELP—The codec type defined in the reference documents G.729 and G.729A, *Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP)*.

ITU—The International Telecommunication Union. The ITU is an international organization within the United Nations System where governments and the private sector coordinate global telecom networks and services. The ITU Telecommunication Standardization Sector (ITU-T), responsible for defining standards (Recommendations) covering all fields of telecommunications, is one of the three operational sectors of the ITU. The ITU web site is at http://www.itu.int.

ITU-T—ITU Telecommunication Standardization Sector. The ITU-T is one of the three operational sectors of the ITU, and is responsible for defining standards (called ITU-T Recommendations) covering all fields of telecommunications.

MOS-CQE (Mean Opinion Score; Conversational Quality, Estimated)—The score calculated by a network planning model which aims at predicting the quality in a conversational application situation. Estimates of conversational quality carried out according to ITU-T Rec. G.107, when transformed to a mean opinion score (MOS), give results in terms of MOS-CQE.[1]

PCM—The codec type defined in the reference document G.711, *Pulse code modulation (PCM) of voice frequencies*.

Note Refer to *Internetworking Terms and Acronyms* for terms not included in this glossary.

1. Definition from ITU-T Recommendation P.800.1. Used in accordance with the ITU Copyright and Disclaimer Notice.

IP SLAs—VoIP Gatekeeper Registration Delay Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This document describes how to use the Cisco IOS IP Service Level Agreements (SLAs) VoIP gatekeeper registration delay operation to determine the average, median, or aggregated response time (delay) of registration attempts from a Voice over IP (VoIP) gateway to a VoIP gatekeeper device.

To measure VoIP gatekeeper registration response time, the gatekeeper registration delay operation functions by sending a lightweight Registration Request (RRQ) from an H.323 gateway (GW) to an H.323 gatekeeper (GK), and recording the amount of time taken to receive the Registration Confirmation (RCF) back from the gatekeeper.

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 VoIP Gatekeeper Registration Delay 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.

Contents

CISCO SYSTEMS

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Restrictions for the IP SLAs VoIP Gatekeeper Registration Delay Operation

You cannot configure the IP SLAs VoIP gatekeeper registration delay operation if the gatekeeper has already been registered with the gateway.

Information About the IP SLAs VoIP Gatekeeper Registration Delay Operation

To configure the IP SLAs VoIP gateway registration delay operation, you should understand the following concepts:

H.323, Gatekeepers, and Gateways

H.232 is the ITU-T protocol standard used for managing and facilitating packetized voice and video over local-area networks (LANs, particularly intranets) and over the Internet. H.323 consists of several component standards; see the "Glossary" section on page 13 for details on these standardized protocols.

H.323 is considered an "umbrella protocol" because it defines all aspects of call transmission, from call establishment to capabilities exchange to network resource availability. H.323 defines Registration, Admission, and Status (RAS) protocols for call routing, H.225 protocols for call setup, and H.245 protocols for capabilities exchange. The IP SLAs VoIP Gatekeeper Registration Delay Monitoring feature focuses on the function of the call control H.323 stack.

For an in-depth discussion of H.323, including gatekeeper and gateway functionality, see the "H.323 Applications" chapter (part of the *Cisco IOS Voice, Video, and Fax Configuration Guide*, Release 12.2) [http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fvvfax_c/index.htm].

Gateway-to-Gatekeeper Registration Delay Time Monitoring

The IP SLAs VoIP gatekeeper registration delay operation provides statistical data on the amount of time taken to register a gateway to a gatekeeper. IP SLAs was designed to gather information over time, at intervals you specify, so that statistics can be provided on key metrics often used in Service Level Agreements (SLAs). Aggregated totals, median, or average data can be viewed using the Cisco IOS command-line interface (CLI) on the device running IP SLAs, or retrieved from the device by external applications using SNMP.

Cisco IOS IP SLAs also provides notification options based on performance thresholds and reaction triggering. These notification options allow for proactive monitoring in an environment where IT departments can be alerted to potential network problems, rather than having to manually examine data.

For further information on these functions, see the *Cisco IOS IP SLAs Monitoring Technology Configuration Guide*.

This operation will measure time from when the RRQ message is sent and when RCF message is received. A timeout may be required if a response is not received in a certain timeframe.

How to Configure the IP SLAs VoIP Gatekeeper Registration Delay Operation

This section contains the following procedures:

- Configuring the VoIP H.323 Gateway, page 3
- Configuring and Scheduling the IP SLAs VoIP Gatekeeper Registration Delay Operation, page 6

Configuring the VoIP H.323 Gateway

Check the registration status of the gateway to a gatekeeper using the **show gateway** command. If the gateway is not registered, perform the task described in this section.

Prerequisites

Prior to configuring the IP SLAs VoIP gatekeeper registration delay operation, the gatekeeper must be enabled and the gateway must be preregistered. As a best practice, you should confirm the gatekeeper and gateway status first.

If the gateway is not registered, select an interface and configure the gatekeeper in the gateway.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **gateway**
4. **exit**
5. **interface** *interface-id*
6. **ip address** *ip-address subnet-mask*
7. **h323-gateway voip interface**
8. **h323-gateway voip id** *gatekeeper-id* {**ipaddr** *ip-address* [*port-number*] | **multicast**}[**priority** *number*]
9. **h323-gateway voip h323-id** *interface-id*
10. **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	**gateway** **Example:** `Router(config)# gateway`	Enables the H.323 VoIP gateway and enters gateway configuration mode.
Step 4	**exit** **Example:** `Router(config-gateway)# exit`	Exits gateway configuration mode and returns to global configuration mode.
Step 5	**interface** *interface-id* **Example:** `Router(config)# interface Ethernet1/1`	Specifies an interface and enters interface configuration mode.
Step 6	**ip address** *ip-address subnet-mask* **Example:** `Router(config-if)# ip address 172.29.129.123 255.255.255.0`	Configures the IP address of the interface.
Step 7	**h323-gateway voip interface** **Example:** `Router(config-if)# h323-gateway voip interface`	Configures the interface as an H.323 gateway interface.

Step 8	**h323-gateway voip id** *gatekeeper-id* {**ipaddr** *ip-address* [*port-number*] | **multicast**} [**priority** *number*]
	
	Example:
	`Router(config-if)# h323-gateway voip id zone1 ipaddr 172.29.129.124 1719`
	`Router(config-if)# h323-gateway voip id saagk ipaddr 172.29.129.28 1719`
		Defines the name and location of the gatekeeper for a specific gateway.
		• Repeat as needed for multiple IDs (see example).

	Command or Action	Purpose
Step 9	**h323-gateway voip h323-id** *interface-id* **Example:** `Router(config-if)# h323-gateway voip h323-id GWZ`	Configures the H.323 name of the gateway that identifies this gateway to its associated gatekeeper.
Step 10	**exit** **Example:** `Router(config-if)# exit`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Examples

Use the **show gateway** command to verify the registration status of the gateway to a gatekeeper.

The following example shows sample output from the **show gateway** command if the gateway (named GW3) is registered to a gatekeeper (named slagk):

```
Router# show gateway
H.323 ITU-T Version: 4.0   H323 Stack Version: 0.1

 H.323 service is up
 Gateway  GW3 is registered to Gatekeeper slagk

Alias list (CLI configured)
 E164-ID 2073418
 E164-ID 5251212
 H323-ID GW3
Alias list (last RCF)
 E164-ID 2073418
 E164-ID 5251212
 H323-ID GW3

    H323 resource thresholding is Disabled
```

The following example shows sample output for the **show gateway** command if the gateway is not registered to a gatekeeper:

```
Router# show gateway

 Gateway gw3 is not registered to any gatekeeper

Alias list (CLI configured)
 E164-ID 2073418
 E164-ID 5251212
 H323-ID gw3/ww
Alias list (last RCF)

    H323 resource thresholding is Disabled
```

Use the **show gatekeeper endpoint** command to verify the endpoint's registration status to the gatekeeper. The following example shows the common output of this command if an endpoint is registered:

```
Router# show gatekeeper endpoint

            GATEKEEPER ENDPOINT REGISTRATION
            ================================
CallSignalAddr   Port   RASSignalAddr   Port   Zone Name   Type   Flags
```

```
--------------   -----  -------------   ----   ---------   ----   -----
172.16.13.35     1720   172.16.13.35    50890  gk          VOIP-GW
    E164-ID: 2073418
    E164-ID: 5251212
    H323-ID: gw3
   Total number of active registrations = 1
```

The following example shows the common output of the **show gatekeeper endpoint** command if an endpoint is not registered:

```
Router# show gatekeeper endpoint

            GATEKEEPER ENDPOINT REGISTRATION
            ================================
CallSignalAddr   Port   RASSignalAddr   Port   Zone Name   Type   Flags
--------------   -----  -------------   ----   ---------   ----   -----
   Total number of active registrations = 0
```

The following configuration example shows a properly configured gateway:

```
gateway
interface Ethernet1/1
 ip address 172.29.129.123 255.255.255.0
 h323-gateway voip interface
 h323-gateway voip id zone1 ipaddr 172.29.129.124 1719
 h323-gateway voip id saagk ipaddr 172.29.129.28 1719
 h323-gateway voip h323-id GWZ
```

Troubleshooting Tips

If there appears to be registration issues, see the *Troubleshooting Gatekeeper Registration Issues* technical assistance document for suggestions on resolving the issue.

http://www.cisco.com/warp/public/788/voip/gk-reg-issues.html

What to Do Next

Configure and schedule the IP SLAs VoIP gatekeeper registration delay operation.

Configuring and Scheduling the IP SLAs VoIP Gatekeeper Registration Delay Operation

Perform this task to begin gathering IP SLAs VoIP gatekeeper registration delay data.

Prerequisites

Prior to configuring the IP SLAs VoIP gatekeeper registration delay operation, the gatekeeper must be enabled and the gateway must be preregistered. As a best practice, you should confirm the gatekeeper and gateway status first.

If the gateway is not registered, select an interface and configure the gatekeeper in the gateway.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type voip delay gatekeeper registration**
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. **statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*
17. **verify-data**
18. **exit**
19. **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**]
20. **exit**
21. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

	Command or Action	Purpose
Step 4	**type voip delay gatekeeper registration** **Example:** `Router(config-sla-monitor)# type voip delay gatekeeper registration`	Configures the IP SLAs operation as a VoIP gatekeeper registration delay operation and enters IP SLA monitor VoIP configuration mode. • If the gatekeeper has not been registered with the gateway prior to entering this command, the following error message will be displayed: `No gatekeeper has been registered!`
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-voip)# 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-voip)# 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-voip)# 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-voip)# 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-voip)# 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-voip)# 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-voip)# 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-voip)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-voip)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 14	**tag** *text* **Example:** `Router(config-sla-monitor-voip)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-voip)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-voip)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	**verify-data** **Example:** `Router(config-sla-monitor-jitter)# verify-data`	(Optional) Causes an IP SLAs operation to check each reply packet for data corruption.
Step 18	**exit** **Example:** `Router(config-sla-monitor-voip)# exit`	Exits VoIP configuration submode and returns to global configuration mode.
Step 19	**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**] `Router(config)# ip sla monitor schedule 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 20	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 21	**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.

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 VoIP Gatekeeper Registration Delay Operation

This section contains the following configuration example:

- Configuring the IP SLAs VoIP gatekeeper registration delay operation: Example, page 10

Configuring the IP SLAs VoIP gatekeeper registration delay operation: Example

In the following example, a VoIP gatekeeper registration delay operation is configured and scheduled to start immediately. This example assumes the gateway to gatekeeper relationship has already been configured.

```
Router# configure terminal
Router(config)# ip sla monitor 1
Router(config-sla-monitor)# type voip delay gatekeeper registration
Router(config-sla-monitor-voip)# exit

Router(config)# ip sla schedule 1 start-time now life forever
```

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 VoIP gatekeeper registration delay operation.

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
Gateway and gatekeeper configuration using Cisco IOS Release 12.3 and later releases	*Cisco IOS Voice Configuration Library* http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123cgcr/vcl.htm
Troubleshooting gatekeeper configurations	*Troubleshooting Gatekeeper Registration Issues* (Tech Note document) http://www.cisco.com/warp/public/788/voip/gk-reg-issues.html

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

Glossary

Gatekeepers—Network devices that help to facilitate and control H.323-based voice and video communications across networks. Gatekeepers are responsible for providing address translation between LAN aliases and IP addresses, call control and routing services to H.323 endpoints, system management, and security policies. These services provided by the gatekeeper in communicating between H.323 endpoints are defined in RAS.

Gateways—Network devices that provide translation between circuit-switched networks (particularly, H.320 ISDN) and packet-based networks (for example, H.323 LANs), allowing endpoints in networks with different transmission formats, codecs, and protocols to communicate.

H.225.0—Protocol standard that defines the establishment and disconnection of H.323 calls.

H.225.0 RAS—H.225.0 Registration/Admission/Status. Standard that facilitates communication between H.323 gateways (endpoints) and H.323 gatekeepers.

H.235—Protocol standard that defines security solutions for H.323 protocols (Q.931, H.245, RAS, Streams). H.235 was formerly called H.SECURE.

H.245—Protocol standard that defines connection management and negotiation capabilities between H.323 devices on the network once the call is established by Q.931.

H.323—An ITU protocol standard for the transmission of real-time audio (Voice/VoIP), video (for example, videoconferencing), and data information over packet switching-based networks. Such networks include IP-based (including the Internet) networks, Internet packet exchange-based local-area networks (LANs), enterprise networks and metropolitan and wide-area networks (WANs). H.323 can also be applied to multipoint multimedia communications. H.323 defines a distributed architecture for IP telephony applications, including multimedia, video conferencing, video over the Internet, and VoIP.

Q.931—Protocol standard that defines the establishment and disconnection of H.323 calls.

RTP/RTCP—Real-time Protocol/Real-Time Control Protocol serves as the standardized means for transmitting and receiving audio and video streams across the network once the call is established.

VoIP—Voice or Video over Internet Protocol. Sometimes used to refer to all IP telephony applications.

Note See *Internetworking Terms and Acronyms* for terms not included in this glossary.

Feature Information for the IP SLAs VoIP Gatekeeper Registration Delay 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 VoIP Gatekeeper Registration Delay Operation

Feature Name	Releases	Feature Information
IP SLAs VoIP Gatekeeper Delay Monitoring	12.3(14)T	The Cisco IOS IP SLAs Voice over IP (VoIP) gatekeeper registration delay operation allows you to measure the average, median, or aggregated network response time of registration attempts from a VoIP gateway to a VoIP gatekeeper device.

IP SLAs—VoIP Call Setup Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

The Cisco IOS IP Service Level Agreements (SLAs) VoIP Call Setup (Post-Dial Delay) Monitoring feature provides the ability to measure your network's response time for setting up a Voice over IP (VoIP) call. This document describes how to use the IP SLAs VoIP call setup operation to monitor the call setup performance of your VoIP network.

When using either H.323 or Session Initiation Protocol (SIP) , the IP SLAs VoIP call setup operation can measure the total time from when an originating gateway sends a call message (containing a call number) to when the originating gateway receives a message from the terminating gateway (destination) indicating that either the called number rang or the called party answered the call.

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 VoIP Call Setup Operation" section on page 12.

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.

Contents

CISCO SYSTEMS

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

Prerequisites for the IP SLAs VoIP Call Setup Monitoring Operation

In order to use the IP SLAs VoIP call setup functionality, your Cisco IOS software image must support the IP SLAs VoIP test-call application and IP SLAs VoIP Responder application. To determine if your Cisco IOS software image is configured with these applications, use the **show call application voice** command in EXEC mode.

Note The IP SLAs VoIP Responder application is different from the IP SLAs Responder (which is configured using the **ip sla monitor responder** command in global configuration mode).

Information About the IP SLAs VoIP Call Setup Monitoring Operation

To configure an IP SLAs VoIP call setup operation, you should understand the following concept:

IP SLAs VoIP Call Setup Monitoring Using H.323 or SIP

The Cisco IOS IP SLAs VoIP Call Setup Monitoring feature provides the ability to measure your network's response time for setting up a Voice over IP (VoIP) call. Prior to configuring the IP SLAs VoIP call setup operation, you must enable the IP SLAs VoIP test-call application on the originating gateway (source). With the IP SLAs VoIP test-call application enabled, H.323 or Session Initiation Protocol (SIP) call messages can be sent to and received by the originating and terminating gateways. The configuration for the IP SLAs VoIP call setup operation is essentially the same for both protocols.

When using either H.323 or SIP, the IP SLAs VoIP call setup operation can measure the total time from when an originating gateway sends a call message (containing a call number) to when the originating gateway receives a message from the terminating gateway (destination) indicating that either the called number rang or the called party answered the call. As with all Cisco IOS IP SLAs operations, you can configure the VoIP call setup operation to repeat at specified time intervals, for a specified number of repetitions, and over a specified duration of time.

Note If a gatekeeper (GK) or directory gatekeeper (DGK) is involved in the H.323 call signaling, additional messages are sent and received between the originating and terminating gateways before the call message (containing a call number) is actually sent. The additional time required for these messages is included in the IP SLAs VoIP call setup response time measurement. Likewise, if a proxy server or

redirection server is involved in the SIP call signaling, any additional time required for messages to be sent and received (prior to sending the call message) is included in the VoIP call setup response time measurement.

A plain old telephone service (POTS) IP phone can be set up at the terminating gateway to respond to an IP SLAs VoIP call setup test call. As a convenient alternative to an actual IP phone, you can enable the IP SLAs VoIP Responder application in the terminating gateway. The IP SLAs VoIP Responder application will respond to incoming call setup messages from the originating gateway using H.323 or SIP.

Note The IP SLAs VoIP Responder application is different from the IP SLAs Responder (which is configured using the **ip sla monitor responder** command in global configuration mode).

How to Configure the IP SLAs VoIP Call Setup Monitoring Operation

This section contains the following tasks:

Configuring the Originating Gateway

Perform this task on the originating gateway (source) in order to start the IP SLAs VoIP test-call application, set up the dial peer to route the test call, define the VoIP call setup operation, and schedule the VoIP call setup operation. The required configuration for setting up the dial peer will vary slightly depending on whether you are using H.323 or SIP.

Prerequisites

In order to use the IP SLAs VoIP call setup functionality, your Cisco IOS software image must support the IP SLAs VoIP test-call application and IP SLAs VoIP Responder application. To determine if your Cisco IOS software image is configured with these applications, use the **show call application voice** command in EXEC mode.

Note The IP SLAs VoIP Responder application is different from the IP SLAs Responder (which is configured using the **ip sla monitor responder** command in global configuration mode).

SUMMARY STEPS

1. **enable**
2. **show call application voice** [*name* | **summary**]
3. **call application session start** *instance-name* [*application-name*]
4. **configure terminal**

5. **dial-peer voice** *tag* **voip**
6. **destination-pattern** [**+**] *string* [**T**]
7. **session target** {**ipv4:***destination-address* | **dns:**[**s.** | **d.** | **e.** | **u.**] *host-name* | **enum:***table-num* | **loopback:rtp** | **ras** | **sip-server**}
8. **session protocol sipv2**
9. **exit**
10. **ip sla monitor** *operation-number*
11. **type voip delay post-dial** [**detect-point** {**alert-ringing** | **connect-ok**}] **destination** *tag*
12. **buckets-of-history-kept** *size*
13. **distributions-of-statistics-kept** *size*
14. **enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*]
15. **filter-for-history** {**none** | **all** | **overThreshold** | **failures**}
16. **frequency** *seconds*
17. **hours-of-statistics-kept** *hours*
18. **lives-of-history-kept** *lives*
19. **owner** *owner-id*
20. **statistics-distribution-interval** *milliseconds*
21. **tag** *text*
22. **threshold** *milliseconds*
23. **timeout** *milliseconds*
24. **exit**
25. **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**]
26. **exit**
27. **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	**show call application voice** [*name* | **summary**]
	
	Example:
	`Router# show call application voice summary`
	`NAME DESCRIPTION`
	`...`
	`ipsla-testcall Basic app to place a simple call`
	`ipsla-responder Basic app to respond to a simple call`
	`...`
	
	`TCL Script Version 2.0 supported.`
	`Call Treatment Action Application - Version 1.`
		(Optional) Displays information about configured voice applications.
		• If the **summary** keyword is entered, the command output displays a one-line summary about each configured voice application.
		• If the Cisco IOS IP SLAs VoIP test-call application is configured on the currently loaded Cisco IOS software image, the ipsla-testcall name is displayed.

