



IP Service Level Agreement Commands

This module describes the Cisco IOS XR software commands to configure IP Service Level Agreements (IP SLAs) on your router.

To use commands of this module, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using any command, contact your AAA administrator for assistance.

For detailed information about IP SLA concepts, configuration tasks, and examples, see the *Implementing IP Service Level Agreements* module in the *System Monitoring Configuration Guide for Cisco CRS Routers*.

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access-list

To specify an access-list name to filter provider edge (PE) addresses to restrict operations that are automatically created by MPLS LSP monitor (MPLSLM) instance, use the **access-list** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

access-list *acl-name*

no access-list

Syntax Description	<i>acl-name</i> Filters an access-list name.
---------------------------	--

Command Default	No access list is configured by default.
------------------------	--

Command Modes	IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration
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Command History	Release Modification
	Release 3.6.0 This command was introduced.

Usage Guidelines	Access-list changes are processed before the scan interval expires to display a planned list of changes in the scan-queue.
-------------------------	--



Note	There is no verification check between the access list and the IPSLA configuration.
-------------	---

Task ID	Task ID Operations
	monitor read, write

Examples The following example shows how to use the **access-list** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplslm)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplslm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplslm-lsp-ping)# access-list ipsla
```

Related Commands	Command	Description
	scan interval, on page 88	Specifies the frequency at which the MPLS LSP monitor instance checks the scan queue for updates.

Command	Description
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

action (IP SLA)

To specify what action or combination of actions the operation performs when you configure the **react** command or when threshold events occur, use the **action** command in the appropriate configuration mode. To clear action or combination of actions (no action can happen), use the **no** form of this command.

```
action {logging | trigger}
no action {logging | trigger}
```

Syntax Description	<p>logging Sends a logging message when the specified violation type occurs for the monitored element. The IP SLA agent generates a syslog and informs SNMP. Then, it is up to the SNMP agent to generate a trap or not.</p> <p>trigger Determines that the operation state of one or more target operations makes the transition from pending to active when the violation conditions are met. The target operations to be triggered are specified using the ipsla reaction trigger command. A target operation continues until its life expires, as specified by the lifetime value of the target operation. A triggered target operation must finish its life before it can be triggered again.</p>
---------------------------	---

Command Default	None
------------------------	------

Command Modes	IP SLA reaction condition configuration IP SLA MPLS LSP monitor reaction configuration
----------------------	---

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor reaction configuration mode.

Usage Guidelines	For the action command to occur for threshold events, the threshold type must be defined. Absence of threshold type configuration is considered if the threshold check is not activated.
-------------------------	---

When the **action** command is used from IP SLA MPLS LSP monitor reaction configuration mode, only the **logging** keyword is available.

If the **action** command is used in IP SLA operation mode, the action defined applies to the specific operation being configured. If the **action** command is used in IP SLA MPLS LSP monitor mode, the action defined applies to all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID	Task ID	Operations
	monitor	read, write

Examples	The following example shows how to use the action command with the logging keyword:
-----------------	---

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react connection-loss
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# action logging
```

The following example shows how to use the **action** command from the IP SLA MPLS LSP monitor reaction configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# reaction monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-react)# react connection-loss
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-react-cond)# action logging
```

Related Commands

Command	Description
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
reaction monitor, on page 74	Configures MPLS LSP monitoring reactions.
reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.
react, on page 68	Specifies an element to be monitored for a reaction.
threshold, on page 140	Sets the lower-limit and upper-limit values.
threshold type average, on page 142	Takes action on average values to violate a threshold.
threshold type consecutive, on page 144	Takes action after a number of consecutive violations.
threshold type immediate, on page 146	Takes action immediately upon a threshold violation.
threshold type xofy, on page 148	Takes action upon X violations in Y probe operations.

ageout

To specify the number of seconds to keep the operation in memory when it is not actively collecting information, use the **ageout** command in IP SLA schedule configuration mode. To use the default value so that the operation will never age out, use the **no** form of this command.

ageout *seconds*
no ageout

Syntax Description	<i>seconds</i> Age-out interval in seconds. The value 0 seconds means that the collected data is not aged out. Range is 0 to 2073600.
---------------------------	---

Command Default	The default value is 0 seconds (never aged out).
------------------------	--

Command Modes	IP SLA schedule configuration
----------------------	-------------------------------

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	No specific guidelines impact the use of this command.
-------------------------	--

Task ID	Task	Operations
	monitor	read, write

Examples The following example shows how to use the **ageout** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# schedule operation 1
RP/0/RP0/CPU0:router(config-ipsla-sched)# ageout 3600
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

buckets (history)

To set the number of history buckets that are kept during the lifetime of the IP SLA operation, use the **buckets** command in IP SLA operation history configuration mode. To use the default value, use the **no** form of this command.

buckets *buckets*
no buckets

Syntax Description	<i>buckets</i> Number of history buckets that are kept during the lifetime of an IP SLA operation. Range is 1 to 60.
---------------------------	--

Command Default	The default value is 15 buckets.
------------------------	----------------------------------

Command Modes	IP SLA operation history configuration
----------------------	--

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines The **buckets** command is supported only to configure the following operations:

- IP SLA ICMP path-echo
- IP SLA ICMP echo
- IP SLA UDP echo

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **buckets** command in IP SLA UDP echo configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp echo
RP/0/RP0/CPU0:router(config-ipsla-udp-echo)# history
RP/0/RP0/CPU0:router(config-ipsla-op-hist)# buckets 30
```

Related Commands	Command	Description
	history, on page 31	Configures the history parameters for the IP SLA operation.
	operation, on page 52	Configures an IP SLA operation.

