



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

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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 IPv4 or IPv6. 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

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the [“Feature Information for the IP SLAs TCP Connect Operation”](#) section on page 14.

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.

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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*.

Information About the IP SLAs TCP Connect Operation

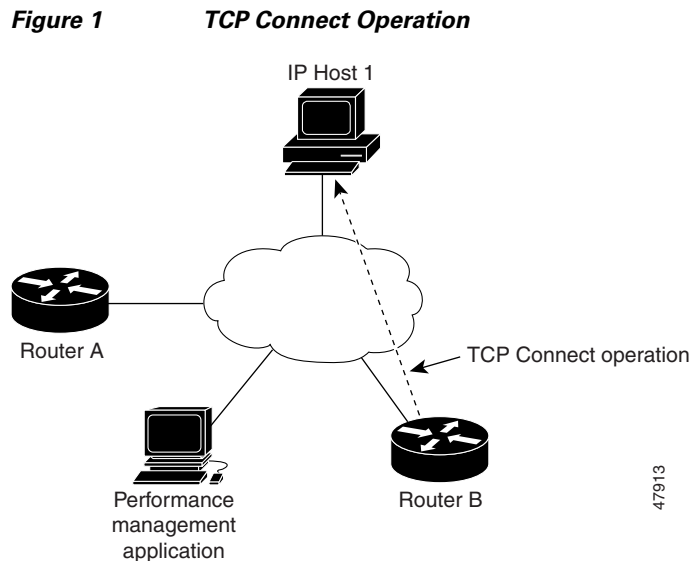
To perform the tasks required to analyze TCP connection times using IP SLA, you should understand the following concept:

- [TCP Connect Operation](#), page 2

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.



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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 responder**
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip sla responder Example: Router(config)# ip sla 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.

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](#)

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.

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.

For information on scheduling a group of operations, see the “[IP SLAs—Multioperation Scheduling of IP SLAs Operations](#)” chapter of the *Cisco IOS IP SLAs Configuration Guide*.

SUMMARY STEPS

- enable**
- configure terminal**

3. **ip sla** *operation-number*
4. **tcp-connect** {*destination-ip-address* | *destination-hostname*} *destination-port* [**source-ip** {*ip-address* | *hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}]
5. **frequency** *seconds*
6. **exit**
7. **ip sla schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh:mm[:ss]* [*month day* | *day month*] | **pending** | **now** | **after** *hh:mm:ss*] [**ageout** *seconds*] [**recurring**]
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>operation-number</i> Example: Router(config)# ip sla 10	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
Step 4	tcp-connect { <i>destination-ip-address</i> <i>destination-hostname</i> } <i>destination-port</i> [source-ip { <i>ip-address</i> <i>hostname</i> } source-port <i>port-number</i>] [control { enable disable }] Example: Router(config-ip-sla)# tcp-connect 172.29.139.132 5000	Defines a TCP Connect operation and enters IP SLA TCP configuration mode.
Step 5	frequency <i>seconds</i> Example: Router(config-ip-sla-tcp)# frequency 30	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	exit Example: Router(config-ip-sla-tcp)# exit	Exits IP SLA TCP configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 7	<pre>ip sla schedule operation-number [life {forever seconds}] [start-time {hh:mm[:ss] [month day day month] pending now after hh:mm:ss] [ageout seconds] [recurring]</pre> <p>Example: Router(config)# ip sla schedule 10 start-time now life forever</p>	Configures the scheduling parameters for an individual IP SLAs operation.
Step 8	<pre>exit</pre> <p>Example: Router(config)# exit</p>	(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 9
 tcp-connect 172.29.139.132 5000
 frequency 10
 !
 ip sla 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 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

The **tos** command defines the type of service (ToS) byte in the IPv4 header of an IP SLAs operation and is valid only in IPv4 networks. The **traffic-class** command defines the traffic class byte in the IPv6 header for a supported IP SLAs operation.

The **flow-label** command defines the value in the flow label field in the IPv6 header for a supported IP SLAs operation and is valid only in IPv6 networks.

For information on scheduling a group of operations, see the “[IP SLAs—Multioperation Scheduling of IP SLAs Operations](#)” chapter of the *Cisco IOS IP SLAs Configuration Guide*.

SUMMARY STEPS

1. **enable**
2. **configure terminal**

3. **ip sla** *operation-number*
4. **tcp-connect** {*destination-ip-address* | *destination-hostname*} *destination-port* [**source-ip** {*ip-address* | *hostname*} **source-port** *port-number*] [**control** {**enable** | **disable**}]
5. **history buckets-kept** *size*
6. **history distributions-of-statistics-kept** *size*
7. **history enhanced** [**interval** *seconds*] [**buckets** *number-of-buckets*]
8. **history filter** {**none** | **all** | **overThreshold** | **failures**}
9. **frequency** *seconds*
10. **history hours-of-statistics-kept** *hours*
11. **history lives-kept** *lives*
12. **owner** *owner-id*
13. **history statistics-distribution-interval** *milliseconds*
14. **tag** *text*
15. **threshold** *milliseconds*
16. **timeout** *milliseconds*
17. **tos** *number*
or
traffic-class *number*
18. **flow-label** *number*
19. **exit**
20. **ip sla schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh:mm[:ss]* [*month day* | *day month*] | **pending** | **now** | **after** *hh:mm:ss*] [**ageout** *seconds*] [**recurring**]
21. **exit**
22. **show ip sla configuration** [*operation-number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none">• Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>operation-number</i> Example: Router(config)# ip sla 10	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.