Step 3	**call application session start** *instance-name* [*application-name*] **Example:** `Router# call application session start ipsla-testcall ipsla-testcall`	Starts a new session of the Cisco IOS IP SLAs VoIP test-call application.
Step 4	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 5	**dial-peer voice** *tag* **voip** **Example:** `Router(config)# dial-peer voice 6789 voip`	Defines a particular dial peer, specifies the method of voice encapsulation, and enters dial-peer configuration mode. • The *tag* argument consists of one or more digits identifying the dial peer. Range is from 1 to 2147483647. • The **voip** keyword indicates a VoIP dial peer using voice encapsulation on an IP network.
Step 6	**destination-pattern** [**+**] *string* [**T**] **Example:** `Router(config-dial-peer)# destination-pattern 6789`	Specifies either the prefix or the full E.164 telephone number to be used for a dial peer.

	Command or Action	Purpose
Step 7	**session target** {**ipv4:***destination-address* | **dns:**[**s.** | **d.** | **e.** | **u.**] *host-name* | **enum:***table-num* | **loopback:rtp** | **ras** | **sip-server**} **Example:** `Router(config-dial-peer)# session target ipv4:172.29.129.123`	Designates a network-specific address to receive calls from a VoIP dial peer.
Step 8	**session protocol sipv2** **Example:** `Router(config-dial-peer)# session protocol sipv2`	(Optional) Specifies SIP as the session protocol for the VoIP dial peer. **Note** Perform this step only if configuring a SIP call.
Step 9	**exit** **Example:** `Router(config-dial-peer)# exit`	Exits dial-peer configuration mode and returns to global configuration mode.
Step 10	**ip sla monitor** *operation-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 11	**type voip delay post-dial** [**detect-point** {**alert-ringing** | **connect-ok**}] **destination** *tag* **Example:** `Router(config-sla-monitor)# type voip delay post-dial detect-point alert-ringing destination 6789`	Enters IP SLA monitor VoIP configuration mode and configures the operation as a VoIP call setup (post-dial delay) operation that will generate VoIP call setup response time measurements.
Step 12	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-voip)# buckets-of-history-kept 25`	(Optional) Sets the number of history buckets that are kept during the lifetime of an IP SLAs operation.
Step 13	**distributions-of-statistics-kept** *size* **Example:** `Router(config-sla-monitor-voip)# distributions-of-statistics-kept 5`	(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.
Step 14	**enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*] **Example:** `Router(config-sla-monitor-voip)# enhanced-history interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.

	Command or Action	Purpose
Step 15	**filter-for-history** {**none** | **all** | **overThreshold** | **failures**} **Example:** `Router(config-sla-monitor-voip)# filter-for-history failures`	(Optional) Defines the type of information kept in the history table for an IP SLAs operation.
Step 16	**frequency** *seconds* **Example:** `Router(config-sla-monitor-voip)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 17	**hours-of-statistics-kept** *hours* **Example:** `Router(config-sla-monitor-voip)# hours-of-statistics-kept 4`	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 18	**lives-of-history-kept** *lives* **Example:** `Router(config-sla-monitor-voip)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 19	**owner** *owner-id* **Example:** `Router(config-sla-monitor-voip)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 20	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-voip)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 21	**tag** *text* **Example:** `Router(config-sla-monitor-voip)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 22	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-voip)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 23	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-voip)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.

	Command or Action	Purpose
Step 24	**exit** **Example:** `Router(config-sla-monitor-voip)# exit`	Exits VoIP configuration submode and returns to global configuration mode.
Step 25	**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**] `Router(config)# ip sla monitor schedule 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 26	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 27	**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.

Troubleshooting Tips

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.

Configuring the Terminating Gateway Using the IP SLAs VoIP Responder Application

Perform this task on the terminating gateway (destination) in order to set up the dial peer and enable the IP SLAs VoIP Responder application to respond to the IP SLAs VoIP test call. The required configuration for setting up the dial peer will vary slightly depending on whether you are using H.323 or SIP.

Prerequisites

In order to use the IP SLAs VoIP call setup functionality, your Cisco IOS software image must support the IP SLAs VoIP test-call application and IP SLAs VoIP Responder application. To determine if your Cisco IOS software image is configured with these applications, use the **show call application voice** command in EXEC mode.

Note The IP SLAs VoIP Responder application is different from the IP SLAs Responder (which is configured using the **ip sla monitor responder** command in global configuration mode).

SUMMARY STEPS

1. **enable**
2. **show call application voice** [*name* | **summary**]
3. **configure terminal**
4. **dial-peer voice** *tag* **voip**
5. **incoming called-number** *tag*
6. **application** *application-name*
7. **session protocol sipv2**
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	**show call application voice** [*name* | **summary**]
	
	Example:
	`Router# show call application voice summary`
	`NAME DESCRIPTION`
	`...`
	`ipsla-testcall Basic app to place a simple call`
	`ipsla-responder Basic app to respond to a simple call`
	`...`
	
	`TCL Script Version 2.0 supported.`
	`Call Treatment Action Application - Version 1.`
		(Optional) Displays information about configured voice applications.
		• If the **summary** keyword is entered, the command output displays a one-line summary of each configured voice application.
		• If the Cisco IOS IP SLAs VoIP Responder application is configured on the currently loaded Cisco IOS software image, the ipsla-responder name is displayed.

Step 3	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 4	**dial-peer voice** *tag* **voip** **Example:** `Router(config)# dial-peer voice 6789 voip`	Defines a particular dial peer, specifies the method of voice encapsulation, and enters dial-peer configuration mode. • The *tag* argument consists of one or more digits identifying the dial peer. Range is from 1 to 2147483647. • The **voip** keyword indicates a VoIP dial peer using voice encapsulation on an IP network.

	Command or Action	Purpose
Step 5	**incoming called-number** *tag* **Example:** `Router(config-dial-peer)# incoming called-number 6789`	Specifies a digit string that can be matched by an incoming call to associate the call with a dial peer.
Step 6	**application** *application-name* **Example:** `Router(config-dial-peer)# application ipsla-responder`	Enables a specific application on a dial peer. • To enable the Cisco IOS IP SLAs VoIP Responder application, enter ipsla-responder as the *application-name* argument.
Step 7	**session protocol sipv2** **Example:** `Router(config-dial-peer)# session protocol sipv2`	(Optional) Specifies SIP as the session protocol for the VoIP dial peer. **Note** Perform this step only if configuring a SIP call.
Step 8	**exit** **Example:** `Router(config-dial-peer)# exit`	Exits dial-peer configuration mode and returns to global configuration mode.

Configuration Examples for the IP SLAs VoIP Call Setup Monitoring Operation

This section contains the following configuration examples:

- Configuring the Originating Gateway: Example, page 10
- Configuring the Terminating Gateway: Example, page 11

Configuring the Originating Gateway: Example

The following example shows how to configure an originating gateway to start the IP SLAs VoIP test-call application, set up the dial peer to route the test call, define the VoIP call setup operation, and schedule the VoIP call setup operation. In this example, test-call messages are generated using the Session Initiation Protocol (SIP).

```
call application session start ipsla-testcall ipsla-testcall
configure terminal
 dial-peer voice 6789 voip
  destination-pattern 6789
  session target ipv4:172.29.129.123
  session protocol sipv2
  exit
 ip sla monitor 1
  type voip delay post-dial detect-point alert-ringing destination 6789
  exit
 ip sla schedule 1 start-time now life forever
```

Configuring the Terminating Gateway: Example

The following example shows how to configure a terminating gateway to set up the dial peer and enable the IP SLAs VoIP Responder application to respond to the IP SLAs VoIP call setup test call. In this example, test-call messages are generated using the Session Initiation Protocol (SIP).

```
configure terminal
 dial-peer voice 6789 voip
 incoming called-number 6789
 application ipsla-responder
 session protocol sipv2
 exit
```

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 VoIP Call Setup Monitoring feature.

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

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

Feature Information for the IP SLAs VoIP Call Setup 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 VoIP Call Setup Operation

Feature Name	Releases	Feature Information
IP SLAs VoIP Call Setup (Post Dial Delay) Monitoring	12.3(14)T	The Cisco IOS IP SLAs Voice over IP (VoIP) call setup operation allows you to measure network response time for setting up a VoIP call.

IP SLAs—Analyzing IP Service Levels Using the UDP Echo Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) User Datagram Protocol (UDP) Echo operation to monitor end-to-end response time between a Cisco router and devices using IP. 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. UDP echo accuracy is enhanced by using the IP SLAs Responder at the destination Cisco router. This module also demonstrates how the results of the UDP echo operation can be displayed and analyzed to determine how a UDP application 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 UDP Echo Operation" section on page 14.

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.

Contents

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

Prerequisites for the IP SLAs UDP Echo Operation

Before configuring the IP SLAs UDP 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 UDP 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 UDP Echo Operation

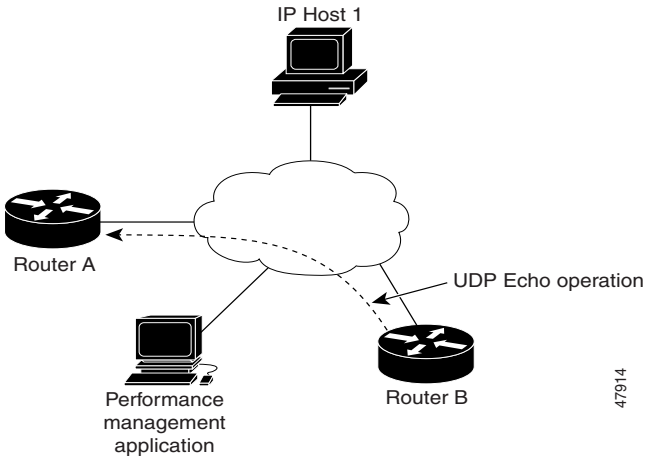
To perform the tasks required to monitor UDP performance using IP SLA, you should understand the following concept:

UDP Echo Operation

The UDP echo operation measures end-to-end response time between a Cisco router and devices using IP. UDP is a network layer (Layer 3) Internet protocol that is used for many IP services. UDP echo is used to measure response times and test end-to-end connectivity.

In Figure 1 Router A has been configured as an IP SLAs Responder and Router B is configured as the source IP SLAs device.

Figure 1 UDP Echo Operation



Response time (round-trip time) is computed by measuring the time taken between sending a UDP echo request message from Router B to the destination router—Router A—and receiving a UDP echo reply from Router A. UDP echo accuracy is enhanced by using the IP SLAs Responder at Router A, the destination Cisco router. If the destination router is a Cisco router, then IP SLAs sends a UDP datagram to any port number that you specified. Using the IP SLAs Responder is optional for a UDP echo operation when using Cisco devices. The IP SLAs Responder cannot be configured on non-Cisco devices.

The results of a UDP echo operation can be useful in troubleshooting issues with business-critical applications by determining the round-trip delay times and testing connectivity to both Cisco and non-Cisco devices.

How to Configure the IP SLAs UDP Echo Operation

This section contains the following procedures:

- Configuring the IP SLAs Responder on the Destination Device, page 3
- Configuring and Scheduling a UDP Echo Operation on the Source Device, page 4 (required)

Configuring the IP SLAs Responder on the Destination Device

Perform this task to enable the IP SLAs Responder on the destination Cisco device of a UDP echo operation. A UDP echo operation measures round-trip delay times and tests connectivity to Cisco and non-Cisco devices.

Prerequisites

If you are using the IP SLAs Responder, ensure that the networking device to be used as the responder is a Cisco device and that you have connectivity to that device through the network.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor 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 monitor responder** **Example:** `Router(config)# ip sla monitor responder`	Enables IP SLAs Responder functionality on a Cisco device.
Step 4	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring and Scheduling a UDP Echo Operation on the Source Device

To monitor UDP performance on a device, use the IP SLAs UDP echo operation. A UDP echo operation measures round-trip delay times and tests connectivity to Cisco and non-Cisco devices.

Prerequisites

If you are using the IP SLAs Responder, ensure that you have completed the "Configuring the IP SLAs Responder on the Destination Device" section on page 3 before you start this task.

Perform one of the following tasks in this section, depending on whether you want to configure a basic UDP echo operation or configure a UDP echo operation with optional parameters:

- Configuring and Scheduling a Basic UDP Echo Operation on the Source Device, page 4
- Configuring and Scheduling a UDP Echo Operation with Optional Parameters on the Source Device, page 7

Configuring and Scheduling a Basic UDP Echo Operation on the Source Device

Perform this task to enable a UDP 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 udpEcho dest-ipaddr** {*ip-address* | *ip-hostname*} **dest-port** *port-number*
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**
9. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

	Command or Action	Purpose
Step 4	**type udpEcho dest-ipaddr** {*ip-address* | *ip-hostname*} **dest-port** *port-number* **Example:** `Router(config-sla-monitor)# type udpEcho dest-ipaddr 172.29.139.134 dest-port 5000`	Defines a UDP echo operation and enters IP SLA Monitor UDP configuration mode. • Use the **dest-ipaddr** keyword and associated options to specify an IP address or designated IP name as the destination of the UDP operation. • Use the **dest-port** keyword and *port-number* value to specify the destination port number in the range from 1 to 65535. **Note** Only partial syntax is used in this example. For more details about the options available in the FTP operation syntax, see the "Configuring and Scheduling a UDP Echo Operation with Optional Parameters on the Source Device" section on page 7.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-udp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-udp)# exit`	Exits IP SLA monitor UDP configuration mode and returns to global configuration mode.
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 5 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.
Step 9	**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 example shows the configuration of an IP SLAs operation type of UDP echo that will start immediately and run indefinitely.

```
ip sla monitor 5
 type udpEcho dest-ipaddr 172.29.139.134 dest-port 5000
 frequency 30
!
ip sla monitor schedule 5 start-time now life forever.
```

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.

Configuring and Scheduling a UDP Echo Operation with Optional Parameters on the Source Device

Perform this task to enable a UDP echo operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 udpEcho dest-ipaddr** {*ip-address* | *ip-hostname*} **dest-port** *port-number* [**source-ipaddr** {*ip-address* | *ip-hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}]
5. **buckets-of-history-kept** *size*
6. **data-pattern** *hex-pattern*
7. **distributions-of-statistics-kept** *size*
8. **enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*]
9. **filter-for-history** {**none** | **all** | **overThreshold** | **failures**}
10. **frequency** *seconds*
11. **hours-of-statistics-kept** *hours*

12. **lives-of-history-kept** *lives*
13. **owner** *owner-id*
14. **request-data-size** *bytes*
15. **statistics-distribution-interval** *milliseconds*
16. **tag** *text*
17. **threshold** *milliseconds*
18. **timeout** *milliseconds*
19. **tos** *number*
20. **verify-data**
21. **exit**
22. **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**]
23. **exit**
24. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

	Command or Action	Purpose
Step 4	**type udpEcho dest-ipaddr** {*ip-address* | *ip-hostname*} **dest-port** *port-number* [**source-ipaddr** {*ip-address* | *ip-hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}] **Example:** `Router(config-sla-monitor)# type udpEcho dest-ipaddr 172.29.139.134 dest-port 5000`	Defines a UDP echo operation and enters IP SLA Monitor UDP configuration mode. • Use the **dest-ipaddr** keyword and associated options to specify an IP address or designated IP name as the destination of the UDP probe. • Use the **dest-port** keyword and *port-number* value to specify the destination port number in the range from 1 to 65535. • Use the optional **source-ipaddr** keyword and associated options to specify an IP address or designated IP name as the source of the UDP operation. This configuration is useful when IP SLAs packets are to be routed within an IPSec or GRE tunnel. • Use the optional **source-port** keyword and *port-number* value to specify a source port number. • Use the optional **control** keyword to specify that the IP SLAs control protocol should be used when running this operation. The control protocol is required when the target device is a Cisco router that does not natively provide the UDP service. Use the **disable** keyword when you want to disable the control protocol. The control protocol is enabled by default.
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-udp)# 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	**data-pattern** *hex-pattern* **Example:** `Router(config-sla-monitor-udp)# data-pattern`	(Optional) Specifies the data pattern in an IP SLAs operation to test for data corruption.
Step 7	**distributions-of-statistics-kept** *size* **Example:** `Router(config-sla-monitor-udp)# distributions-of-statistics-kept 5`	(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.
Step 8	**enhanced-history** [**interval** *seconds*] [**buckets** *number-of-buckets*] **Example:** `Router(config-sla-monitor-udp)# enhanced-history interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.

	Command or Action	Purpose
Step 9	**filter-for-history** {**none** | **all** | **overThreshold** | **failures**} **Example:** `Router(config-sla-monitor-udp)# filter-for-history failures`	(Optional) Defines the type of information kept in the history table for an IP SLAs operation.
Step 10	**frequency** *seconds* **Example:** `Router(config-sla-monitor-udp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 11	**hours-of-statistics-kept** *hours* **Example:** `Router(config-sla-monitor-udp)# hours-of-statistics-kept 4`	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 12	**lives-of-history-kept** *lives* **Example:** `Router(config-sla-monitor-udp)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 13	**owner** *owner-id* **Example:** `Router(config-sla-monitor-udp)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 14	**request-data-size** *bytes* **Example:** `Router(config-sla-monitor-udp)# request-data-size 64`	(Optional) Sets the protocol data size in the payload of an IP SLAs operation's request packet.
Step 15	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-udp)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 16	**tag** *text* **Example:** `Router(config-sla-monitor-udp)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 17	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-udp)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.

	Command or Action	Purpose
Step 18	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-udp)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 19	**tos** *number* **Example:** `Router(config-sla-monitor-udp)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.
Step 20	**verify-data** **Example:** `Router(config-sla-monitor-udp)# verify-data`	(Optional) Causes an IP SLAs operation to check each reply packet for data corruption.
Step 21	**exit** **Example:** `Router(config-sla-monitor-udp)# exit`	Exits UDP configuration submode and returns to global configuration mode.
Step 22	**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 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 23	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 24	**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 UDP echo operation number 5.

```
Router# show ip sla monitor configuration 5

Complete configuration Table (includes defaults)
Entry number: 5
Owner: jdoe
Tag: FLL-RO
Type of operation to perform: udpEcho
Target address: 172.29.139.134
Source address: 0.0.0.0
Target port: 5000
Source port: 0
```

```
Request size (ARR data portion): 160
Operation timeout (milliseconds): 1000
Type Of Service parameters: 128
Verify data: No
Data pattern:
Vrf Name:
Control Packets: enabled
Operation frequency (seconds): 30
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): Forever
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 distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Enhanced History:
Aggregation Interval:60 Buckets:2
Number of history Lives kept: 0
Number of history Buckets kept: 15
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 UDP Echo Operation

This section contains the following example:

- Configuring a UDP Echo Operation: Example, page 12

Configuring a UDP Echo Operation: Example

The following example configures an IP SLAs operation type of UDP echo that will start immediately and run indefinitely.

