



# 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**

- [Prerequisites for the IP SLAs DHCP Operation, page 2](#)
- [Information About the IP SLAs DHCP Operation, page 2](#)
- [How to Configure the IP SLAs DHCP Operation, page 3](#)



---

**Corporate Headquarters:**

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

Copyright © 2005 Cisco Systems, Inc. All rights reserved.

- [Configuration Examples for the IP SLAs DHCP Operation, page 9](#)
- [Where to Go Next, page 9](#)
- [Additional References, page 10](#)
- [Feature Information for the IP SLAs DHCP Operation, page 11](#)

## 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, 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—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	<p><b>enable</b></p> <p><b>Example:</b> Router&gt; enable</p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b> Router# configure terminal</p>	<p>Enters global configuration mode.</p>
Step 3	<p><b>ip sla monitor operation-number</b></p> <p><b>Example:</b> Router(config)# ip sla monitor 10</p>	<p>Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.</p>
Step 4	<p><b>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]]</b></p> <p><b>Example:</b> Router(config-sla-monitor)# type dhcp dest-ipaddr 10.10.10.3</p>	<p>Defines a DHCP operation and enters IP SLA Monitor DHCP configuration mode.</p>
Step 5	<p><b>frequency seconds</b></p> <p><b>Example:</b> Router(config-sla-monitor-dhcp)# frequency 30</p>	<p>(Optional) Sets the rate at which a specified IP SLAs operation repeats.</p>
Step 6	<p><b>exit</b></p> <p><b>Example:</b> Router(config-sla-monitor-dhcp)# exit</p>	<p>Exits IP SLA Monitor DHCP configuration mode and returns to global configuration mode.</p>
Step 7	<p><b>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]</b></p> <p><b>Example:</b> Router(config)# ip sla monitor schedule 10 start-time now life forever</p>	<p>Configures the scheduling parameters for an individual IP SLAs operation.</p>
Step 8	<p><b>exit</b></p> <p><b>Example:</b> Router(config)# exit</p>	<p>(Optional) Exits the global configuration mode and returns to privileged EXEC mode.</p>

## 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	<p><b>enable</b></p> <p><b>Example:</b> Router&gt; enable</p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b> Router# configure terminal</p>	<p>Enters global configuration mode.</p>
Step 3	<p><b>ip sla monitor</b> <i>operation-number</i></p> <p><b>Example:</b> Router(config)# ip sla monitor 10</p>	<p>Begins configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.</p>
Step 4	<p><b>type dhcp</b> [<b>source-ipaddr</b> {<i>ip-address</i>   <i>hostname</i>}] [<b>dest-ipaddr</b> {<i>ip-address</i>   <i>hostname</i>}] [<b>option 82</b> [<b>circuit-id</b> <i>circuit-id</i>] [<b>remote-id</b> <i>remote-id</i>] [<b>subnet-mask</b> <i>subnet-mask</i>]]</p> <p><b>Example:</b> Router(config-sla-monitor)# type dhcp dest-ipaddr 10.10.10.3 option 82 circuit-id 10005A6F1234</p>	<p>Defines a DHCP operation and enters IP SLA Monitor DHCP configuration mode.</p>
Step 5	<p><b>buckets-of-history-kept</b> <i>size</i></p> <p><b>Example:</b> Router(config-sla-monitor-dhcp)# buckets-of-history-kept 25</p>	<p>(Optional) Sets the number of history buckets that are kept during the lifetime of an IP SLAs operation.</p>
Step 6	<p><b>distributions-of-statistics-kept</b> <i>size</i></p> <p><b>Example:</b> Router(config-sla-monitor-dhcp)# distributions-of-statistics-kept 5</p>	<p>(Optional) Sets the number of statistics distributions kept per hop during an IP SLAs operation.</p>
Step 7	<p><b>enhanced-history</b> [<b>interval</b> <i>seconds</i>] [<b>buckets</b> <i>number-of-buckets</i>]</p> <p><b>Example:</b> Router(config-sla-monitor-dhcp)# enhanced-history interval 900 buckets 100</p>	<p>(Optional) Enables enhanced history gathering for an IP SLAs operation.</p>
Step 8	<p><b>filter-for-history</b> {<b>none</b>   <b>all</b>   <b>overThreshold</b>   <b>failures</b>}</p> <p><b>Example:</b> Router(config-sla-monitor-dhcp)# filter-for-history failures</p>	<p>(Optional) Defines the type of information kept in the history table for an IP SLAs operation.</p>

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 9</b>	<b>frequency</b> <i>seconds</i>  <b>Example:</b> Router(config-sla-monitor-dhcp)# frequency 30	(Optional) Sets the rate at which a specified IP SLAs operation repeats.
<b>Step 10</b>	<b>hours-of-statistics-kept</b> <i>hours</i>  <b>Example:</b> 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.
<b>Step 11</b>	<b>lives-of-history-kept</b> <i>lives</i>  <b>Example:</b> 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.
<b>Step 12</b>	<b>owner</b> <i>owner-id</i>  <b>Example:</b> Router(config-sla-monitor-dhcp)# owner admin	(Optional) Configures the Simple Network Management Protocol (SNMP) owner of an IP SLAs operation.
<b>Step 13</b>	<b>statistics-distribution-interval</b> <i>milliseconds</i>  <b>Example:</b> Router(config-sla-monitor-dhcp)# statistics-distribution-interval 10	(Optional) Sets the time interval for each statistics distribution kept for an IP SLAs operation.
<b>Step 14</b>	<b>tag</b> <i>text</i>  <b>Example:</b> Router(config-sla-monitor-dhcp)# tag TelnetPollServer1	(Optional) Creates a user-specified identifier for an IP SLAs operation.
<b>Step 15</b>	<b>threshold</b> <i>milliseconds</i>  <b>Example:</b> Router(config-sla-monitor-dhcp)# threshold 10000	(Optional) Sets the upper threshold value for calculating network monitoring statistics created by an IP SLAs operation.
<b>Step 16</b>	<b>timeout</b> <i>milliseconds</i>  <b>Example:</b> 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.
<b>Step 17</b>	<b>exit</b>  <b>Example:</b> Router(config-sla-monitor-dhcp)# exit	Exits DHCP configuration submode and returns to global configuration mode.

	Command or Action	Purpose
Step 18	<pre>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]</pre> <p><b>Example:</b> Router(config)# ip sla monitor schedule 10 start-time now life forever</p>	Configures the scheduling parameters for an individual IP SLAs operation.
Step 19	<pre>exit</pre> <p><b>Example:</b> Router(config)# exit</p>	(Optional) Exits global configuration mode and returns to privileged EXEC mode.
Step 20	<pre>show ip sla monitor configuration [operation-number]</pre> <p><b>Example:</b> Router# show ip sla monitor configuration 10</p>	(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	“ <a href="#">Cisco IOS IP SLAs Overview</a> ” chapter of the <i>Cisco IOS IP SLAs Configuration Guide</i> , Release 12.4
Cisco IOS IP SLAs commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples	<a href="#">Cisco IOS IP SLAs Command Reference</a> , 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: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### 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.	<a href="http://www.cisco.com/public/support/tac/home.shtml">http://www.cisco.com/public/support/tac/home.shtml</a>

## 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.

---

CCVP, the Cisco logo, and Welcome to the Human Network are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc.; and Access Registrar, Aironet, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, LightStream, Linksys, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PIX, ProConnect, ScriptShare, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0711R)

© 2005 Cisco Systems, Inc. All rights reserved.