IP SLAs—Analyzing IP Service Levels Using the DHCP Operation

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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

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 DHCP Operation" section on page 11.

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 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*.

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, page 2
- IP SLAs DHCP Relay Agent Options, page 2

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—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. **dhcp** {*destination-ip-address* | *destination-hostname*} [**source-ip** {*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 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** *operation-number* **Example:** `Router(config)# ip sla 10`	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
Step 4	**dhcp** {*destination-ip-address* | *destination-hostname*} [**source-ip** {*ip-address* | *hostname*}] [**option-82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]] **Example:** `Router(config-ip-sla)# dhcp 10.10.10.3`	Defines a DHCP operation and enters IP SLA DHCP configuration mode.
Step 5	**frequency** *seconds* **Example:** `Router(config-ip-sla-dhcp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 6	**exit** **Example:** `Router(config-ip-sla-dhcp)# exit`	Exits IP SLA DHCP configuration mode and returns to global configuration mode.
Step 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**] **Example:** `Router(config)# ip sla 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 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—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. **dhcp** {*destination-ip-address* | *destination-hostname*} [**source-ip** {*ip-address* | *hostname*}] [**option-82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]]
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. **exit**
18. **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**]
19. **exit**
20. **show ip sla configuration** [*operation-number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *operation-number* **Example:** `Router(config)# ip sla 10`	Begins configuration for an IP SLAs operation and enters IP SLA configuration mode.
Step 4	**dhcp** {*destination-ip-address* | *destination-hostname*} [**source-ip** {*ip-address* | *hostname*}] [**option-82** [**circuit-id** *circuit-id*] [**remote-id** *remote-id*] [**subnet-mask** *subnet-mask*]] **Example:** `Router(config-ip-sla)# dhcp 10.10.10.3 option-82 circuit-id 10005A6F1234`	Defines a DHCP operation and enters IP SLA DHCP configuration mode.
Step 5	**history buckets-kept** *size* **Example:** `Router(config-ip-sla-dhcp)# history buckets-kept 25`	(Optional) Sets the number of history buckets that are kept during the lifetime of an IP SLAs operation.
Step 6	**history distributions-of-statistics-kept** *size* **Example:** `Router(config-ip-sla-dhcp)# history distributions-of-statistics-kept 5`	(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.
Step 7	**history enhanced** [**interval** *seconds*] [**buckets** *number-of-buckets*] **Example:** `Router(config-ip-sla-dhcp)# history enhanced interval 900 buckets 100`	(Optional) Enables enhanced history gathering for an IP SLAs operation.
Step 8	**history filter** {**none** | **all** | **overThreshold** | **failures**} **Example:** `Router(config-ip-sla-dhcp)# history filter 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-ip-sla-dhcp)# frequency 30`	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
Step 10	**history hours-of-statistics-kept** *hours* **Example:** `Router(config-ip-sla-dhcp)# history hours-of-statistics-kept 4`	(Optional) Sets the number of hours for which statistics are maintained for an IP SLAs operation.
Step 11	**history lives-kept** *lives* **Example:** `Router(config-ip-sla-dhcp)# history lives-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-ip-sla-dhcp)# owner admin`	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
Step 13	**history statistics-distribution-interval** *milliseconds* **Example:** `Router(config-ip-sla-dhcp)# history 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-ip-sla-dhcp)# tag TelnetPollServer1`	(Optional) Creates a user-specified identifier for an IP SLAs operation.
Step 15	**threshold** *milliseconds* **Example:** `Router(config-ip-sla-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-ip-sla-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-ip-sla-dhcp)# exit`	Exits DHCP configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 18	**ip sla schedule** *operation-number* [**life** {**forever** | *seconds*}] [**start-time** {*hh*:*mm*[:*ss*] [*month day* | *day month*] | **pending** | **now** | **after** *hh*:*mm*:*ss*] [**ageout** *seconds*] [**recurring**] **Example:** `Router(config)# ip sla schedule 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 configuration** [*operation-number*] **Example:** `Router# show ip sla configuration 10`	(Optional) Displays configuration values including all defaults for all IP SLAs operations or a specified operation.

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 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 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 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 12
 dhcp 10.10.10.3 option-82 circuit-id 10005A6F1234
 frequency 30
 timeout 5000
 tag DHCP_Test
!
ip sla schedule 12 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 DHCP operation.

Related Documents

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

Standards

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

Feature Name	Releases	Feature Information
IP SLAs DHCP 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 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.