```
ip sla monitor 5
 type udpEcho dest-ipaddr 172.29.139.134 dest-port 5000
 frequency 30
 request-data-size 160
 tos 128
 timeout 1000
```

```
 tag FLL-RO
ip sla monitor schedule 5 life forever start-time now
```

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 UDP 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 UDP 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 UDP Echo Operation

Feature Name	Releases	Feature Information
IP SLAs UDP Jitter Operation	12.3(14)T	The Cisco IOS IP SLAs User Datagram Protocol (UDP) jitter operation allows you to measure round-trip delay, one-way delay, one-way jitter, one-way packet loss, and connectivity in networks that carry UDP traffic.

IP SLAs—Analyzing IP Service Levels Using the HTTP Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) HTTP operation to monitor the response time between a Cisco device and an HTTP server to retrieve a web page. The IP SLAs HTTP operation supports both the normal GET requests and customer RAW requests. 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. This module also demonstrates how the results of the HTTP operation can be displayed and analyzed to determine how an HTTP server 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 HTTP Operation" section on page 17.

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.

Contents

CISCO SYSTEMS

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Prerequisites for the IP SLAs HTTP Operation

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

Information About the IP SLAs HTTP Operation

To perform the tasks required to monitor the performance of an HTTP server using IP SLA, you should understand the following concept:

HTTP Operation

The HTTP operation measures the round-trip time (RTT) between a Cisco device and an HTTP server to retrieve a web page. The HTTP server response time measurements consist of three types:

- DNS lookup—RTT taken to perform domain name lookup.
- TCP Connect—RTT taken to perform a TCP connection to the HTTP server.
- HTTP transaction time—RTT taken to send a request and get a response from the HTTP server. The operation retrieves only the home HTML page.

Note IP SLAs has individual Domain Name Server (DNS) and TCP Connect operations. For more details, see the "Where to Go Next" section on page 16.

The DNS operation is performed first and the DNS RTT is measured. Once the domain name is found, a TCP Connect operation to the appropriate HTTP server is performed and the RTT for this operation is measured. The final operation is an HTTP request and the RTT to retrieve the home HTML page from the HTTP server is measured. One other measurement is made and called the time to first byte which measures the time from the start of the TCP Connect operation to the first HTML byte retrieved by the HTTP operation. The total HTTP RTT is a sum of the DNS RTT, the TCP Connect RTT, and the HTTP RTT.

For GET requests, IP SLAs will format the request based on the specified URL. For RAW requests, IP SLAs requires the entire content of the HTTP request. When a RAW request is configured, the raw commands are specified in HTTP RAW configuration mode. A RAW request is flexible and allows you to control fields such as authentication. An HTTP request can be made through a proxy server.

The results of an HTTP operation can be useful in monitoring your web server performance levels by determining the RTT taken to retrieve a web page.

How to Configure the IP SLAs HTTP Operation

This section contains the following procedures:

Configuring and Scheduling an HTTP GET Operation on the Source Device

To measure the response time between a Cisco device and an HTTP server to retrieve a web page, use the IP SLAs HTTP operation. A GET request requires only a specified URL. This operation does not require the IP SLAs Responder to be enabled.

Perform one of the following tasks in this section, depending on whether you want to configure a basic HTTP GET operation or configure an HTTP GET operation with optional parameters:

Configuring and Scheduling a Basic HTTP GET Operation on the Source Device

Perform this task to enable an HTTP GET 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 http operation get url** *url* [**name-server** *ip-address*] [**version** *version-number*] [**source-ipaddr** {*ip-address* | *ip-hostname*}] [**source-port** *port-number*] [**cache** {**enable** | **disable**}] [**proxy** *proxy-url*]
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**
9. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type http operation get url** *url* [**name-server** *ip-address*] [**version** *version-number*] [**source-ipaddr** {*ip-address* | *ip-hostname*}] [**source-port** *port-number*] [**cache** {**enable** | **disable**}] [**proxy** *proxy-url*] **Example:** `Router(config-sla-monitor)# type http operation get url http://198.133.219.25`	Defines an HTTP operation and enters IP SLA monitor configuration mode. • Use the **operation** and **get** keywords to specify an HTTP GET operation. • Use the **url** keyword and *url* argument to specify the URL of the destination HTTP server. **Note** Only the syntax applicable to the HTTP GET operation is used in this example. For more details, see the *Cisco IOS Configuration Fundamentals and Network Management Command Reference*, 12.3T.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-http)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-http)# exit`	Exits HTTP configuration submode and returns to global configuration mode.
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 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.

	Command or Action	Purpose
Step 8	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 9	**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 example shows the configuration of an IP SLAs operation type of HTTP GET that will start immediately and run indefinitely. This operation will retrieve the home page from the www.cisco.com website.

```
ip sla monitor 8
 type http operation get url http://198.133.219.25
 frequency 10
!
ip sla monitor schedule 8 life forever start-time now
```

Troubleshooting Tips

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.

Configuring and Scheduling an HTTP GET Operation with Optional Parameters on the Source Device

Perform this task to enable an HTTP GET operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 http operation get url** *url* [**name-server** *ip-address*] [**version** *version-number*] [**source-ipaddr** {*ip-address* | *ip-hostname*}] [**source-port** *port-number*] [**cache** {**enable** | **disable**}] [**proxy** *proxy-url*]

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. **http-raw-request**
12. **lives-of-history-kept** *lives*
13. **owner** *owner-id*
14. **statistics-distribution-interval** *milliseconds*
15. **tag** *text*
16. **threshold** *milliseconds*
17. **timeout** *milliseconds*
18. **tos** *number*
19. **exit**
20. **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**]
21. **exit**
22. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

	Command or Action	Purpose
Step 4	**type http operation get url** *url* [**name-server** *ip-address*] [**version** *version-number*] [**source-ipaddr** {*ip-address* | *ip-hostname*}] [**source-port** *port-number*] [**cache** {**enable** | **disable**}] [**proxy** *proxy-url*] **Example:** `Router(config-sla-monitor)# type http operation get url http://198.133.219.25`	Defines an HTTP operation and enters IP SLA Monitor configuration mode. • Use the **operation** and **get** keywords to specify an HTTP GET operation. • Use the **url** keyword and *url* argument to specify the URL of the destination HTTP server. • Use the **name-server** keyword and *ip-address* argument to specify the IP address of the destination DNS. • Use the **version** keyword and *version-number* argument to specify the version number. • Use the optional **source-ipaddr** keyword and associated options to specify an IP address or designated IP name as the source of the HTTP operation. This is useful when IP SLAs packets are to be routed within an IPSec or GRE tunnel. • Use the optional **source-port** keyword and *port-number* argument to specify a source port number. • Use the optional **cache** keyword to specify that cached HTTP pages can be downloaded. Use the **disable** keyword when you want to disable the download of cached HTTP pages. This is enabled by default. • Use the optional **proxy** keyword and proxy-url argument to specify proxy information. **Note** Only the syntax applicable to the HTTP GET operation is used in this example. For more details, see the *Cisco IOS Configuration Fundamentals and Network Management Command Reference*, 12.3T.
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-http)# 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-http)# 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-http)# enhanced-history interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.

	Command or Action	Purpose
Step 8	**filter-for-history** {**none** | **all** | **overThreshold** | **failures**} **Example:** `Router(config-sla-monitor-http)# 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-http)# 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-http)# hours-of-statistics-kept 4`	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 11	**http-raw-request** **Example:** `Router(config-sla-monitor-http)# http-raw-request`	(Optional) Explicitly specifies the options for a GET request for an IP SLAs HTTP operation.
Step 12	**lives-of-history-kept** *lives* **Example:** `Router(config-sla-monitor-http)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 13	**owner** *owner-id* **Example:** `Router(config-sla-monitor-http)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 14	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-http)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 15	**tag** *text* **Example:** `Router(config-sla-monitor-http)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 16	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-http)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.

	Command or Action	Purpose
Step 17	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-http)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 18	**tos** *number* **Example:** `Router(config-sla-monitor-http)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.
Step 19	**exit** **Example:** `Router(config-sla-monitor-http)# exit`	Exits HTTP configuration submode and returns to global configuration mode.
Step 20	**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 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 21	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 22	**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 HTTP GET operation number 8.

```
Router# show ip sla monitor configuration 8

Complete Configuration Table (includes defaults)
Entry Number: 8
Owner:
Tag: FLL-LA
Type of Operation to Perform: http
Reaction and History Threshold (milliseconds): 5000
Operation Frequency (seconds): 60
Operation Timeout (milliseconds): 5000
Verify Data: FALSE
Status of Entry (SNMP RowStatus): active
Protocol Type: httpAppl
Target Address:
Source Address: 0.0.0.0
Target Port: 0
Source Port: 0
```

```
Request Size (ARR data portion): 1
Response Size (ARR data portion): 1
Control Packets: enabled
Loose Source Routing: disabled
LSR Path:
Type of Service Parameters: 0x0
HTTP Operation: get
HTTP Server Version: 1.0
URL: http://198.133.219.25
Proxy:
Raw String(s):

Cache Control: enabled
Life (seconds): infinite - runs forever
Next Scheduled Start Time: Start Time already passed
Entry Ageout (seconds): never
Connection Loss Reaction Enabled: FALSE
Timeout Reaction Enabled: FALSE
Threshold Reaction Type: never
Threshold Falling (milliseconds): 3000
Threshold Count: 5
Threshold Count2: 5
Reaction Type: none
Verify Error Reaction Enabled: FALSE
Number of Statistic Hours kept: 2
Number of Statistic Paths kept: 1
Number of Statistic Hops kept: 1
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: 1
History Filter Type: none
```

Troubleshooting Tips

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.

Configuring and Scheduling an HTTP RAW Operation on the Source Device

To measure the response time between a Cisco device and an HTTP server to retrieve a web page, use the IP SLAs HTTP operation. To perform a RAW request, IP SLAs requires you to specify the entire contents of the HTTP request. After entering HTTP RAW configuration mode, you can specify HTTP 1.0 commands to complete the HTTP RAW request. This operation does not require the IP SLAs Responder to be enabled.

Perform this task to enable an HTTP RAW operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 http operation raw url** *url* [**name-server** *ip-address*] [**version** *version-number*] [**source-ipaddr** {*ip-address* | *ip-hostname*}] [**source-port** *port-number*] [**cache** {**enable** | **disable**}] [**proxy** *proxy-url*]
5. **http-raw-request**
6. Enter the required HTTP 1.0 command syntax.
7. **exit**
8. **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**]
9. **exit**
10. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

	Command or Action	Purpose
Step 4	**type http operation raw url** *url* [**name-server** *ip-address*] [**version** *version-number*] [**source-ipaddr** {*ip-address* | *ip-hostname*}] [**source-port** *port-number*] [**cache** {**enable** | **disable**}] [**proxy** *proxy-url*] **Example:** `Router(config-sla-monitor)# type http operation raw url http://198.133.219.25`	Defines an HTTP operation. • Use the **operation** and **raw** keywords to specify an HTTP RAW operation. • Use the **url** keyword and *url* argument to specify the URL of the destination HTTP server. • Use the **name-server** keyword and *ip-address* argument to specify the IP address of the destination DNS. • Use the **version** keyword and *version-number* argument to specify the version number. • Use the optional **source-ipaddr** keyword and associated options to specify an IP address or designated IP name as the source of the HTTP operation. This is useful when IP SLAs packets are to be routed within an IPSec or GRE tunnel. • Use the optional **source-port** keyword and *port-number* argument to specify a source port number. • Use the optional **cache** keyword to specify that cached HTTP pages can be downloaded. Use the **disable** keyword when you want to disable the download of cached HTTP pages. This is enabled by default. • Use the optional **proxy** keyword and *proxy-url* argument to specify proxy information. **Note** Only the syntax applicable to the HTTP RAW operation is used in this example. For more details, see the *Cisco IOS Configuration Fundamentals and Network Management Command Reference*, 12.3T.
Step 5	**http-raw-request** **Example:** `Router(config-sla-monitor)# http-raw-request`	Enters HTTP RAW configuration mode.
Step 6	Enter the required HTTP 1.0 command syntax. **Example:** `Router(config-sla-monitor-http)# GET /en/US/hmpgs/index.html HTTP/1.0\r\n\r\n`	Specifies all the required HTTP 1.0 commands.
Step 7	**exit** **Example:** `Router(config-sla-monitor-http)# exit`	Exits HTTP RAW configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 8	**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 5 start-time now life forever`	Configures the scheduling parameters for an individual IP SLAs operation.
Step 9	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 10	**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 HTTP RAW operation number 8.

```
Router# show ip sla monitor configuration 8

Complete Configuration Table (includes defaults)
Entry Number: 8
Owner:
Tag:
Type of Operation to Perform: http
Reaction and History Threshold (milliseconds): 5000
Operation Frequency (seconds): 60
Operation Timeout (milliseconds): 5000
Verify Data: FALSE
Status of Entry (SNMP RowStatus): active
Protocol Type: httpAppl
Target Address:
Source Address: 0.0.0.0
Target Port: 0
Source Port: 0
Request Size (ARR data portion): 1
Response Size (ARR data portion): 1
Control Packets: enabled
Loose Source Routing: disabled
LSR Path:
Type of Service Parameters: 0x0
HTTP Operation: raw
HTTP Server Version: 1.0
URL: http://198.133.219.25
Proxy:
Raw String(s):
GET /en/US/hmpgs/index.html HTTP/1.0\r\n\r\n

Cache Control: enabled
Life (seconds): infinite - runs forever
Next Scheduled Start Time: Start Time already passed
Entry Ageout (seconds): never
```

```
Connection Loss Reaction Enabled: FALSE
Timeout Reaction Enabled: FALSE
Threshold Reaction Type: never
Threshold Falling (milliseconds): 3000
Threshold Count: 5
Threshold Count2: 5
Reaction Type: none
Verify Error Reaction Enabled: FALSE
Number of Statistic Hours kept: 2
Number of Statistic Paths kept: 1
Number of Statistic Hops kept: 1
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: 1
History Filter Type: none
```

Troubleshooting Tips

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.

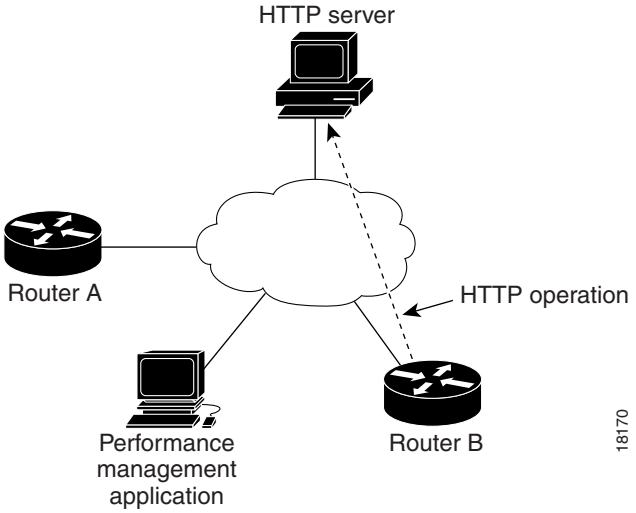
Configuration Examples for the IP SLAs HTTP Operation

This section provides the following configuration examples:

Configuring an HTTP GET Operation: Example

The following example show how to create and configure operation number 8 as an HTTP GET operation. The destination URL IP address represents the www.cisco.com website. Figure 1 depicts the HTTP GET operation.

Figure 1 HTTP Operation



Router B Configuration

```
ip sla monitor 8
 type http operation get url http://198.133.219.25
!
ip sla monitor schedule 8 start-time now
```

Configuring an HTTP RAW Operation: Example

The following example shows how to configure an HTTP RAW operation. To use the RAW commands, enter HTTP RAW configuration mode by using the **http-raw-request** command in IP SLA Monitor configuration mode. The IP SLA Monitor HTTP RAW configuration mode is indicated by the (config-sla-monitor-http) router prompt.

```
ip sla monitor 8
 type http operation raw url http://198.133.219.25
 http-raw-request
 GET /en/US/hmpgs/index.html HTTP/1.0\r\n
 \r\n
 end
ip sla monitor schedule 8 life forever start-time now
```

Configuring an HTTP RAW Operation Through a Proxy Server: Example

The following example shows how to configure an HTTP RAW operation through a proxy server. The proxy server is www.proxy.cisco.com and the HTTP server is www.yahoo.com.

```
ip sla monitor 8
 type http operation raw url http://www.proxy.cisco.com
 http-raw-request
 GET http://www.yahoo.com HTTP/1.0\r\n
 \r\n
 end
ip sla monitor schedule 8 life forever start-time now
```

Configuring an HTTP RAW Operation with Authentication: Example

The following example shows how to configure an HTTP RAW operation with authentication.

```
ip sla monitor 8
 type http operation raw url http://site-test.cisco.com
 http-raw-request
 GET /lab/index.html HTTP/1.0\r\n
 Authorization: Basic btNpdGT4biNvoZe=\r\n
 \r\n
 end
ip sla monitor schedule 8 life forever start-time now
```

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 the performance of an HTTP server 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
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
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 HTTP 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 HTTP Operation

Feature Name	Releases	Feature Information
IP SLAs HTTP Operation	12.3(14)T	The Cisco IOS IP SLAs Hypertext Transfer Protocol (HTTP) operation allows you to measure the network response time between a Cisco device and an HTTP server to retrieve a web page.

IP SLAs—Analyzing IP Service Levels Using the TCP Connect Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) TCP Connect operation to measure the response time taken to perform a TCP Connect operation between a Cisco router and devices using IP. 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. TCP Connect accuracy is enhanced by using the IP SLAs Responder at the destination Cisco router. This module also demonstrates how the results of the TCP Connect operation can be displayed and analyzed to determine how the connection times to servers and hosts within your network can affect IP service levels. The TCP Connect operation is useful for measuring response times for a server used for a particular application or connectivity testing for server availability.

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 TCP Connect Operation" section on page 13.

Finding Support Information for Platforms and Cisco IOS Software Images

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Contents

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Prerequisites for the IP SLAs TCP Connect Operation

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

Information About the IP SLAs TCP Connect Operation

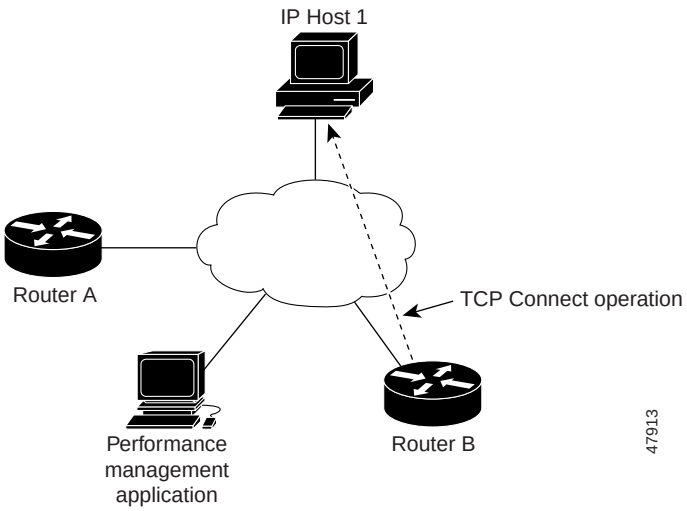
To perform the tasks required to analyze TCP connection times using IP SLA, you should understand the following concept:

TCP Connect Operation

The IP SLAs TCP Connect operation measures the response time taken to perform a TCP Connect operation between a Cisco router and devices using IP. TCP is a transport layer (Layer 4) Internet protocol that provides reliable full-duplex data transmission. The destination device can be any device using IP or an IP SLAs Responder.

In Figure 1 Router B is configured as the source IP SLAs device and a TCP Connect operation is configured with the destination device as IP Host 1.

Figure 1 TCP Connect Operation



Connection response time is computed by measuring the time taken between sending a TCP request message from Router B to IP Host 1 and receiving a reply from IP Host 1.

TCP Connect accuracy is enhanced by using the IP SLAs Responder at the destination Cisco device. If the destination router is a Cisco router, then IP SLAs makes a TCP connection to any port number that you specified. If the destination is not a Cisco IP host, then you must specify a known destination port number such as 21 for FTP, 23 for Telnet, or 80 for an HTTP server.

Using the IP SLAs Responder is optional for a TCP Connect operation when using Cisco devices. The IP SLAs Responder cannot be configured on non-Cisco devices.

TCP Connect is used to test virtual circuit availability or application availability. Server and application connection performance can be tested by simulating Telnet, SQL, and other types of connection to help you verify your IP service levels.

How to Configure the IP SLAs TCP Connect Operation

This section contains the following procedures:

- Configuring the IP SLAs Responder on the Destination Device, page 3 (optional)
- Configuring and Scheduling a TCP Connect Operation on the Source Device, page 4 (required)

Configuring the IP SLAs Responder on the Destination Device

Perform this task to enable the IP SLAs Responder on the destination Cisco device of a TCP Connect operation. A TCP Connect operation measures the response time taken to perform a TCP Connect operation between a Cisco router and devices using IP.

Prerequisites

If you are using the IP SLAs Responder, ensure that the networking device to be used as the Responder is a Cisco device and that you have connectivity to that device through the network.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor 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 monitor responder`
	
	Example:
	`Router(config)# ip sla monitor responder`
		Enables IP SLAs Responder functionality on a Cisco device.

Step 4	`exit`
	
	Example:
	`Router(config)# exit`
		(Optional) Exits global configuration mode and returns to privileged EXEC mode.

Configuring and Scheduling a TCP Connect Operation on the Source Device

To measure TCP connection response times between a Cisco IP device and a destination IP device, use the IP SLAs TCP Connect operation. A TCP Connect operation measures the response time taken to perform a TCP Connect operation between a Cisco router and devices using IP.

Prerequisites

If you are using the IP SLAs Responder, ensure that you have completed the "Configuring the IP SLAs Responder on the Destination Device" section on page 3 before you start this task.

Perform one of the following tasks in this section, depending on whether you want to configure a basic TCP Connect operation or configure a TCP Connect operation with optional parameters:

- Configuring and Scheduling a Basic TCP Connect Operation on the Source Device, page 4
- Configuring and Scheduling a TCP Connect Operation with Optional Parameters on the Source Device, page 6

Configuring and Scheduling a Basic TCP Connect Operation on the Source Device

Perform this task to enable a TCP Connect 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 tcpConnect dest-ipaddr** {*destination-ip-address* | *destination-hostname*} **dest-port** *port-number* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}]
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type tcpConnect dest-ipaddr** {*destination-ip-address* | *destination-hostname*} **dest-port** *port-number* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}] **Example:** `Router(config-sla-monitor)# type tcpConnect dest-ipaddr 172.29.139.132 dest-port 5000`	Defines a TCP Connect operation and enters IP SLA Monitor TCP configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-tcp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-tcp)# exit`	Exits IP SLA Monitor TCP 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 the global configuration mode and returns to privileged EXEC mode.

Examples

The following example shows the configuration of an IP SLAs operation type of TCP Connect that will start immediately and run indefinitely.