How to Configure the IP SLAs TCP Connect Operation

	Command or Action	Purpose
Step 4	<p>tcp-connect <i>{destination-ip-address destination-hostname} destination-port</i> <i>[source-ip {ip-address hostname} source-port</i> <i>port-number] [control {enable disable}]</i></p> <p>Example: Router(config-ip-sla)# tcp-connect 172.29.139.132 5000</p>	Defines a TCP Connect operation and enters IP SLA TCP configuration mode.
Step 5	<p>history buckets-kept <i>size</i></p> <p>Example: Router(config-ip-sla-tcp)# history buckets-kept 25</p>	(Optional) Sets the number of history buckets that are kept during the lifetime of an IP SLAs operation.
Step 6	<p>history distributions-of-statistics-kept <i>size</i></p> <p>Example: Router(config-ip-sla-tcp)# history distributions-of-statistics-kept 5</p>	(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.
Step 7	<p>history enhanced [<i>interval seconds</i>] [buckets <i>number-of-buckets</i>]</p> <p>Example: Router(config-ip-sla-tcp)# history enhanced interval 900 buckets 100</p>	(Optional) Enables enhanced history gathering for an IP SLAs operation.
Step 8	<p>history filter {<i>none all overThreshold </i> <i>failures</i>}</p> <p>Example: Router(config-ip-sla-tcp)# history filter failures</p>	(Optional) Defines the type of information kept in the history table for an IP SLAs operation.
Step 9	<p>frequency <i>seconds</i></p> <p>Example: Router(config-ip-sla-tcp)# frequency 30</p>	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 10	<p>history hours-of-statistics-kept <i>hours</i></p> <p>Example: Router(config-ip-sla-tcp)# history hours-of-statistics-kept 4</p>	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 11	<p>history lives-kept <i>lives</i></p> <p>Example: Router(config-ip-sla-tcp)# history lives-kept 5</p>	(Optional) Sets the number of lives maintained in the history table for an IP SLAs operation.
Step 12	<p>owner <i>owner-id</i></p> <p>Example: Router(config-ip-sla-tcp)# owner admin</p>	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.

	Command or Action	Purpose
Step 13	<p>history statistics-distribution-interval <i>milliseconds</i></p> <p>Example: Router(config-ip-sla-tcp)# history statistics-distribution-interval 10</p>	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
Step 14	<p>tag <i>text</i></p> <p>Example: Router(config-ip-sla-tcp)# tag TelnetPollServer1</p>	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	<p>threshold <i>milliseconds</i></p> <p>Example: Router(config-ip-sla-tcp)# threshold 10000</p>	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
Step 16	<p>timeout <i>milliseconds</i></p> <p>Example: Router(config-ip-sla-tcp)# timeout 10000</p>	(Optional) Sets the amount of time an IP SLAs operation waits for a response from its request packet.
Step 17	<p>tos <i>number</i> or traffic-class <i>number</i></p> <p>Example: Router(config-ip-sla-jitter)# tos 160 or Example: Router(config-ip-sla-jitter)# traffic-class 160</p>	<p>(Optional) In an IPv4 network only, defines the ToS byte in the IPv4 header of an IP SLAs operation.</p> <p>or</p> <p>(Optional) In an IPv6 network only, defines the traffic class byte in the IPv6 header for a supported IP SLAs operation.</p>
Step 18	<p>flow-label <i>number</i></p> <p>Example: Router(config-ip-sla-tcp)# flow-label 112233</p>	(Optional) In an IPv6 network only, defines the flow label field in the IPv6 header for a supported IP SLAs operation.
Step 19	<p>exit</p> <p>Example: Router(config-ip-sla-tcp)# exit</p>	Exits TCP configuration submode and returns to global configuration mode.
Step 20	<p>ip sla schedule <i>operation-number</i> [life {forever <i>seconds</i>}] [start-time {<i>hh:mm[:ss]</i> [<i>month day</i> <i>day month</i>] pending now after <i>hh:mm:ss</i>}] [ageout <i>seconds</i>] [recurring]</p> <p>Example: Router(config)# ip sla schedule 10 start-time now life forever</p>	Configures the scheduling parameters for an individual IP SLAs operation.

	Command or Action	Purpose
Step 21	exit Example: Router(config)# exit	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 22	show ip sla configuration [<i>operation-number</i>] Example: Router# show ip sla 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 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 trace** and **debug ip sla error** commands to help troubleshoot issues with an IP SLAs operation.

What to Do Next

To view and interpret the results of an IP SLAs operation use the **show ip sla statistics** 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 responder
```

Router B Configuration

```
ip sla 9
tcp-connect 10.0.0.1 23 control disable
frequency 30
tos 128
timeout 1000
tag FLL-RO
ip sla 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 9
tcp-connect 173.29.139.132 21 control disable
frequency 30
ip sla schedule 9 life forever start-time now
```

Where to Go Next

For information about other types of IP SLAs operations and IP SLAs features, see the [Cisco IOS IP SLAs Features Roadmap](#).

Additional References

The following sections provide references related to the IP SLAs TCP Connect operation.

Related Documents

Related Topic	Document Title
Cisco IOS IP SLAs command-line interface enhancements	<i>Cisco IOS IP Service Level Agreements Command Line Interface</i> , Cisco white paper
Cisco IOS IP SLAs commands	<i>Cisco IOS IP SLAs Command Reference</i>

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
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/techsupport</p>

Feature Information for the IP SLAs TCP Connect Operation

Table 1 lists the release history for this feature.

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

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 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, 12.2(31)SB2, 12.2(33)SRB1, 12.2(33)SXH, Cisco IOS XE Release 2.1	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 for IPv6 (UDP Jitter, UDP Echo, ICMP Echo, TCP Connect)	12.2(33)SRC, 12.2(33)SB, 12.4(20)T	Support was added for operability in IPv6 networks.

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