```
ip sla monitor 9
 type tcpConnect dest-ipaddr 172.29.139.132 dest-port 5000
 frequency 10
!
ip sla monitor schedule 9 life forever start-time now
```

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.

Configuring and Scheduling a TCP Connect Operation with Optional Parameters on the Source Device

Perform this task to enable a TCP Connect operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 tcpConnect dest-ipaddr** {*destination-ip-address* | *destination-hostname*} **dest-port** *port-number* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}]
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. **statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*
17. **tos** *number*
18. **exit**
19. **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**]
20. **exit**
21. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type tcpConnect dest-ipaddr** {*destination-ip-address* | *destination-hostname*} **dest-port** *port-number* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}] **Example:** `Router(config-sla-monitor)# type tcpConnect dest-ipaddr 172.29.139.132 dest-port 5000`	Defines a TCP Connect operation and enters IP SLA Monitor TCP configuration mode.

	Command or Action	Purpose
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-tcp)# 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-tcp)# 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-tcp)# 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-tcp)# 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-tcp)# 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-tcp)# 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-tcp)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-tcp)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-tcp)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.

	Command or Action	Purpose
Step 14	**tag** *text* **Example:** `Router(config-sla-monitor-tcp)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-tcp)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-tcp)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	**tos** *number* **Example:** `Router(config-sla-monitor-tcp)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.
Step 18	**exit** **Example:** `Router(config-sla-monitor-tcp)# exit`	Exits TCP configuration submode and returns to global configuration mode.
Step 19	**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 20	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 21	**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 TCP Connect operation number 9.

```
Router# show ip sla monitor configuration 9

Complete Configuration Table (includes defaults)
Entry Number: 9
Owner:
```

```
Tag: SL-SGU
Type of Operation to Perform: tcpConnect
Reaction and History Threshold (milliseconds): 5000
Operation Frequency (seconds): 20
Operation Timeout (milliseconds): 60000
Verify Data: FALSE
Status of Entry (SNMP RowStatus): active
Protocol Type: ipTcpConn
Target Address: 172.29.139.132
Source Address: 0.0.0.0
Target Port: 5000
Source Port: 0
Request Size (ARR data portion): 1
Response Size (ARR data portion): 1
Control Packets: enabled
Loose Source Routing: disabled
LSR Path:
Type of Service Parameters: 128
Life (seconds): infinite - runs forever
Next Scheduled Start Time: Start Time already passed
Entry Ageout (seconds): never
Connection Loss Reaction Enabled: FALSE
Timeout Reaction Enabled: FALSE
Threshold Reaction Type: never
Threshold Falling (milliseconds): 3000
Threshold Count: 5
Threshold Count2: 5
Reaction Type: none
Verify Error Reaction Enabled: FALSE
Number of Statistic Hours kept: 2
Number of Statistic Paths kept: 1
Number of Statistic Hops kept: 1
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: 1
History Filter Type: none
```

Troubleshooting Tips

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 TCP Connect Operation

This section contains the following configuration example:

- Configuring a TCP Connect Operation: Examples, page 11

Configuring a TCP Connect Operation: Examples

The following example shows how to configure a TCP Connect operation as shown in Figure 1 from Router B to the Telnet port (TCP port 23) of IP Host 1 (IP address 10.0.0.1). The operation is scheduled to start immediately. In this example, the control protocol is disabled. IP SLAs uses the control protocol to notify the IP SLAs Responder to enable the target port temporarily. This action allows the Responder to reply to the TCP Connect operation. In this example, because the target is not a router and a well-known TCP port is used, there is no need to send the control message.

Router A Configuration

```
configure terminal
 ip sla monitor responder
```

Router B Configuration

```
ip sla monitor 9
 type tcpConnect dest-ipaddr 10.0.0.1 dest-port 23 control disable
 frequency 30
 tos 128
 timeout 1000
 tag FLL-RO
ip sla monitor schedule 9 start-time now
```

The following example shows how to configure a TCP Connect operation with a specific port, port 23, and without an IP SLAs Responder. The operation is scheduled to start immediately and run indefinitely.

```
ip sla monitor 9
 type tcpConnect dest-ipaddr 173.29.139.132 dest-port 21 control disable
 frequency 30
ip sla monitor schedule 9 life forever start-time now
```

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 TCP Connect operation.

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
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
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 TCP Connect 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.

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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 TCP Connect Operation

Feature Name	Releases	Feature Information
IP SLAs TCP Connect Operation	12.3(14)T	The Cisco IOS IP SLAs Transmission Control Protocol (TCP) connect operation allows you to measure the network response time taken to perform a TCP Connect operation between a Cisco device and other devices using IP.

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

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) Internet Control Message Protocol (ICMP) Echo operation to monitor end-to-end response time between a Cisco router and devices using IP. ICMP Echo is useful 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. This module also demonstrates how the results of the ICMP Echo operation can be displayed and analyzed to determine how the network IP connections are 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 Echo Operation" section on page 12.

Finding Support Information for Platforms and Cisco IOS Software Images

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Contents

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Prerequisites for the IP SLAs ICMP Echo Operation

Before configuring the IP SLAs ICMP 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 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 Echo Operation

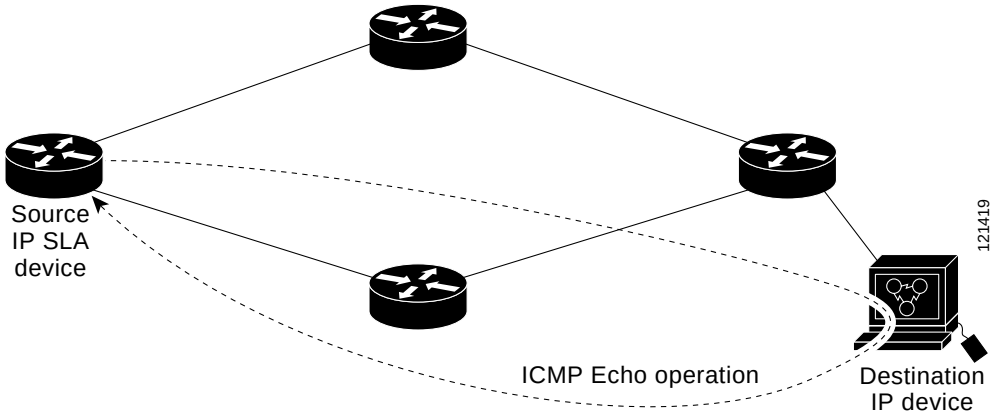
To perform the tasks required to analyze ICMP Echo performance using IP SLA, you should understand the following concept:

ICMP Echo Operation

The ICMP Echo operation measures end-to-end response time between a Cisco router and any devices using IP. Response time is computed by measuring the time taken between sending an ICMP Echo request message to the destination and receiving an ICMP Echo reply.

In Figure 1 ping is used by the ICMP Echo operation to measure the response time between the source IP SLAs device and the destination IP device. Many customers use IP SLAs ICMP-based operations, in-house ping testing, or ping-based dedicated probes for response time measurements.

Figure 1 ICMP Echo Operation



The IP SLAs ICMP Echo operation conforms to the same IETF specifications for ICMP ping testing and the two methods result in the same response times.

How to Configure the IP SLAs ICMP Echo Operation

This section contains the following procedure:

- Configuring and Scheduling an ICMP Echo Operation, page 3 (required)

Configuring and Scheduling an ICMP Echo Operation

To monitor IP connections on a device, use the IP SLAs ICMP Echo operation. An ICMP Echo operation measures end-to-end response times between a Cisco router and devices using IP. ICMP Echo is useful 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 Echo operation or configure and schedule an ICMP Echo operation with optional parameters:

- Configuring and Scheduling a Basic ICMP Echo Operation on the Source Device, page 3
- Configuring and Scheduling an ICMP Echo Operation with Optional Parameters on the Source Device, page 5

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

Perform this task to enable and schedule an ICMP 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 echo protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*} | **source-interface** *interface-name*]
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type echo protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*} | **source-interface** *interface-name*] **Example:** `Router(config-sla-monitor)# type echo protocol ipIcmpEcho 172.29.139.134`	Defines an ICMP Echo operation and enters IP SLA Monitor ICMP Echo configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-echo)# frequency 300`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-echo)# exit`	Exits IP SLA Monitor ICMP 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 Echo operation number 6 that will start immediately and run indefinitely.

```
ip sla monitor 6
 type echo protocol ipIcmpEcho 172.29.139.134 source-ipaddr 172.29.139.132
 frequency 300
!
ip sla monitor schedule 6 life forever start-time now
```

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.

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

Perform this task to enable an ICMP 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 echo protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*} | **source-interface** *interface-name*]
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. **request-data-size** *bytes*
14. **statistics-distribution-interval** *milliseconds*
15. **tag** *text*
16. **threshold** *milliseconds*
17. **timeout** *milliseconds*
18. **tos** *number*
19. **verify-data**
20. **vrf** *vrf-name*
21. **exit**
22. **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**]
23. **exit**
24. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type echo protocol ipIcmpEcho** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*} | **source-interface** *interface-name*] **Example:** `Router(config-sla-monitor)# type echo protocol ipIcmpEcho 172.29.139.134 source-ipaddr 172.29.139.132`	Defines an Echo operation and enters IP SLA Monitor Echo configuration mode.

	Command or Action	Purpose
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-echo)# 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-echo)# 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-echo)# 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-echo)# 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-echo)# 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-echo)# 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-echo)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-echo)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**request-data-size** *bytes* **Example:** `Router(config-sla-monitor-echo)# request-data-size 64`	(Optional) Sets the protocol data size in the payload of an IP SLAs operation's request packet.

	Command or Action	Purpose
Step 14	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-echo)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 15	**tag** *text* **Example:** `Router(config-sla-monitor-echo)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 16	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-echo)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 17	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-echo)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 18	**tos** *number* **Example:** `Router(config-sla-monitor-echo)# tos 160`	(Optional) Defines a type of service (ToS) byte in the IP header of an IP SLAs operation.
Step 19	**verify-data** **Example:** `Router(config-sla-monitor-echo)# verify-data`	(Optional) Causes an IP SLAs operation to check each reply packet for data corruption.
Step 20	**vrf** *vrf-name* **Example:** `Router(config-sla-monitor-echo)# vrf vpn-A`	(Optional) Allows monitoring within Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) using IP SLAs operations.
Step 21	**exit** **Example:** `Router(config-sla-monitor-echo)# exit`	Exits ICMP Echo configuration submode and returns to global configuration mode.
Step 22	**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.

	Command or Action	Purpose
Step 23	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 24	**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 Echo operation number 6.

```
Router# show ip sla monitor configuration 6

Entry number: 6
Owner: jdoe
Tag: SFO-RO
Type of operation to perform: echo
Target address: 172.29.139.134
Source address: 172.29.139.132
Request size (ARR data portion): 28
Operation timeout (milliseconds): 2000
Type Of Service parameters: 160
Verify data: No
Vrf Name:
Operation frequency (seconds): 300
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): Forever
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 distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
History Filter Type: None
Enhanced History:
```

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 Echo Operation

This section contains the following configuration example:

- Configuring an ICMP Echo Operation: Example, page 10

Configuring an ICMP Echo Operation: Example

The following example shows how to configure an IP SLAs operation type of ICMP Echo that will start immediately and run indefinitely.

```
ip sla monitor 6
 type echo protocol ipIcmpEcho 172.29.139.134 source-ipaddr 172.29.139.132
 frequency 300
 request-data-size 28
 tos 160
 timeout 2000
 tag SFO-RO
ip sla monitor schedule 6 life forever start-time now
```

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 IP connections using an IP SLAs ICMP Echo operation.

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 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 Echo Operation

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

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

First Published: May 2, 2005
Last Updated: August 29, 2006

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.

Contents

Corporate Headquarters:
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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

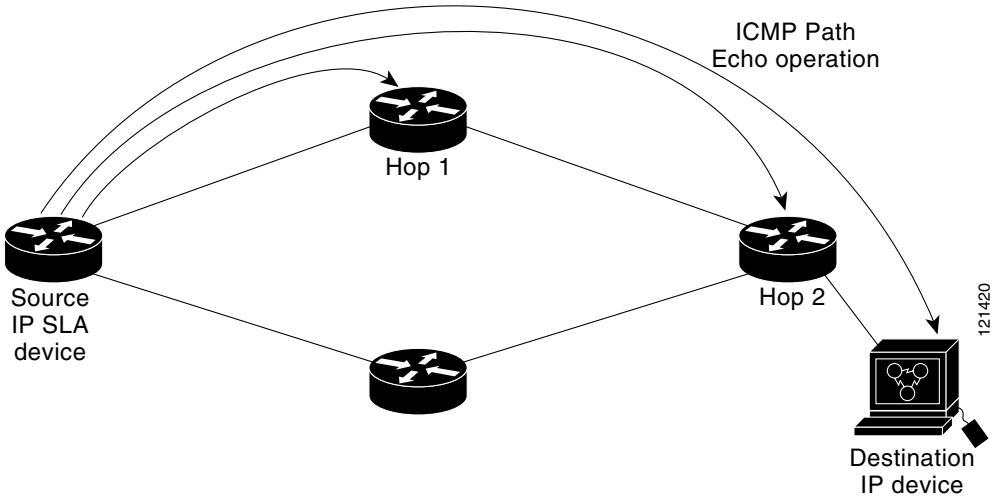
To perform the tasks required to monitor ICMP Path Echo performance using IP SLA, you should understand the following concept:

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, page 3 (required)

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, page 3
- Configuring and Scheduling an ICMP Path Echo Operation with Optional Parameters on the Source Device, page 5

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

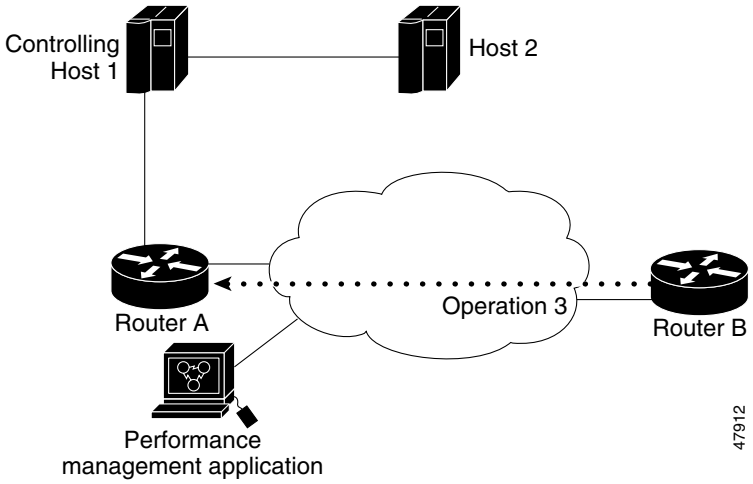
This section contains the following example:

- Configuring an ICMP Path Echo Operation: Example, page 10

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.

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

First Published: May 2, 2005
Last Updated: July 31, 2006

This document describes how to use the Cisco IOS IP Service Level Agreements (SLAs) ICMP Path Jitter operation to monitor hop-by-hop jitter (inter-packet delay variance).

Cisco IOS IP SLAs is an embedded feature set in Cisco IOS software that allows you to analyze IP service levels for IP applications and services, to increase productivity, to lower operational costs, and to reduce occurrences of network congestion or outages. IP SLAs uses active traffic monitoring—the generation of traffic in a continuous, reliable, and predictable manner—for measuring network performance. The accuracy of measured data is enhanced by enabling the IP SLAs responder, available in Cisco routers, on the destination device. This document also demonstrates how the data gathered using the Path Jitter operations can be displayed and analyzed using the Cisco IOS CLI.

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 Jitter Operation" section on page 11.

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.

Contents

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Prerequisites

- To use the IP SLAs ICMP Path Jitter operation, your device must be running Cisco IOS Software Release 12.2(2)T and later, 12.0(26)S and later, 12.2(20)S and later, or a derivative release with the correct feature set.
- Before configuring the IP SLAs ICMP Path Jitter operation you should be familiar with the "Cisco IOS IP SLAs Overview" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.

Information About the IP SLAs ICMP Path Jitter Operation

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

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 is not supported in the RTTMON MIB; configuration and performance data can only be obtained using the CLI.

How to Configure the IP SLAs ICMP Path Jitter Operation

This section contains the following procedure:

Configuring and Scheduling a ICMP Path Jitter Operation

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	**type pathJitter** command, **num-packets** option
Time between Echo probes, in milliseconds (*T*)	20 ms	**type pathJitter** 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

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

- Configuring and Scheduling a Basic ICMP Path Jitter Operation, page 4
- Configuring and Scheduling an ICMP Path Jitter Operation with Additional Parameters, page 5

Restrictions

- 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.
- 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 the CLI, and statistics can only be returned using CLI **show ip sla monitor** commands.

Note 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; see the "Cisco IOS IP SLAs Overview" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4, for information about the IP SLAs Responder and the IP SLAs Control Protocol.

Note Before configuring any IP SLAs application, you can use the **show ip sla monitor application** command to verify that the operation type is supported on your software image.

Configuring and Scheduling a Basic ICMP Path Jitter Operation

Perform the following steps to configure and schedule an ICMP Path Jitter operation using the general default characteristics for the operation. Start in Privileged Exec mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type pathJitter dest-ipaddr** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**]
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type pathJitter dest-ipaddr** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**] **Example:** `Router(config-sla-monitor)# type PathJitter dest-ipaddr 172.31.1.129 source-ipaddr 10.2.30.1 num-packets 12 interval 22`	Defines an ICMP Path Jitter operation and enters IP SLA Monitor Path Jitter configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-pathJitter)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config-sla-monitor-pathJitter)# exit`	Exits path jitter configuration submode and returns to global configuration mode.
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.

Examples

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 monitor 1
router(config-sla-monitor)# type pathJitter dest-ipaddr 172.17.246.20 num-packets 50
interval 30 targetOnly
```

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.

Configuring and Scheduling an ICMP Path Jitter Operation with Additional Parameters

Perform the following steps to configure and schedule an ICMP Path Jitter operation with additional parameters, using any of the optional commands needed. Start in Privileged Exec mode.

Restrictions

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. This means that the following IP SLAs commands are not supported for Jitter operations: **buckets-of-history-kept**, **filter-for-history**, **lives-of-history-kept**, **samples-of-history-kept**, and **show ip sla monitor history**.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*

4. **type pathJitter dest-ipaddr** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*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. **exit**
12. **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**]
13. **exit**
14. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type pathJitter dest-ipaddr** {*destination-ip-address* | *destination-hostname*} [**source-ipaddr** {*ip-address* | *hostname*}] [**num-packets** *packet-number*] [**interval** *milliseconds*] [**targetOnly**] **Example:** `Router(config-sla-monitor)# type PathJitter dest-ipaddr 172.31.1.129 source-ipaddr 10.2.30.1 num-packets 12 interval 22`	Defines an ICMP Path Jitter operation and enters IP SLA Monitor Path Jitter configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-pathJitter)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.

	Command or Action	Purpose
Step 6	**owner** *owner-id* **Example:** `Router(config-sla-monitor-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-sla-monitor-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-sla-monitor-pathJitter)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 9	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-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-sla-monitor-pathJitter)# vrf vpn-A`	(Optional) Allows monitoring within Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) using IP SLAs operations.
Step 11	**exit** **Example:** `Router(config-sla-monitor-pathJitter)# exit`	Exits Path Jitter configuration submode and returns to global configuration mode.
Step 12	**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 13	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 14	**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.

The following commands, available in Path Jitter configuration mode, do not apply to Path Jitter operations:

- **buckets-of-history-kept**
- **distributions-of-statistics-kept**
- **enhanced-history**
- **filter-for-history**
- **hours-of-statistics-kept**
- **lives-of-history-kept**
- **lsr-path**
- **samples-of-history-kept**
- **statistics-distribution-interval**
- **tos**
- **threshold**
- **verify-data**

Examples

In the following example, a Path Jitter operation is configured to run over a VPN using the VRF "red" to the CE at 10.3.30.130:

```
Router# configure terminal
Enter configuration commands, one per line.  End with the end command.
Router(config)# ip sla monitor 7
Router(config-sla-monitor)# type pathJitter dest-ipaddr 10.3.30.130
Router(config-sla-monitor-pathJitter)# vrf red
Router(config-sla-monitor-pathJitter)# exit
Router(config)# ip sla monitor schedule 7 start-time now life forever
```

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 monitor 1
router(config-sla-monitor)# type pathJitter dest-ipaddr 172.17.246.20 num-packets 50
interval 30 targetOnly
```

Troubleshooting Tips

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 Jitter Operation

This section contains the following examples:

Configuring a Path Jitter Operation: Example

In the following example, the ICMP Path Jitter operation is configured with an explicit source IP address, and the number of packets in each echo is changed to 20.

```
Router# configure terminal
Router(config)# ip sla monitor 10
Router(config-sla-monitor)# type PathJitter dest-ipaddr 209.165.200.225 source-ipaddr
172.31.1.129 num-packets 20
.
.
.
Router# show ip sla monitor configuration 10

Entry Number: 10
Owner:
Tag:
Type of operation to perform: pathJitter
Destination address: 209.165.200.225
Source address: 172.31.1.129
Number of packets: 20
Interval (milliseconds): 20
Target Only: Disabled
Request size (ARR data portion): 28
Operation timeout (milliseconds): 5000
Type Of Service parameters: 0x0
Verify data: No
Loose Source Routing: Disabled
Vrf Name:
LSR Path:
Operation frequency (seconds): 60
Next Scheduled Start Time: Already Started
Group Scheduled : FALSE

Life (seconds): 3600
Entry Ageout (seconds): never
Recurring (Starting Everyday): FALSE
Status of entry (SNMP RowStatus): notInService
Threshold (milliseconds): 0

Router# show ip sla monitor statistics

Current Operational State
Entry Number: 10
Modification Time: 21:12:32.471 UTC Tue Sep 14 2004
Diagnostics Text:
Last Time this Entry was Reset: Never
Number of Octets in use by this Entry: 1882
Number of Operations Attempted: 1
Current Seconds Left in Life: 3586
Operational State of Entry: active
Latest Completion Time Average (milliseconds): 4
```

```
Latest Operation Start Time: 15:41:43.000 UTC Tue Sep 19 2000


Path Jitter Statistics:
Legend - TR = Total Receives; RTT = Round Trip Time (Avg); PL = Packet Loss;
         DS = Discarded Samples; OS = Out Of Sequence Echo Replies


        HopAddress       TR      RTT     PL      DS      OS      Jitter(RFC 1889)
        10.2.30.1        10      1       0       0       0       0
        172.21.22.1      10      1       0       0       0       0
        172.24.112.122   10      1       0       0       0       0
        171.69.4.16      10      1       0       0       0       0
        171.69.5.6       10      1       0       0       0       0
        171.69.1.129     10      1       0       0       0       0
```

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 UDP 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 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"

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

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 Jitter 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.

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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 Jitter Operation

Feature Name	Releases	Feature Information
IP SLAs Path Jitter Operation	12.3(14)T	The Cisco IOS IP SLAs Internet Control Message Protocol (ICMP) path jitter operation allows you to measure hop-by-hop jitter (inter-packet delay variance).

IP SLAs—Analyzing IP Service Levels Using the FTP Operation

First Published: May 2, 2005
Last Updated: July 31, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) FTP operation to measure the response time between a Cisco device and a File Transfer Protocol (FTP) server to retrieve a file. The IP SLAs FTP operation supports an FTP GET request only. 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. This module also demonstrates how the results of the FTP operation can be displayed and analyzed to determine the capacity of your network. The FTP operation can be used also for troubleshooting FTP server performance.

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 FTP Operation" section on page 11.

Finding Support Information for Platforms and Cisco IOS Software Images

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Contents

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Prerequisites for the IP SLAs FTP Operation

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

Information About the IP SLAs FTP Operation

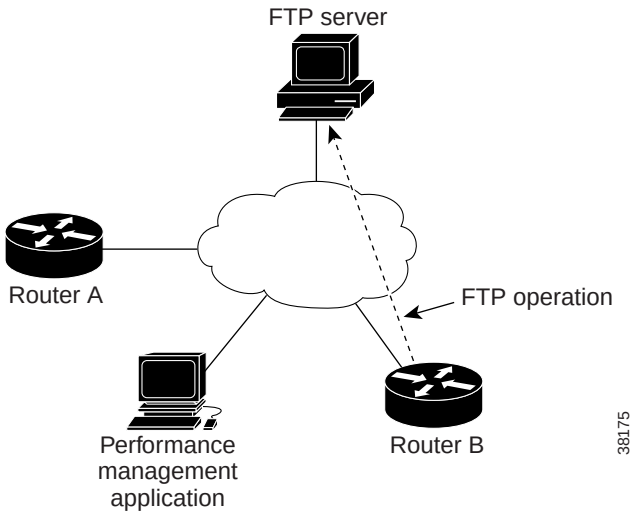
To perform the tasks required to analyze FTP server response times using IP SLA, you should understand the following concept:

FTP Operation

The FTP operation measures the round-trip time (RTT) between a Cisco device and an FTP server to retrieve a file. FTP is an application protocol, part of the Transmission Control Protocol (TCP)/IP protocol stack, used for transferring files between network nodes.

In Figure 1 Router B is configured as the source IP SLAs device and an FTP operation is configured with the FTP server as the destination device.

Figure 1 FTP Operation



Connection response time is computed by measuring the time taken to download a file to Router B from the remote FTP server using FTP over TCP. This operation does not use the IP SLAs Responder.

Note To test the response time to connect to an FTP port (Port 21), use the IP SLAs TCP Connect operation.

Both active and passive FTP transfer modes are supported. The passive mode is enabled by default. Only the FTP GET (download) operation type is supported. The URL specified for the FTP GET operation must be in one of the following formats:

- ftp://username:password@host/filename
- ftp://host/filename

If the username and password are not specified, the defaults are anonymous and test, respectively.

FTP carries a significant amount of data traffic and can affect the performance of your network. The results of an IP SLAs FTP operation to retrieve a large file can be used to determine the capacity of the network but retrieve large files with caution because the FTP operation will consume more bandwidth. The FTP operation also measures your FTP server performance levels by determining the RTT taken to retrieve a file.

How to Configure the IP SLAs FTP Operation

This section contains the following procedure:

- Configuring and Scheduling an FTP Operation on the Source Device, page 3 (required)

Configuring and Scheduling an FTP Operation on the Source Device

To measure the response time between a Cisco device and an FTP server to retrieve a file, use the IP SLAs FTP operation. The IP SLAs FTP operation only supports FTP GET (download) requests. This operation does not require the IP SLAs Responder to be enabled so there are no tasks to be performed on the destination device.

Perform one of the following tasks in this section, depending on whether you want to configure a basic FTP operation or configure an FTP operation with optional parameters:

- Configuring and Scheduling a Basic FTP Operation on the Source Device, page 3
- Configuring and Scheduling an FTP Operation with Optional Parameters on the Source Device, page 5

Configuring and Scheduling a Basic FTP Operation on the Source Device

Perform this task to enable an FTP 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 ftp operation get url** *url* [**source-ipaddr** {*ip-address* | *hostname*}] [**mode** {**passive** | **active**}
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type ftp operation get url** *url* [**source-ipaddr** {*ip-address* | *hostname*}] [**mode** {**passive** | **active**} **Example:** `Router(config-sla-monitor)# type ftp operation get url ftp://username:password@hostip/test.cap`	Defines an FTP operation and enters IP SLA Monitor FTP configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-ftp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-ftp)# exit`	Exits IP SLA Monitor FTP 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 the global configuration mode and returns to privileged EXEC mode.

Examples

The following example shows the configuration of an IP SLAs operation type of FTP to retrieve a file named test.cap. The FTP operation number 10 is scheduled to start immediately and run indefinitely.

```
ip sla monitor 10
 type ftp operation get url ftp://username:password@hostip/test.cap
 frequency 30
!
ip sla monitor schedule 10 life forever start-time now
```

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.

Configuring and Scheduling an FTP Operation with Optional Parameters on the Source Device

Perform this task to enable an FTP operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 ftp operation get url** *url* [**source-ipaddr** {*ip-address* | *hostname*}] [**mode** {**passive** | **active**}
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. **statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*
17. **exit**
18. **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**]
19. **exit**
20. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type ftp operation get url** *url* [**source-ipaddr** {*ip-address* | *hostname*}] [**mode** {**passive** | **active**} **Example:** `Router(config-sla-monitor)# type ftp operation get url ftp://username:password@hostip/filename`	Defines an FTP operation and enters IP SLA Monitor FTP configuration mode.
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-ftp)# buckets-of-history-kept 25`	(Optional) Sets the number of history buckets that are kept during the lifetime of an IP SLAs operation.

	Command or Action	Purpose
Step 6	**distributions-of-statistics-kept** *size* **Example:** `Router(config-sla-monitor-ftp)# 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-ftp)# 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-ftp)# 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-ftp)# 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-ftp)# 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-ftp)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-ftp)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-ftp)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 14	**tag** *text* **Example:** `Router(config-sla-monitor-ftp)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.

	Command or Action	Purpose
Step 15	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-ftp)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-ftp)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	**exit** **Example:** `Router(config-sla-monitor-ftp)# exit`	Exits FTP configuration submode and returns to global configuration mode.
Step 18	**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 19	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 20	**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 FTP operation number 10.

```
Router# show ip sla monitor configuration 10

Complete Configuration Table (includes defaults)
Entry number: 10
Owner: FTP-Test
Tag: FTP-Test
Type of operation to perform: ftp
Source address: 0.0.0.0
FTP URL: ftp://username:password@hostip/filename
Type Of Service parameters: 128
Operation timeout (milliseconds): 30000
Operation frequency (seconds): 30
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): Forever
Entry Ageout (seconds): never
Recurring (Starting Everyday): FALSE
```

```
Status of entry (SNMP RowStatus): Active
Threshold (milliseconds): 30000
Number of statistic hours kept: 2
Number of statistic distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
```

Troubleshooting Tips

Use the **debug ip sla monitor trace** and **debug ip sla monitor error** commands to help troubleshoot issues with the FTP 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 FTP Operation

This section contains the following configuration example:

- Configuring an FTP Operation: Example, page 9

Configuring an FTP Operation: Example

The following example shows how to configure an FTP operation as shown in Figure 1 from Router B to the FTP server. The operation is scheduled to start every day at 1:30 a.m. In this example, the file named test.cap is to be retrieved from the host, cisco.com, with a password of abc using FTP in active mode.

Router B Configuration

```
ip sla monitor 10
 type ftp operation get url ftp://user1:abc@test.cisco.com/test.cap mode active
 frequency 20
 tos 128
 timeout 40000
 tag FLL-FTP
ip sla monitor schedule 10 start-time 01:30:00 recurring
```

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 FTP operation.

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
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
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 FTP 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 FTP Operation

Feature Name	Releases	Feature Information
IP SLAs FTP Operation	12.3(14)T	The Cisco IOS IP SLAs File Transfer Protocol (FTP) operation allows you to measure the network response time between a Cisco device and an FTP server to retrieve a file.

IP SLAs—Analyzing IP Service Levels Using the DNS Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) DNS operation to measure the difference between the time taken to send a Domain Name System (DNS) request and receive a reply. 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. This module also demonstrates how the results of the DNS operation can be displayed and analyzed to determine the DNS lookup time which is a critical element for determining the performance of a DNS or web server.

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 DNS Operation" section on page 11.

Finding Support Information for Platforms and Cisco IOS Software Images

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Contents

CISCO SYSTEMS

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Prerequisites for the IP SLAs DNS Operation

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

Information About the IP SLAs DNS Operation

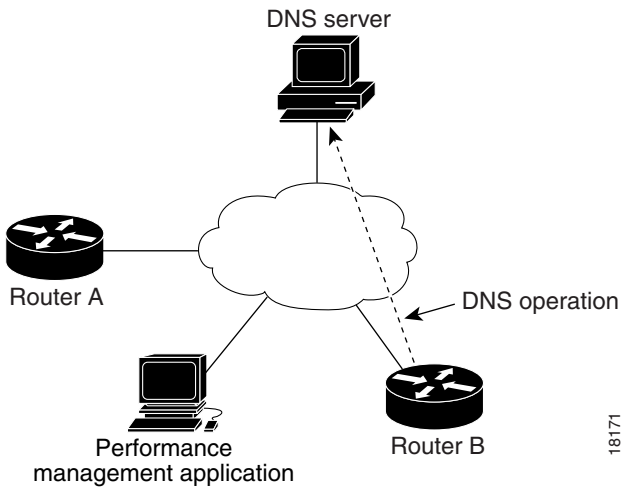
To perform the tasks required to analyze DNS lookup times using IP SLA, you should understand the following concept:

DNS Operation

The DNS operation measures the difference between the time taken to send a DNS request and receive a reply. DNS is used in the Internet for translating names of network nodes into addresses. The IP SLAs DNS operation queries for an IP address if you specify a host name, or queries for a host name if you specify an IP address.

In Figure 1 Router B is configured as the source IP SLAs device and a DNS operation is configured with the DNS server as the destination device.

Figure 1 DNS Operation



Connection response time is computed by measuring the difference between the time taken to send a request to the DNS server and the time a reply is received by Router B. The resulting DNS lookup time can help you analyze your DNS performance. Faster DNS lookup times translate to a faster web server access experience.

How to Configure the IP SLAs DNS Operation

This section contains the following procedure:

- Configuring and Scheduling a DNS Operation on the Source Device, page 3 (required)

Configuring and Scheduling a DNS Operation on the Source Device

To measure the difference between the time taken to send a DNS request and the time a reply is received by a Cisco device, use the IP SLAs DNS operation. This operation does not require the IP SLAs Responder to be enabled so there are no tasks to be performed on the destination device.

Perform one of the following tasks in this section, depending on whether you want to configure a basic DNS operation or configure a DNS operation with optional parameters:

- Configuring and Scheduling a Basic DNS Operation on the Source Device, page 3
- Configuring and Scheduling a DNS Operation with Optional Parameters on the Source Device, page 5

Configuring and Scheduling a Basic DNS Operation on the Source Device

Perform this task to enable a DNS 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 dns target-addr** {*target-hostname* | *target-ip-address*} **name-server** *ip-address* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*]
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type dns target-addr** {*target-hostname* | *target-ip-address*} **name-server** *ip-address* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*] **Example:** `Router(config-sla-monitor)# type dns target-addr www.cisco.com name-server 172.20.2.132`	Defines a DNS operation and enters IP SLA Monitor DNS configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-dns)# frequency 60`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-dns)# exit`	Exits DNS configuration submode and returns to global configuration mode.
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.

Examples

The following example shows the configuration of an IP SLAs operation type of DNS to find the IP address of the hostname cisco.com. The DNS operation number 11 is scheduled to start immediately and run indefinitely.

```
ip sla monitor 11
 type dns target-addr www.cisco.com name-server 172.20.2.132
 frequency 60
 exit
ip sla monitor schedule 11 life forever start-time now
```

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.

Configuring and Scheduling a DNS Operation with Optional Parameters on the Source Device

Perform this task to enable a DNS operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 dns target-addr** {*target-hostname* | *target-ip-address*} **name-server** *ip-address* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*]
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. **statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*
17. **exit**

18. **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**]
19. **exit**
20. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type dns target-addr** {*target-hostname* | *target-ip-address*} **name-server** *ip-address* [**source-ipaddr** {*ip-address* | *hostname*} **source-port** *port-number*] **Example:** `Router(config-sla-monitor)# type dns target-addr www.cisco.com name-server 172.20.2.132`	Defines a DNS operation and enters IP SLA Monitor DNS configuration mode.
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-dns)# 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-dns)# 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-dns)# enhanced-history interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.

	Command or Action	Purpose
Step 8	**filter-for-history** {**none** | **all** | **overThreshold** | **failures**} **Example:** `Router(config-sla-monitor-dns)# 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-dns)# 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-dns)# 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-dns)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-dns)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-dns)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 14	**tag** *text* **Example:** `Router(config-sla-monitor-dns)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-dns)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-dns)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	**exit** **Example:** `Router(config-sla-monitor-dns)# exit`	Exits DNS configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 18	**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 19	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 20	**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 DNS operation number 11.

```
Router# show ip sla monitor configuration 11

Complete Configuration Table (includes defaults)
Entry number: 11
Owner: DNS-Test
Tag: DNS-Test
Type of operation to perform: dns
Target address: www.cisco.com
Source address: 0.0.0.0
Source port: 0
Operation timeout (milliseconds): 9000
Operation frequency (seconds): 60
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): Forever
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 distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
History Filter Type: None
```

Troubleshooting Tips

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 DNS Operation

This section contains the following configuration example:

- Configuring a DNS Operation: Example, page 9

Configuring a DNS Operation: Example

The following example shows how to configure a DNS operation as shown in Figure 1 from Router B to the DNS server (IP address 172.20.2.132). The operation is scheduled to start immediately. In this example, the target address is a hostname—cisco.com—and the DNS operation will query the DNS server for the IP address associated with the hostname www.cisco.com. No configuration is required at the DNS server.

Router B Configuration

```
ip sla monitor 11
 type dns target-addr www.cisco.com name-server 172.20.2.132
 frequency 50
 timeout 8000
 tag DNS-Test
ip sla monitor schedule 11 start-time now
```

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 DNS operation.

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
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
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 DNS 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 DNS Operation

Feature Name	Releases	Feature Information
IP SLAs DNS Operation	12.3(14)T	The Cisco IOS IP SLAs Domain Name System (DNS) operation allows you to measure the difference between the time taken to send a DNS request and receive a reply.

IP SLAs—Analyzing IP Service Levels Using the DHCP Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) DHCP operation to measure the response time between a Cisco device and a Dynamic Host Control Protocol (DHCP) server to obtain an IP address. 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. This module also demonstrates how the results of the DHCP operation can be displayed and analyzed to determine the DHCP response time within your network, or for a specific DHCP server. The DHCP operation can be used also for troubleshooting DHCP server performance.

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 DHCP Operation" section on page 11.

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.

Contents

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Prerequisites for the IP SLAs DHCP Operation

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

Information About the IP SLAs DHCP Operation

To perform the tasks required to analyze DHCP server response times using IP SLAs, you should understand the following concepts:

DHCP Operation

The Dynamic Host Configuration Protocol (DHCP) operation measures the round-trip time (RTT) taken to discover a DHCP server and obtain a leased IP address from it. DHCP provides a mechanism for allocating IP addresses dynamically so that addresses can be reused when hosts no longer need them. IP SLAs releases the leased IP address after the operation.

There are two modes for the DHCP operation. By default, the DHCP operation sends discovery packets on every available IP interface on the router. If a specific server is configured on the router, using the **ip dhcp-server** command, discovery packets are sent only to that DHCP server.

The DHCP operation also measures your DHCP server performance levels by determining the RTT taken to obtain a leased IP address.

IP SLAs DHCP Relay Agent Options

A DHCP relay agent is any host that forwards DHCP packets between clients and servers. Relay agents are used to forward requests and replies between clients and servers when they are not on the same physical subnet. Relay agent forwarding is distinct from the normal forwarding of an IP router, where IP packets are switched between networks somewhat transparently. Relay agents receive DHCP messages and then generate a new DHCP message to send out on another interface.

The IP SLAs DHCP operation contains a relay agent information option—Option 82—which is inserted by the DHCP relay agent when forwarding client-originated DHCP packets to a DHCP server. Servers recognizing the relay agent information option may use the information to implement IP address or other parameter assignment policies. The DHCP server echoes the option back verbatim to the relay agent in server-to-client replies, and the relay agent strips the option before forwarding the reply to the client.

Option 82 includes three suboptions that convey information known by the relay agent:

- **circuit-id**—identifies the incoming circuit.

- **remote-id**—provides a trusted identifier for a remote high-speed modem.
- **subnet-mask**—identifies the mask of the logical IP subnet from which the relay agent received the client DHCP packet.

How to Configure the IP SLAs DHCP Operation

This section contains the following procedure:

- Configuring and Scheduling a DHCP Operation on the Source Device, page 3 (required)

Configuring and Scheduling a DHCP Operation on the Source Device

To measure the response time between a Cisco device and a DHCP server to lease an IP address, use the IP SLAs DHCP operation. This operation does not require the IP SLAs responder to be enabled so there are no tasks to be performed on the destination device.

Perform one of the following tasks in this section, depending on whether you want to configure a basic DHCP operation or configure a DHCP operation with optional parameters:

- Configuring and Scheduling a Basic DHCP Operation on the Source Device, page 3
- Configuring and Scheduling a DHCP Operation with Optional Parameters on the Source Device, page 5

Configuring and Scheduling a Basic DHCP Operation on the Source Device

Perform this task to enable a DHCP 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 dhcp** [**source-ipaddr** {*ip-address* | *hostname*}] [**dest-ipaddr** {*ip-address* | *hostname*}] [**option 82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]]
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type dhcp** [**source-ipaddr** {*ip-address* | *hostname*}] [**dest-ipaddr** {*ip-address* | *hostname*}] [**option 82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]] **Example:** `Router(config-sla-monitor)# type dhcp dest-ipaddr 10.10.10.3`	Defines a DHCP operation and enters IP SLA Monitor DHCP configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-dhcp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-dhcp)# exit`	Exits IP SLA Monitor DHCP configuration mode and returns to global configuration mode.
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 the global configuration mode and returns to privileged EXEC mode.

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.

Configuring and Scheduling a DHCP Operation with Optional Parameters on the Source Device

Perform this task to enable a DHCP operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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 dhcp** [**source-ipaddr** {*ip-address* | *hostname*}] [**dest-ipaddr** {*ip-address* | *hostname*}] [**option 82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]]
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. **statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*
17. **exit**
18. **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**]
19. **exit**
20. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type dhcp** [**source-ipaddr** {*ip-address* | *hostname*}] [**dest-ipaddr** {*ip-address* | *hostname*}] [**option 82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]] **Example:** `Router(config-sla-monitor)# type dhcp dest-ipaddr 10.10.10.3 option 82 circuit-id 10005A6F1234`	Defines a DHCP operation and enters IP SLA Monitor DHCP configuration mode.
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-dhcp)# 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-dhcp)# 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-dhcp)# 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-dhcp)# filter-for-history failures`	(Optional) Defines the type of information kept in the history table for an IP SLAs operation.

	Command or Action	Purpose
Step 9	**frequency** *seconds* **Example:** `Router(config-sla-monitor-dhcp)# 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-dhcp)# 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-dhcp)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-dhcp)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-dhcp)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 14	**tag** *text* **Example:** `Router(config-sla-monitor-dhcp)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-dhcp)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-dhcp)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	**exit** **Example:** `Router(config-sla-monitor-dhcp)# exit`	Exits DHCP configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 18	**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 19	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 20	**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 DHCP operation number 12.

```
Router# show ip sla monitor configuration 12

Complete Configuration Table (includes defaults)
Entry number: 12
Owner: DHCP-Test
Tag: DHCP-Test
Type of operation to perform: dhcp
Target address: 10.10.10.3
Source address: 0.0.0.0
Operation timeout (milliseconds): 5000
Dhcp option:
Operation frequency (seconds): 30
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): Forever
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 distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
History Filter Type: None
```

Troubleshooting Tips

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 DHCP Operation

This section contains the following configuration example:

- Configuring a DHCP Operation: Example, page 9

Configuring a DHCP Operation: Example

In the following example, IP SLAs operation number 12 is configured as a DHCP operation enabled for DHCP server 172.16.20.3. Note that DHCP option 82 is used to specify the circuit ID.

Router B Configuration

```
ip dhcp-server 172.16.20.3
!
ip sla monitor 12
 type dhcp option 82 circuit-id 10005A6F1234
 frequency 30
 timeout 5000
 tag DHCP_Test
!
ip sla monitor schedule 12 start-time now
```

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 DHCP operation.

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
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
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 DHCP 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 DHCP Operation

Feature Name	Releases	Feature Information
IP SLAs DHCP Operation	12.3(14)T	The Cisco IOS IP SLAs Dynamic Host Control Protocol (DHCP) operation allows you to schedule and measure the network response time between a Cisco device and a DHCP server to obtain an IP address.

IP SLAs—Analyzing IP Service Levels Using the DLSw+ Operation

First Published: May 2, 2005
Last Updated: August 29, 2006

This module describes how to use the Cisco IOS IP Service Level Agreements (SLAs) DLSw+ operation to measure the Data Link Switching Plus (DLSw+) protocol stack and network response time between DLSw+ peers. 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. This module also demonstrates how the results of the DLSw+ operation can be displayed and analyzed to determine the DLSw+ peer tunnel response time.

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 DLSw+ Operation" section on page 11.

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 DLSw+ Operation

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

Information About the IP SLAs DLSw+ Operation

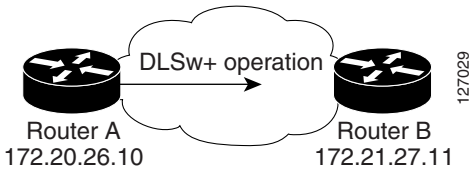
To perform the tasks required to analyze DLSw+ peer response times using IP SLA, you should understand the following concept:

DLSw+ Operation

The Cisco IOS IP SLAs DLSw+ operation measures the DLSw+ protocol stack and network response time between DLSw+ peers. DLSw+ is the enhanced Cisco version of RFC 1795. DLSw+ tunnels non-routable Layer 2 traffic such as Systems Network Architecture (SNA) traffic over IP backbones via TCP. The networking devices performing the tunneling of non-routable traffic into TCP/IP are referred to as DLSw+ peers. DLSw+ peers normally communicate through TCP port 2065. The destination networking device does not have to be a Cisco router if it supports RFC 1795.

In Figure 1, Router A is configured as the source IP SLAs device and a DLSw+ operation is configured with Router B as the remote DLSw+ peer. Router A and Router B are configured as connected DLSw+ peers. The peer (destination device) does not have to run a Cisco IOS IP SLA-capable image.

Figure 1 DLSw+ Operation



Network response time is computed by measuring the round-trip time (RTT) taken to connect to the remote DLSw+ peer using TCP. This operation does not use the IP SLAs Responder.

How to Configure the IP SLAs DLSw+ Operation

This section contains the following procedure:

Configuring and Scheduling a DLSw+ Operation on the Source Device

To measure the response time between a Cisco device and a DLSw+ peer, use the IP SLAs DLSw+ operation. This operation does not require the IP SLAs Responder to be enabled so there are no tasks to be performed on the destination device.

Perform one of the following tasks in this section, depending on whether you want to configure a basic DLSw+ operation or configure a DLSw+ operation with optional parameters:

- Configuring and Scheduling a Basic DLSw+ Operation on the Source Device, page 3
- Configuring and Scheduling a DLSw+ Operation with Optional Parameters on the Source Device, page 5

Configuring and Scheduling a Basic DLSw+ Operation on the Source Device

Perform this task to enable a DLSw+ 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.

Prerequisites

Before enabling the IP SLAs DLSw+ operation you must configure a connected DLSw+ peer between the source and destination networking devices.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type dlsw peer-ipaddr** *ip-address*
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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type dlsw peer-ipaddr** *ip-address* **Example:** `Router(config-sla-monitor)# type dlsw peer-ipaddr 172.21.27.11`	Defines a DLSw+ operation and enters IP SLA Monitor DLSw+ configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-sla-monitor-dlsw)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-sla-monitor-dlsw)# exit`	Exits IP SLA Monitor DLSw+ configuration mode and returns to global configuration mode.
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.

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.

Configuring and Scheduling a DLSw+ Operation with Optional Parameters on the Source Device

Perform this task to enable a DLSw+ operation on the source device and configure some optional IP SLAs parameters. The source device is the location at which the measurement statistics are stored.

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.

Prerequisites

Before enabling the IP SLAs DLSw+ operation you must configure a connected DLSw+ peer between the source and destination networking devices.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor** *operation-number*
4. **type dlsw peer-ipaddr** *ip-address*
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. **request-data-size** *bytes*
14. **statistics-distribution-interval** *milliseconds*
15. **tag** *text*
16. **threshold** *milliseconds*
17. **timeout** *milliseconds*
18. **exit**
19. **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**]
20. **exit**
21. **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-number* **Example:** `Router(config)# ip sla monitor 10`	Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
Step 4	**type dlsw peer-ipaddr** *ip-address* **Example:** `Router(config-sla-monitor)# type dlsw peer-ipaddr 172.21.27.11`	Defines a DLSw+ operation and enters IP SLA Monitor DLSw configuration mode.
Step 5	**buckets-of-history-kept** *size* **Example:** `Router(config-sla-monitor-dlsw)# 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-dlsw)# 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-dlsw)# 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-dlsw)# 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-dlsw)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.

	Command or Action	Purpose
Step 10	**hours-of-statistics-kept** *hours* **Example:** `Router(config-sla-monitor-dlsw)# 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-dlsw)# lives-of-history-kept 5`	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	**owner** *owner-id* **Example:** `Router(config-sla-monitor-dlsw)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**request-data-size** *bytes* **Example:** `Router(config-sla-monitor-dlsw)# request-data-size 64`	(Optional) Sets the protocol data size in the payload of an IP SLAs operation's request packet.
Step 14	**statistics-distribution-interval** *milliseconds* **Example:** `Router(config-sla-monitor-dlsw)# statistics-distribution-interval 10`	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 15	**tag** *text* **Example:** `Router(config-sla-monitor-dlsw)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 16	**threshold** *milliseconds* **Example:** `Router(config-sla-monitor-dlsw)# threshold 10000`	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 17	**timeout** *milliseconds* **Example:** `Router(config-sla-monitor-dlsw)# timeout 10000`	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 18	**exit** **Example:** `Router(config-sla-monitor-dlsw)# exit`	Exits DLSw configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 19	**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 20	**exit** **Example:** `Router(config)# exit`	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 21	**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 DLSw+ operation number 14.

```
Router# show ip sla monitor configuration 14

Complete Configuration Table (includes defaults)
Entry number: 14
Owner:
Tag: DLSw-Test
Type of operation to perform: dlsw
Peer address: 172.21.27.11
Request size (ARR data portion): 0
Operation timeout (milliseconds): 50000
Operation frequency (seconds): 50
Next Scheduled Start Time: Start Time already passed
Group Scheduled: FALSE
Life (seconds): 50
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 distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Number of history Lives kept: 0
Number of history Buckets kept: 15
History Filter Type: None
```

Troubleshooting Tips

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 DLSw+ Operation

This section contains the following configuration example:

Configuring a DLSw+ Operation: Example

The following example shows how to configure a DLSw+ operation as shown in Figure 1 from Router A to Router B, a remote DLSw+ peer. Router B is configured as a DLSw+ peer and Router A is specified as the remote (connected) DLSw+ peer. Router A is then configured as a DLSw+ peer with Router B as the connected DLSw+ peer, and the IP SLAs DLSw+ operation parameters are configured. The operation is scheduled to start immediately and run for 7200 seconds (2 hours).

Router B Configuration

```
configure terminal
dlsw local-peer peer-id 172.21.27.11
dlsw remote-peer 0 tcp 172.20.26.10
```

Router A Configuration

```
dlsw local-peer peer-id 172.20.26.10
dlsw remote-peer 0 tcp 172.21.27.11
ip sla monitor 14
 type dlsw peer-ipaddr 172.21.27.11
 frequency 50
 timeout 50000
 tag DLSw-Test
 exit
ip sla monitor schedule 14 life 7200 start-time now
```

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 DLSw+ operation.

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 1795	*Data Link Switching: Switch-to-Switch 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 DLSw+ 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 DLSw+ Operation

Feature Name	Releases	Feature Information
IP SLAs DLSw+ Operation	12.3(14)T	The Cisco IOS IP SLAs Data Link Switching Plus (DLSw+) operation allows you to schedule and measure the DLSw+ protocol stack and network response time between DLSw+ peers

IP SLAs—Multiple Operation Scheduling

First Published: May 2, 2005
Last Updated: July 31, 2006

This document describes how to schedule multiple operations at once using the Cisco IOS IP Service Level Agreements (SLAs) group-scheduling feature.

Cisco IOS IP SLAs allows you to analyze IP service levels for IP applications and services, to increase productivity, to lower operational costs, and to reduce occurances of network congestion or outages. IP SLAs uses active traffic monitoring—the generation of traffic in a continuous, reliable, and predictable manner with proactive notification capabilities—for measuring network performance. IP SLAs can be used for network troubleshooting, network assessment, and health monitoring.

The ability to schedule hundreds of operations at once allows service providers with large networks to monitor service levels for mulitple environments.

In addition to allowing you to schedule multiple IP SLAs operations with a single command, IP SLAs can be used to schedule operations to run at equal intervals, automatically distributing the operations over a specified time frame. This distribution helps to minimize the CPU utilization, thereby enhancing the scalability of the IP SLAs monitoring solution.

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 IP SLAs Multiple Operation Scheduling" section on page 14.

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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Contents

Prerequisites for IP SLAs Multiple Operations Scheduling

- Configure the IP SLAs operations before group scheduling those operations.
- Determine the IP SLAs operations you want to schedule as a single group.
- Identify the network traffic type and the location of your network management station.
- Identify the topology and the types of devices in your network.
- Decide on the frequency of testing for each operation.

Information About Scheduling Multiple and Recurring IP SLAs Operations

To schedule IP SLAs as multiple or recurring operations, you should understand the following concept:

- Scheduling of Multiple IP SLAs Operations, page 2

Scheduling of Multiple IP SLAs Operations

Normal scheduling of IP SLAs operations allows you to schedule one operation at a time. If you have large networks with thousands of IP SLAs operations to monitor network performance, normal scheduling (scheduling each operation individually) will be inefficient and time-consuming.

Multiple operations scheduling allows you to schedule multiple IP SLAs operations using a single command through the command line interface (CLI) or the CISCO-RTTMON-MIB. This feature allows you to control the amount of IP SLAs monitoring traffic by scheduling the operations to run at evenly distributed times. You must specify the operation ID numbers to be scheduled and the time range over which all the IP SLAs operations should start. This feature automatically distributes the IP SLAs operations at equal intervals over a specified time frame. The spacing between the operations (start interval) is calculated and the operations are started. This distribution of IP SLAs operations helps minimize the CPU utilization and thereby enhances the scalability of the network.

The IP SLAs multiple operations scheduling functionality allows you to schedule multiple IP SLAs operations as a group using the **ip sla monitor group schedule** command. The following parameters can be configured with this command:

- Group operation number—Group configuration or group schedule number of the IP SLAs operation to be scheduled.
- Operation ID numbers—A list of IP SLAs operation ID numbers in the scheduled operation group.
- Schedule period—Amount of time for which the IP SLAs operation group is scheduled.
- Ageout—Amount of time to keep the operation in memory when it is not actively collecting information. By default, the operation remains in memory indefinitely.
- Frequency—Amount of time after which each IP SLAs operation is restarted. When the frequency option is specified, it overwrites the operation frequency of all operations belonging to the group. Note that when the frequency option is not specified,the frequency for each operation is set to the value of the schedule period.
- Life—Amount of time the operation actively collects information. The operation can be configured to run indefinitely. By default, the lifetime of an operation is one hour.
- Start time—Time when the operation starts collecting information. You can specify an operation to start immediately or at an absolute start time using hours, minutes, seconds, day, and month.

The IP SLAs multiple operations scheduling functionality schedules the maximum number of operations possible without aborting. However, this functionality skips those IP SLAs operations that are already running or those that are not configured and hence do not exist. The total number of operations will be calculated based on the number of operations specified in the command, irrespective of the number of operations that are missing or already running. The IP SLAs multiple operations scheduling functionality displays a message showing the number of active and missing operations. However, these messages are displayed only if you schedule operations that are not configured or are already running.

A main benefit for scheduling multiple IP SLAs operations is that the load on the network is reduced by distributing the operations equally over a scheduled period. This distribution helps you to achieve more consistent monitoring coverage. To illustrate this scenario, consider configuring 60 operations to start during the same 1-second interval over a 60-second schedule period. If a network failure occurs 30 seconds after all 60 operations have started and the network is restored before the operations are due to start again (in another 30 seconds), then this failure would never be detected by any of the 60 operations. However, if the 60 operations are distributed equally at 1-second intervals over a 60-second schedule period, then some of the operations would detect the network failure. Conversely, if a network failure occurs when all 60 operations are active, then all 60 operations would fail, indicating that the failure is possibly more severe than it really is.

Operations of the same type and same frequency should be used for IP SLAs multiple operations scheduling. If you do not specify a frequency, the default frequency will be the same as that of the schedule period. The schedule period is the period of time in which all the specified operations should run. The following sections explain the IP SLAs multiple operations scheduling process:

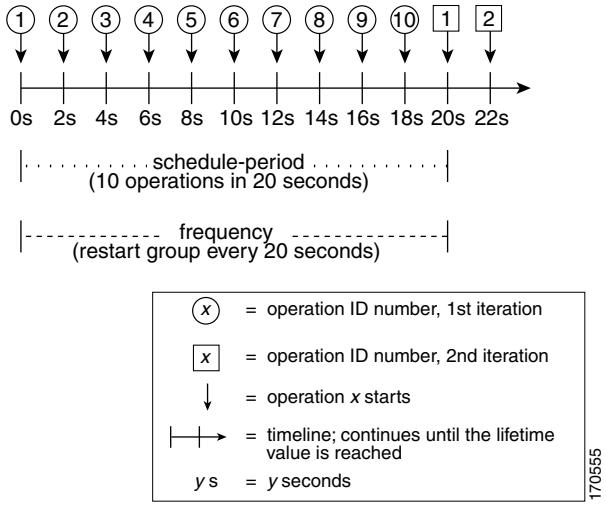
- Default Behavior of IP SLAs Multiple Operations Scheduling, page 4
- IP SLAs Multiple Operations Scheduling with Scheduling Period Less Than Frequency, page 4
- Multiple Operations Scheduling When the Number of IP SLAs Operations Are Greater Than the Schedule Period, page 6
- IP SLAs Multiple Operations Scheduling with Scheduling Period Greater Than Frequency, page 7

Note The examples that follow focus on the interaction of the schedule period and frequency values, so the additional command syntax, such as start time and lifetime values, is not included in the illustrations.

Default Behavior of IP SLAs Multiple Operations Scheduling

The IP SLAs Multiple Operations Scheduling feature allows you to schedule multiple IP SLAs operations as a group using the **ip sla monitor group schedule** command. In the example shown in Figure 1, the **ip sla monitor group schedule 1 1-10 schedule-period 20 [frequency 20]** command is configured. This example schedules operation 1 to operation 10 within operation group 1. Operation group 1 has a schedule period of 20 seconds, which means that all operations in the group will be started at equal intervals within a 20-second period. By default, the frequency is set to the same value as the configured schedule period. As shown in Figure 1, configuring the frequency is optional because 20 is the default.

Figure 1 Schedule Period Equals Frequency—Default Behavior



In this example, the first operation (operation 1) in operation group 1 will start at 0 seconds. All 10 operations in operation group 1 (operation 1 to operation 10) must be started in the schedule period of 20 seconds. The start time of each IP SLAs operation is evenly distributed over the schedule period by dividing the schedule period by the number of operations (20 seconds divided by 10 operations). Therefore, each operation will start 2 seconds after the previous operation.

The frequency is the period of time that passes before the operation group is started again (repeated). If the frequency is not specified, the frequency is set to the value of the schedule period. In the example shown in Figure 1, operation group 1 will start again every 20 seconds. This configuration provides optimal division (spacing) of operations over the specified schedule period.

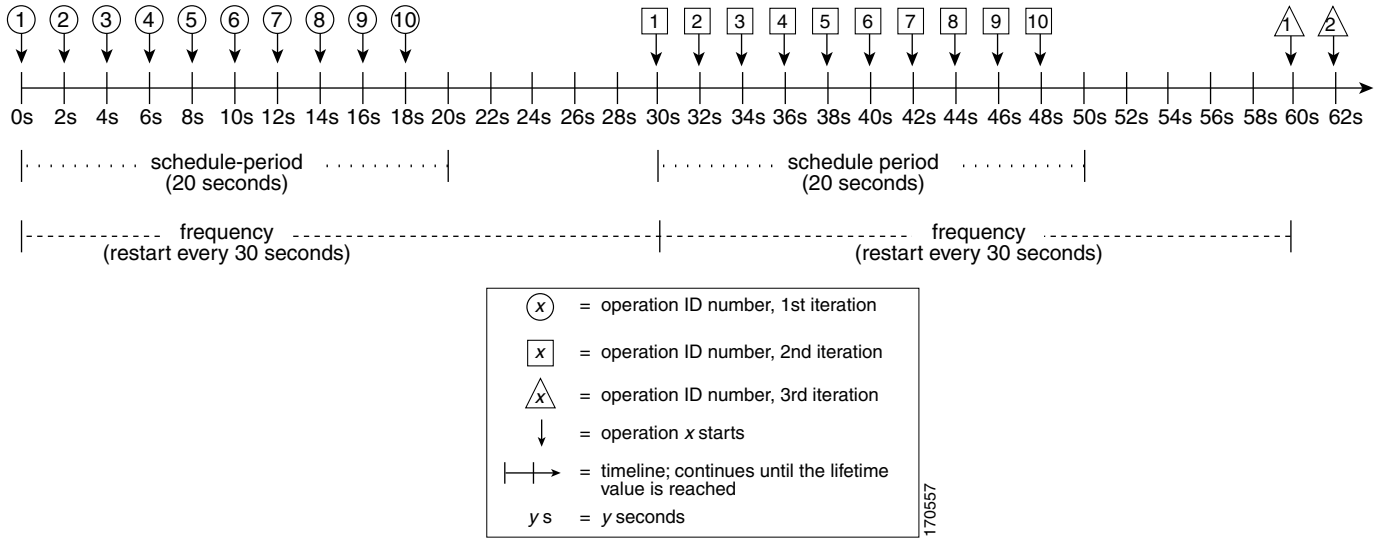
IP SLAs Multiple Operations Scheduling with Scheduling Period Less Than Frequency

As the frequency value in the **ip sla monitor group schedule** configuration is the amount of time that passes before the schedule group is restarted, if the schedule period is less than the frequency, there will be a period of time in which no operations are started.

In the example shown in Figure 2, the **ip sla monitor group schedule 1 1-10 schedule-period 20 frequency 30** command is configured. This example schedules operation 1 to operation 10 within operation group 2. Operation group 2 has a schedule period of 20 seconds and a frequency of 30 seconds.

Figure 2 Schedule Period Is Less Than Frequency

ip sla monitor group schedule 2 1-10 schedule-period 20 frequency 30



n this example, the first operation (operation 1) in operation group 2 will start at 0 seconds. All 10 operations in operation group 2 (operation 1 to operation 10) must be started in the schedule period of 20 seconds. The start time of each IP SLAs operation is evenly distributed over the schedule period by dividing the schedule period by the number of operations (20 seconds divided by 10 operations). Therefore, each operation will start 2 seconds after the previous operation.

In the first iteration of operation group 2, operation 1 starts at 0 seconds, and the last operation (operation 10) starts at 18 seconds. However, because the group frequency has been configured to 30 seconds each operation in the operation group is restarted every 30 seconds. So, after 18 seconds, there is a gap of 10 seconds as no operations are started in the time from 19 seconds to 29 seconds. Hence, at 30 seconds, the second iteration of operation group 2 starts. As all ten operations in the operation group 2 must start at an evenly distributed interval in the configured schedule period of 20 seconds, the last operation (operation 10) in the operation group 2 will always start 18 seconds after the first operation (operation 1).

As shown in Figure 2, the following events occur when the **ip sla monitor group schedule 1 1-10 schedule-period 20 frequency 30** command is configured:

- At 0 seconds, the first operation (operation 1) in operation group 2 is started.
- At 18 seconds, the last operation (operation 10) in operation group 2 is started. This means that the first iteration (schedule period) of operation group 1 ends here.
- From 19 to 29 seconds, no operations are started.
- At 30 seconds, the first operation (operation 1) in operation group 2 is started again. The second iteration of operation group 2 starts here.
- At 48 seconds (18 seconds after the second iteration started) the last operation (operation 10) in operation group 2 is started, and the second iteration of operation group 2 ends.
- At 60 seconds, the third iteration of operation group 2 starts.

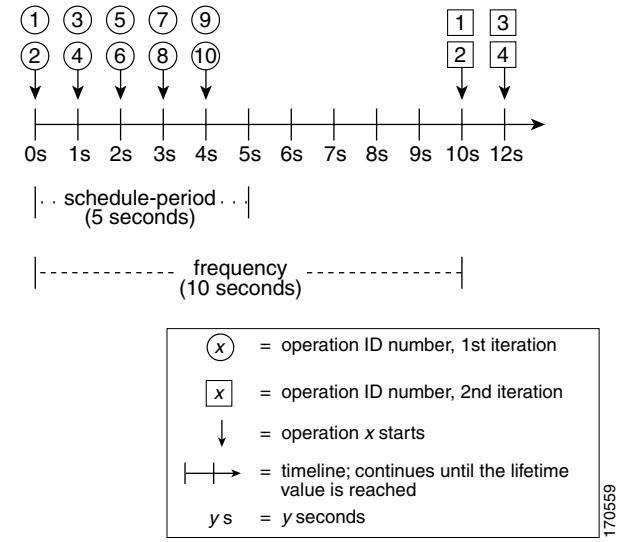
This process continues until the lifetime of operation group 2 ends. The lifetime can be configured using the **ip sla monitor group schedule** command. The default lifetime for an operation group is forever.

Multiple Operations Scheduling When the Number of IP SLAs Operations Are Greater Than the Schedule Period

The minimum time interval between the start of IP SLAs operations in a group operation is 1 second. Therefore, if the number of operations to be multiple scheduled is greater than the schedule period, the IP SLAs multiple operations scheduling functionality will schedule more than one operation to start within the same 1-second interval. If the number of operations getting scheduled does not equally divide into 1-second intervals, then the operations are equally divided at the start of the schedule period with the remaining operations to start at the last 1-second interval.

In the example shown in Figure 3, the **ip sla monitor group schedule 3 1-10 schedule-period 5 frequency 10** command is configured. This example schedules operation 1 to operation 10 within operation group 3. Operation group 3 has a schedule period of 5 seconds and a frequency of 10 seconds.

Figure 3 Number of IP SLAs Operations Is Greater Than the Schedule Period—Even Distribution



In this example, when dividing the schedule period by the number of operations (5 seconds divided by 10 operations, which equals one operation every 0.5 seconds) the start time of each IP SLAs operation is less than 1 second. Since the minimum time interval between the start of IP SLAs operations in a group operation is 1 second, the IP SLAs multiple operations scheduling functionality instead calculates how many operations it should start in each 1-second interval by dividing the number of operations by the schedule period (10 operations divided by 5 seconds). Therefore, as shown in Figure 3, two operations will be started every 1 second.

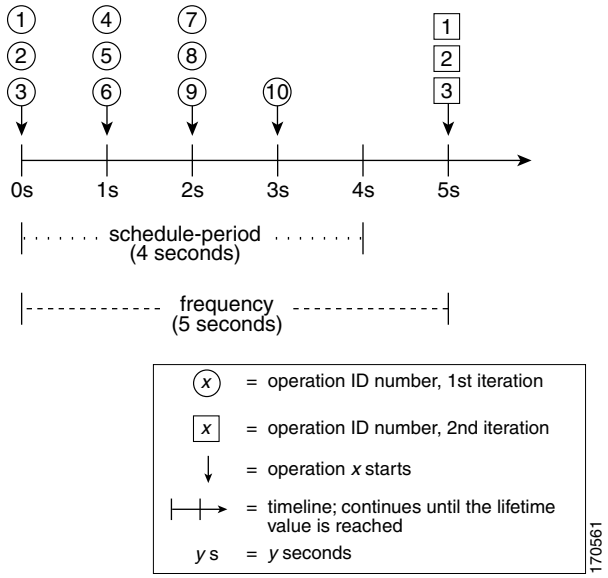
As the frequency is set to 10 in this example, each iteration of operation group 3 will start 10 seconds after the start of the previous iteration. However, this distribution is not optimal as there is a gap of 5 seconds (frequency minus schedule period) between the cycles.

If the number of operations getting scheduled does not equally divide into 1-second intervals, then the operations are equally divided at the start of the schedule period with the remaining operations to start at the last 1-second interval.

In the example shown in Figure 4, the **ip sla monitor group schedule 4 1-10 schedule-period 4 frequency 5** command is configured. This example schedules operation 1 to operation 10 within operation group 4. Operation group 4 has a schedule period of 4 seconds and a frequency of 5 seconds.

Figure 4 Number of IP SLAs Operations Is Greater Than the Schedule Period—Uneven Distribution

ip sla monitor group schedule 4 1-10 schedule-period 4 frequency 5



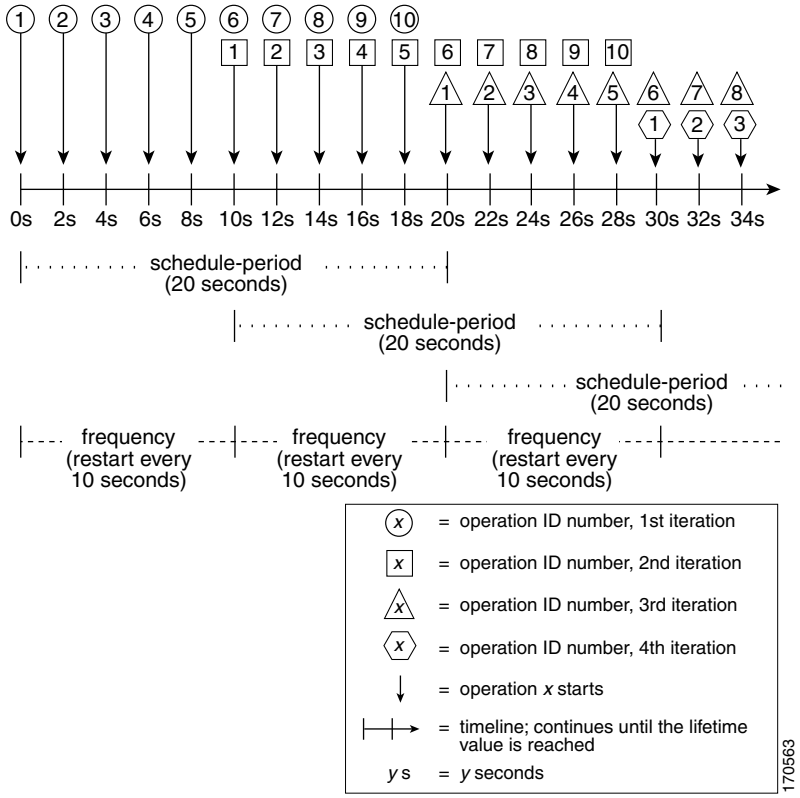
In this example, the IP SLAs multiple operations scheduling functionality calculates how many operations it should start in each 1-second interval by dividing the number of operations by the schedule period (10 operations divided by 4 seconds, which equals 2.5 operations every 1 second). Since the number of operations does not equally divide into 1-second intervals, this number will be rounded off to the next whole number (see Figure 4) with the remaining operations to start at the last 1-second interval.

IP SLAs Multiple Operations Scheduling with Scheduling Period Greater Than Frequency

As the frequency value in the **ip sla monitor group schedule** configuration is the amount of time that passes before the schedule group is restarted, if the schedule period is greater than the frequency, there will be a period of time in which the operations in one iteration of an operation group overlap with the operations of the following iteration.

In the example shown in Figure 5, the **ip sla monitor group schedule 5 1-10 schedule-period 20 frequency 10** command is configured. This example schedules operation 1 to operation 10 within operation group 5. Operation group 5 has a schedule period of 20 seconds and a frequency of 10 seconds.

Figure 5 IP SLAs Group Scheduling with Schedule Period Greater Than Frequency



In this example, the first operation (operation 1) in operation group 5 will start at 0 seconds. All 10 operations in operation group 5 (operation 1 to operation 10) must be started in the schedule period of 20 seconds. The start time of each IP SLAs operation is evenly distributed over the schedule period by dividing the schedule period by the number of operations (20 seconds divided by 10 operations). Therefore, each operation will start 2 seconds after the previous operation.

In the first iteration of operation group 5, operation 1 starts at 0 seconds, and operation 10, the last operation in the operation group, starts at 18 seconds. Because the operation group is configured to restart every 10 seconds (**frequency 10**), the second iteration of operation group 5 starts again at 10 seconds, before the first iteration is completed. Therefore, an overlap of operations 6 to 10 of the first iteration occurs with operations 1 to 5 of the second iteration during the time period of 10 to 18 seconds (see Figure 5). Similarly, there is an overlap of operations 6 to 10 of the second iteration with operations 1 to 5 of the third iteration during the time period of 20 to 28 seconds.

In this example, the start time of operation 1 and operation 6 need not be at exactly the same time, but will be within the same 2-second interval.

The configuration described in this section is not recommended as you can configure multiple operations to start within the same 1-second interval by configuring the number of operations greater than the schedule period (see the Multiple Operations Scheduling When the Number of IP SLAs Operations Are Greater Than the Schedule Period, page 6).

How to Schedule Multiple and Recurring IP SLAs Operations

This section contains the following tasks. Each task in the list is identified as either required or optional.

Scheduling Multiple IP SLAs Operations

Perform this task to schedule multiple IP SLAs operations using a single command.

Prerequisites

Before scheduling a group of operations, you should configure all the IP SLAs operations that will be used in that group. For information on configuring IP SLAs operations, refer to the appropriate IP SLAs document at http://www.cisco.com/univercd/cc/td/doc/product/software/lib/netman/ipsla/index.htm

Restrictions

- The frequency of all operations scheduled in the operation group should be the same.
- The operation ID numbers are limited to a maximum of 125 characters. Do not give large integer values as operation ID numbers.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla monitor 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 monitor group schedule**
6. **show ip sla monitor 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	**ip sla monitor 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*}] **Example:** `Router# ip sla monitor group schedule 1 3,4,6-9`	Specifies an IP SLAs operation group number and the range of operation numbers to be scheduled in global configuration mode. • The *group-operation-number* argument identifies the IP SLAs operation ID to be group scheduled. • The *operation-id-numbers* argument specifies the number of operations that need to be group scheduled.
Step 4	**end** **Example:** `Router# end`	Returns to the privileged Exec mode.
Step 5	**show ip sla monitor group schedule** **Example:** `Router# show ip sla monitor group schedule`	(Optional) Displays the IP SLAs group schedule details.
Step 6	**show ip sla monitor configuration** **Example:** `Router# show ip sla monitor configuration`	(Optional) Displays the IP SLAs configuration details.

Verifying IP SLAs Multiple Operations Scheduling

To verify and analyze the scheduled operation, use the **show ip sla monitor statistics**, **show ip sla monitor group schedule**, and **show ip sla monitor configuration** commands.

SUMMARY STEPS

1. **show ip sla monitor statistics**
2. **show ip sla monitor group schedule**
3. **show ip sla monitor configuration**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**show ip sla monitor statistics** **Example:** `Router# show ip sla monitor statistics`	(Optional) Displays the IP SLAs operation details.
Step 2	**show ip sla monitor group schedule** **Example:** `Router# show ip sla monitor group schedule`	(Optional) Displays the IP SLAs group schedule details.
Step 3	**show ip sla monitor configuration** **Example:** `Router# show ip sla monitor configuration`	(Optional) Displays the IP SLAs configuration details.

Examples

After you have scheduled the multiple IP SLAs operations, you can verify the latest operation details using the above show commands.

The following example schedules IP SLAs operations 1 through 20 in the operation group 1 with a schedule period of 60 seconds and a life value of 1200 seconds. By default, the frequency is equivalent to the schedule period. In this example, the start interval is 3 seconds (schedule period divided by number of operations).

```
Router# ip sla monitor group schedule 1 1-20 schedule-period 60 life 1200
```

The following example shows the details of the scheduled multiple IP SLAs operation using the **show ip sla monitor group schedule** command.

```
Router# show ip sla monitor group schedule

Group Entry Number: 1
Probes to be scheduled: 1-20
Total number of probes: 20
Schedule period: 60
Group operation frequency: Equals schedule period
Status of entry (SNMP RowStatus): Active
Next Scheduled Start Time: Start Time already passed
Life (seconds): 1200
Entry Ageout (seconds): never
```

The following example shows the details of the scheduled multiple IP SLAs operation using the **show ip sla monitor configuration** command. The last line in the example indicates that the IP SLAs operations are multiple scheduled (TRUE).

```
Router# show ip sla monitor configuration 1

Entry number: 1
Owner:
Tag:
Type of operation to perform: udpEcho
Target address: 10.2.31.121
Source address: 0.0.0.0
Target port: 9001
Source port: 0
```

```
Request size (ARR data portion): 16
Operation timeout (milliseconds): 5000
Type Of Service parameters: 0x0
Verify data: No
Data pattern:
Vrf Name:
Control Packets: enabled
Operation frequency (seconds): 60
Next Scheduled Start Time: Start Time already passed
Life (seconds): 1200
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 distribution buckets kept: 1
Statistic distribution interval (milliseconds): 20
Enhanced History:
Number of history Lives kept: 0
Number of history Buckets kept: 15
History Filter Type: None
Group Scheduled : TRUE
```

The following example shows the latest operation start time of the scheduled multiple IP SLAs operation, when the operations are scheduled at equal intervals, using the **show ip sla monitor statistics** command:

```
Router# show ip sla monitor statistics | include Latest operation start time

Latest operation start time: *03:06:21.760 UTC Tue Oct 21 2003
Latest operation start time: *03:06:24.754 UTC Tue Oct 21 2003
Latest operation start time: *03:06:27.751 UTC Tue Oct 21 2003
Latest operation start time: *03:06:30.752 UTC Tue Oct 21 2003
Latest operation start time: *03:06:33.754 UTC Tue Oct 21 2003
Latest operation start time: *03:06:36.755 UTC Tue Oct 21 2003
Latest operation start time: *03:06:39.752 UTC Tue Oct 21 2003
Latest operation start time: *03:06:42.753 UTC Tue Oct 21 2003
Latest operation start time: *03:06:45.755 UTC Tue Oct 21 2003
Latest operation start time: *03:06:48.752 UTC Tue Oct 21 2003
Latest operation start time: *03:06:51.753 UTC Tue Oct 21 2003
Latest operation start time: *03:06:54.755 UTC Tue Oct 21 2003
Latest operation start time: *03:06:57.752 UTC Tue Oct 21 2003
Latest operation start time: *03:07:00.753 UTC Tue Oct 21 2003
Latest operation start time: *03:07:03.754 UTC Tue Oct 21 2003
Latest operation start time: *03:07:06.752 UTC Tue Oct 21 2003
Latest operation start time: *03:07:09.752 UTC Tue Oct 21 2003
Latest operation start time: *03:07:12.753 UTC Tue Oct 21 2003
Latest operation start time: *03:07:15.755 UTC Tue Oct 21 2003
Latest operation start time: *03:07:18.752 UTC Tue Oct 21 2003
```

Configuration Examples for Scheduling Multiple IP SLAs Operations

This section provides the following configuration examples:

- Scheduling Multiple IP SLAs Operations: Example, page 13

Scheduling Multiple IP SLAs Operations: Example

The following example schedules IP SLAs operations 1 to 10 in the operation group 1 with a schedule period of 20 seconds. By default, the frequency is equivalent to the schedule period.

```
Router# ip sla monitor group schedule 1 1-10 schedule-period 20
```

The following example shows the details of the scheduled multiple IP SLAs operation using the **show ip sla monitor group schedule** command. The last line in the example indicates that the IP SLAs operations are multiple scheduled (TRUE).

```
Router# show ip sla monitor group schedule

Multi-Scheduling Configuration:
Group Entry Number: 1
Probes to be scheduled: 1-10
Schedule period :20
Group operation frequency: 20
Multi-scheduled: TRUE
```

Where to Go Next

- If you want to configure an IP SLAs operation, see the "Cisco IOS IP SLAs Overview" 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.

Additional References

The following sections provide references related to IP SLAs group scheduling.

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.	—

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
No new or modified RFCs are supported by this feature.	—

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 IP SLAs Multiple Operation Scheduling

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 IP SLAs Multiple Operation Scheduling

Feature Name	Releases	Feature Information
IP SLAs Multioperation Scheduler	12.3(14)T	The IP SLAs Multioperation Scheduler feature provides a highly scalable infrastructure for Cisco IOS IP SLAs by allowing you to schedule multiple IP SLAs operations using a single command.

IP SLAs—Proactive Threshold Monitoring

First Published: May 2, 2005
Last Updated: July 18, 2008

This document describes the proactive monitoring capabilities of Cisco IOS IP Service Level Agreements (SLAs) using thresholds and reaction triggering.

Cisco IOS IP SLAs allows you to montior, analyze and verify IP service levels for IP applications and services, to increase productivity, to lower operational costs, and to reduce occurances of network congestion or outages. IP SLAs uses active traffic monitoring for measuring network performance.

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 IP SLAs Proactive Threshold Monitoring" section on page 11.

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.

Contents

CISCO SYSTEMS

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Information About Proactive Threshold Monitoring for IP SLAs

To perform the tasks required to configure proactive threshold monitoring using IP SLA, you should understand the following concepts:

IP SLAs Reaction Configuration

IP SLAs can be configured to react to certain measured network conditions. For example, if IP SLAs measures too much jitter on a connection, IP SLAs can generate a notification to a network management application, or trigger another IP SLAs operation to gather more data.

IP SLAs reaction configuration is performed using the **ip sla monitor reaction-configuration** command. You can configure the **ip sla monitor reaction-configuration** command multiple times so as to allow reactions for multiple monitored elements (for example, configuring thresholds for operation 1 for destination-to-source packet loss, and also configuring MOS thresholds for same operation). However, issuing the **no ip sla monitor reaction-configuration** *operation-number* will clear all reactions for the specified operation. In other words, disabling of granular reaction elements (**no ip sla monitor reaction-configuration** *operation-number* **react** *monitored-element*) is not currently supported, so as to provide backwards compatibility with the earlier version of this command.

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

IP SLAs Threshold Monitoring and Notifications

IP SLAs includes the capability for triggering SNMP notifications based on defined thresholds. This allows for proactive monitoring in an environment where IT departments can be alerted to potential network problems, rather than having to manually examine data.

IP SLAs supports threshold monitoring for performance parameters such as average jitter, unidirectional latency and bidirectional round trip time and connectivity. This proactive monitoring capability provides options for configuring reaction thresholds for important VoIP related parameters including unidirectional jitter, unidirectional packet loss, and unidirectional VoIP voice quality scoring (MOS scores).

IP SLAs can generate system logging (syslog) messages when the reaction threshold increases or decreases beyond the configured values for packet loss, average jitter, or MOS. These system logging messages can then be sent as SNMP notifications (traps) using the CISCO-SYSLOG-MIB.

For packet loss and jitter, notifications can be generated for violations in either direction (source to destination and destination to source) or for round trip values. Packet loss, jitter and MOS statistics are specific to IP SLAs Jitter operations. Notifications can also be triggered for other events, such as round-trip-time violations, for most IP SLAs monitoring operations.

Note Trap generation through the CISCO-SYSLOG-MIB is only needed for packet loss, average jitter, or MOS violations. For other violations, traps can be generated through the CISCO-RTTMON-MIB.

SNMP notifications (traps) for IP SLAs can be configuredas a triggered action, to be sent when monitored values exceed an upper threshold or fall below a lower threshold, or when a set of defined conditions are met. For example, an SNMP trap can be triggered by 5 consecutive timeouts during an IP SLAs operation. The sending of SNMP traps is one of the options for triggered actions that can be configured for IP SLAs violations. The monitored values (also called monitored elements), the threshold type, and the triggered action are configured using the **ip sla monitor reaction-configuration** global configuration mode command.

SNMP traps for IP SLAs are handled through the system logging (syslog) process. This means that system logging messages for IP SLAs violations are generated when the specified conditions are met, then sent as SNMP traps using the CISCO-SYSLOG-MIB. The **ip sla monitor logging traps** command is used to enable the generation of these IP SLAs specific traps. The generation of IP SLAs specific logging messages is dependant on the configuration of the standard set of logging commands (for example, **logging on**). IP SLAs logging messages are generated at the "informational" system logging severity level.

Note Severity levels in the CISCO-SYSLOG-MIB are defined as follows:
SyslogSeverity INTEGER { emergency(1), alert(2), critical(3), error(4), warning(5), notice(6), info(7), debug(8) }
The values for severity levels are defined differently for the system logging process in Cisco IOS software: { emergency (0), alert (1), critical (2), error (3), warning (4), notice (5), informational (6), debugging (7) }.
This means that IP SLAs Threshold violations are logged as level 6 (informational) within the logging process, but are sent as level 7 (info) traps from the CISCO-SYSLOG-MIB.

Restrictions

- The MIB used for IP SLAs (CISCO-RTTMON-MIB) does not currently support the reaction configuration described in this document. In other words, the traps available for PacketLossSD, PacketLossDS, JitterSD, jitterDS, maxOflatencySD, maxOflatencyDS, and MOS cannot be generated through CISCO-RTTMON-MIB. These traps are generated through the CISCO-SYSLOG-MIB, and enabled using the **ip sla monitor logging traps** global configuration mode command.
- As MOS, jitterSD, jitterDS, PacketLossSD and PacketLossDS are specific to Jitter operations, reactions (such as triggered notifications) to theshold violations for these monitored elements can only be configured for UDP Jitter operations or VoIP Jitter operations.

How to Configure IP SLAs Reactions and Threshold Monitoring

IP SLAs Reactions are configured using the **ip sla monitor reaction-configuration** command. The elements of this command are described in the following sections

- Configuring Monitored Elements for IP SLAs Reactions [**react** *monitored-element*]
- Configuring Threshold Violation Types for IP SLAs Reactions [**threshold-type** *violation-condition*]
- Specifying Reaction Events [**action-type** *trap-or-trigger*]

Configuring Monitored Elements for IP SLAs Reactions

IP SLAs reactions are configured to be triggered when a monitored value exceeds or falls below a specified level, or when a monitored event (such as a timeout or connection loss) occurs. These monitored values and events are called monitored elements. The types of monitored elements available are described in the following sections:

- Configuring Triggers for Round-Trip-Time Violations
- Configuring Triggers for Jitter Violations
- Configuring Triggers for Packet Loss Violations
- Configuring Triggers for Mean Opinion Score Violations

You can configure the **ip sla monitor reaction-configuration** command multiple times so as to allow reactions for multiple monitored elements (for example, configuring a threshold for operation 1 for destination-to-sourcepacket loss, and also configuring a MOS threshold for same operation). However, issuing the **no ip sla monitor reaction-configuration** *operation-number* will clear all reactions for the specified operation (in other words, disabling of granular reaction elements is not currently supported, so as to provide backwards compatibility with the earlier version of this command).

Configuring Triggers for Round-Trip-Time Violations

Round-trip-time (rtt) is one of the monitored values of all IP SLAs operations. Events (such as traps) can be triggered when the rtt value rises above a specified threshold, or when it falls below a specified threshold. To configure rtt as the monitored element, use the following version of the **ip sla monitor reaction-configuration** command:

Command or Action	Purpose
ip sla monitor reaction-configuration *operation-number* **react rtt** [**threshold-type** *violation-condition*] **threshold-value** *upper-threshold lower-threshold* [**action-type** {**trapOnly** | **triggerOnly** | **trapAndTrigger**}] **Example:** `Router# ip sla monitor reaction-configuration 10 react rtt threshold-type immediate threshold-value 5000 3000 action-type trapAndTrigger`	Configures an action (SNMP trap or IP SLAs trigger) to occur based on violations of thresholds for round-trip-time (rtt).

Configuring Triggers for Jitter Violations

Jitter (interpacket delay variance) is one of the monitored values of IP SLAs UDP Jitter operations. Jitter values are computed as source-to-destination, destination-to-source, and combined round-trip values. Events (such as traps) can be triggered when the average jitter value in either direction, or in both directions, rises above a specified threshold, or when it falls below a specified threshold.

Command or Action	Purpose
ip sla monitor reaction-configuration *operation-number* **react** {**jitterAvg** | **jitterDSAvg** | **jitterSDAvg**} [**threshold-type** *violation-type*] **threshold-value** *upper-threshold lower-threshold* [**action-type** {**trapOnly** | **triggerOnly** | **trapAndTrigger**}] **Example:** `Router# ip sla monitor reaction-configuration 10 react jitterAvg threshold-type immediate threshold-value 5000 3000 action-type trapAndTrigger`	Configures an action (SNMP trap or IP SLAs trigger) to occur based on violations of thresholds for average round-trip jitter values. • To configure the average source-to-destination jitter as the monitored element, use the **react jitterAvg** keyword combination. • To configure average destination-to-source jitter as the monitored element, use the **react jitterDSAvg** keyword combination. • To configure average round-trip jitter as the monitored element, use the **react jitterSDAvg** keyword combination.

Configuring Triggers for Packet Loss Violations

Pactket loss is one of the monitored values of IP SLAs UDP Jitter operations. Jitter values are computed as source-to-destination and destination-to-source values. Events (such as traps) can be triggered when the jitter value in either direction rises above a specified threshold, or when it falls below a specified threshold.

To configure source-to-destination packet loss as the monitored element, use the **react PacketLossSD** syntax in the **ip sla monitor reaction-configuration** command.

To configure destination-to-source jitter as the monitored element , use the **react PacketLossDS** syntax in the **ip sla monitor reaction-configuration** command.

Configuring Triggers for Mean Opinion Score Violations

Mean opinion score (MOS) is one of the monitored values of IP SLAs Jitter VoIP operations. MOS values are computed as numbers to two decimal places, from a value of 1.00 (worst quality) to 5.00 (best quality). Events (such as traps) can be triggered when the MOS value in either direction rises above a specified threshold, or when it falls below a specified threshold.

To configure destination-to-source jitter as the monitored element , use the **react mos** syntax in the **ip sla monitor reaction-configuration** command.

Configuring Threshold Violation Types for IP SLAs Reactions

The threhold-type syntax of the **ip sla monitor reaction-configuration** command defines the type of threshold violation (or combination of threshold violations) that will trigger an event. Threshold violation types are as follows:

- immediate—Triggers an event immediately when the value for a reaction type (such as response time) exceeds the upper threshold value or falls below the lower threshold value, or when a timeout, connectionLoss, or verifyError event occurs.

- consecutive—Triggers an event only after a violation occurs a specified number of times consecutively. For example, the consecutive violation type could be used to configure an action to occur after a timeout occurs 5 times in a row, or when the round-trip-time exceeds the upper threshold value 5 times in a row.
- x of y—Triggers an event after some number (x) of violations within some other number (y) of probe operations (x of y).
- averaged—Triggers an event when the averaged totals of a value for x number of probe operations exceeds the specied upper-threshold value, or falls below the lower-threshold value.

Configuring these threshold violation types is described in the following sections.

Generating Events for Each Violation

To generate a trap (or trigger another operation) each time a specified condition is met, use the **immediate** threshold-type keyword:

ip sla monitor reaction-configuration *operation-number* **react** *data-type* **threshold-type immediate threshold-value** *raising-value falling-value* **action-type** *action-value*

Generating Events for Consecutive Violations

To generate a trap (or trigger another operation) after a certain number (x) of consecutive violations, use the consecutive keyword with the optional number-of-occurrences argument:

ip sla monitor reaction-configuration *operation-number* **react** *reaction-condition* **threshold-type consecutive** [*number-of-occurances*] **threshold-value** *raising-value falling-value* **action-type** *action-value*

The default value for *number-of-occurances* is 5.

Generating Events for x of y Violations

To generate a trap (or trigger another operation) after some number (x) of violations within some other number (y) of probe operations (x of y), use the **xofy** [*x-value y-value*] syntax:

ip sla monitor reaction-configuration *operation-number* **react** *reaction-condition* **threshold-type xofy** *x-value y-value* **threshold-value** *raising-value falling-value* **action-type** *action-value*

The default x-value and y-value is 5 (**xofy 5 5**).

Generating Events for Averaged Violations

To generate a trap (or trigger another operation) when the averaged totals of x number of probe operations violate a falling-threshold or rising-threshold, use the **average** [*attempts*] syntax:

ip sla monitor reaction-configuration *operation-number* **react** *reaction-condition* **threshold-type average** [*attempts*] **threshold-value** *raising-value falling-value* **action-type** *action-value*

The default value for *attempts* is 5.

Specifying Reaction Events

Action type options for the **ip sla monitor reaction-configuration** command are as follows:

none—No action is taken.

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 monitor logging traps** command. For SNMP logging traps to be sent, SNMP logging must be enabled using the appropriate SNMP commands, including the **snmp-server enable traps syslog** 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 monitor 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.

trapAndTrigger—Trigger both an SNMP trap and start another IP SLAs operation when the violation conditions are met, as defined in the trapOnly and triggerOnly options above.

Examples of Proactive Threshold Monitoring Using IP SLA

This section contains the following examples:

Configuring an IP SLAs Reaction Configuration: Example

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) of falls below 2.5 (poor quality):

```
Router(config)# ip sla monitor reaction-configuration 10 react mos threshold-type
immediate threshold-value 490 250 action-type trapOnly
```

The following example shows the default settings for the **ip sla monitor reaction-configuration** command when none of the optional syntax is used:

```
Router# show ip sla monitor reaction-configuration 1

Entry number: 1
Reaction Configuration not configured

Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# ip sla monitor reaction-configuration 1
Router(config)# do show ip sla monitor reaction-configuration 1

Entry number: 1
Reaction: rtt
Threshold Type: Never
Rising (milliseconds): 5000
Falling (milliseconds): 3000
```

```
Threshold Count: 5
Threshold Count2: 5
Action Type: None
```

Verifying an IP SLAs Reaction Configuraiton: Example

In the following example, multiple monitored elements (indicated by the `Reaction:` value) are configured for a single IP SLAs operation:

```
Router# show ip sla monitor reaction-configuration

Entry Number: 1
Reaction: RTT
Threshold type: Never
Rising (milliseconds): 5000
Falling (milliseconds): 3000
Threshold Count: 5
Threshold Count2: 5
Action Type: None

Reaction: jitterDSAvg
Threshold type: average
Rising (milliseconds): 5
Falling (milliseconds): 3
Threshold Count: 5
Threshold Count2: 5
Action Type: triggerOnly

Reaction: jitterDSAvg
Threshold type:  immediate
Rising (milliseconds): 5
Falling (milliseconds): 3
Threshold Count: 5
Threshold Count2: 5
Action Type: trapOnly

Reaction: PacketLossSD
Threshold type:  immediate
Rising (milliseconds): 5
Threshold Falling (milliseconds): 3
Threshold Count: 5
Threshold Count2: 5
Action Type: trapOnly
```

Table 1 describes the significant fields shown in this output.

Table 1 show ip sla monitor reaction-configuration Field Descriptions

Field	Description
Reaction	The configured monitored element for IP SLAs reactions. Corresponds to the **react** { **connectionLoss** | **jitterAvg** | **jitterDSAvg** | **jitterSDAvg** | **mos** | **PacketLossDS** | **PacketLossSD** | **rtt** | **timeout** | **verifyError** } syntax in the **ip sla monitor reaction-configuration** command.

Table 1 show ip sla monitor reaction-configuration Field Descriptions (continued)

Field	Description
Threshold type	The configured theshold type. Corresponds to the **threshold-type** { **never** | **immediate** | **consecutive** | **xofy** | **average** } syntax in the **ip sla monitor reaction-configuration** command.
Rising (milliseconds)	The *upper-threshold* value, as configured by the **threshold-value** *upper-threshold lower-threshold* syntax in the **ip sla monitor reaction-configuration** command.
Threshold Falling (milliseconds)	The *lower-threshold* value, as configured by the **threshold-value** *upper-threshold lower-threshold* syntax in the **ip sla monitor reaction-configuration** command.
Threshold Count	The *x-value* in the **xofy** threshold-type, or the *number-of-probes* value for **average** threshold-type.
Threshold Count2	The *y-value* in the **xofy** threshold-type.
Action Type	The reaction to be performed when the violation conditions are met, as configured by the **action-type** { **none** | **trapOnly** | **triggerOnly** | **trapAndTrigger** } syntax in the **ip sla monitor reaction-configuration** command.

Triggering SNMP Notifications: Example

In the following example, CISCO-SYSLOG-MIB traps will be sent to the remote host at 209.165.202.129 if the threshold values for round-trip-time (rtt) or VoIP mean opion score (MOS) are violated:

```
Router(config)# ip sla monitor 1
Router(config-sla-monitor)# type jitter dest-ipaddr 209.165.200.225 dest-port 3000 codec
g711alaw
Router(config-sla-monitor-jitter)# default frequency
Router(config-sla-monitor-jitter)# exit

Router(config)# ip sla monitor schedule 1 start now life forever
Router(config)# ip sla monitor reaction-configuration 1 react rtt threshold-type immediate
threshold-value 3000 2000 action-type trapOnly
Router(config)# ip sla monitor reaction-configuration 1 react MOS threshold-type
consecutive 4 threshold-value 390 220 action-type trapOnly

Router(config)# ip sla monitor logging traps
Router(config)#
Router(config)# snmp-server host 209.165.202.129 version 2c public syslog
! The following command is needed for the system to generate CISCO-SYSLOG-MIB traps.
Router(config)# snmp-server enable traps syslog
```

As shown in the following example, the IP SLAs Threshold violations are generated as level 6 (informational) in the Cisco IOS system logging process:

```
3d18h:%RTT-6-SAATHRESHOLD:RTR(11):Threshold exceeded for MOS
```

but are sent as level 7 (info) notifications from the CISCO-SYSLOG-MIB:

```
3d18h:SNMP:V2 Trap, reqid 2, errstat 0, erridx 0
```

```
sysUpTime.0 = 32613038
snmpTrapOID.0 = ciscoSyslogMIB.2.0.1
clogHistoryEntry.2.71 = RTT
clogHistoryEntry.3.71 = 7
clogHistoryEntry.4.71 = SAATHRESHOLD
clogHistoryEntry.5.71 = RTR(11):Threshold exceeded for MOS
clogHistoryEntry.6.71 = 32613037
```

Where to Go Next

- If you want to configure an IP SLAs operation, see the "Cisco IOS IP SLAs Overview" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4.
- 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.

Additional References

The following sections provide references related to configuring Cisco IOS IP SLAs.

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 features in this document.	—

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
No specific RFCs are supported by the features in this document.	—

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 IP SLAs Proactive Threshold Monitoring

Table 2 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 2 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 2 Feature Information for IP SLAs Proactive Threshold Monitoring

Feature Name	Releases	Feature Information
IP SLAs Reaction Threshold	12.3(14)T	Cisco IOS IP SLAs proactive threshold monitoring capability allows you to configure an IP SLAs operation to react to certain measured network conditions.
IP SLAs VoIP Threshold Traps	12.3(14)T	Cisco IOS IP SLAs VoIP proactive threshold monitoring capability allows you to configure an IP SLAs operation to react to certain measured network conditions.