Command	Description
schedule operation, on page 91	Schedules an IP SLA operation.

buckets (statistics hourly)

To set the number of hours for which statistics are kept, use the **bucket** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

buckets *hours*
no buckets

Syntax Description	<i>hours</i> Number of hours for which statistics are maintained for the IP SLA operations. Range is 0 to 25 in IP SLA operation statistics configuration mode, and 0 to 2 in IP SLA MPLS LSP monitor statistics configuration mode.
---------------------------	--

Command Default	The default value is 2.
------------------------	-------------------------

Command Modes	IP SLA operation statistics configuration IP SLA MPLS LSP monitor statistics configuration
----------------------	---

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor statistics configuration mode.

Usage Guidelines	The buckets command with the <i>hours</i> argument is valid only for the statistics command with the hourly keyword.
-------------------------	---

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to set the number of hours in which statistics are maintained for the IP SLA UDP jitter operation for the **buckets** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# statistics hourly
RP/0/RP0/CPU0:router(config-ipsla-op-stats)# buckets 10
```

Related Commands	Command	Description
	statistics, on page 130	Sets the statistics collection parameters for the operation.

buckets (statistics interval)

To specify the maximum number of buckets in which the enhanced history statistics are kept, use the **buckets** command in IP SLA operation statistics configuration mode. To remove the statistics collection of the specified interval, use the **no** form of this command.

buckets *bucket-size*

no buckets

Syntax Description	<i>bucket-size</i> The bucket size is when the configured bucket limit is reached. Therefore, statistics gathering for the operation ends. Range is 1 to 100. Default is 100.
---------------------------	---

Command Default	The default value is 100.
------------------------	---------------------------

Command Modes	IP SLA operation statistics configuration
----------------------	---

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	The buckets command with the <i>bucket-size</i> argument is valid only for the statistics command with the interval keyword.
-------------------------	---

Examples	The following example shows how to collect statistics for a given time interval for the IP SLA UDP jitter operation for the buckets command:
-----------------	---

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# statistics interval 60
RP/0/RP0/CPU0:router(config-ipsla-op-stats)# buckets 50
```

Related Commands	Command	Description
	statistics, on page 130	Sets the statistics collection parameters for the operation.

control disable

To disable the control packets, use the **control disable** command in the appropriate configuration mode. To use the control packets again, use the **no** form of this command.

control disable
no control disable

Syntax Description This command has no keywords or arguments.

Command Default Control packets are enabled by default.

Command Modes IP SLA UDP echo configuration
 IP SLA UDP jitter configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines When you configure the **control disable** command on the agent side, you need to configure a permanent port on the responder side or the operation returns a timeout error. If you configure the **control disable** command, a permanent port of the IP SLA Responder or some other functionality, such as the UDP echo server, is required on the remote device.

The **control disable** command is valid for operations that require a responder.

The IP SLA control protocol is disabled, which is used to send a control message to the IP SLA Responder prior to sending an operation packet. By default, IP SLA control messages are sent to the destination device to establish a connection with the IP SLA Responder.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **control disable** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# control disable
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.

Command	Description
schedule operation, on page 91	Schedules an IP SLA operation.

datasize request

To set the protocol data size in the request packet in the payload of an operation, use the **datasize request** command in the appropriate configuration mode. To reset the default data size, use the **no** form of this command.

datasize request *size*
no datasize request

Syntax Description

size Specifies the following ranges and default values that are protocol dependent:

- For a UDP jitter operation, range is 16 to 1500 B.
- For a UDP echo operation, range is 4 to 1500 B.
- For an ICMP echo operation, range is 0 to 16384 B.
- For an ICMP path-echo operation, range is 0 to 16384 B.
- For an ICMP path-jitter operation, range is 0 to 16384 B.
- For an MPLS LSP ping operation, range is 100 to 17986 B.

Command Default

For a UDP jitter operation, the default value is 32 B.

For a UDP echo operation, the default value is 16 B.

For an ICMP echo operation, the default value is 36 B.

For an ICMP path-echo operation, the default value is 36 B.

For an ICMP path-jitter operation, the default value is 36 B.

For an MPLS LSP ping operation, the default value is 100 B.

Command Modes

IP SLA UDP echo configuration

IP SLA UDP jitter configuration

IP SLA ICMP path-jitter configuration

IP SLA ICMP path-echo configuration

IP SLA ICMP echo configuration

IP SLA MPLS LSP ping configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Support was added for IP SLA MPLS LSP ping configuration mode.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping configuration mode.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **datasize request** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# datasize request 512
```

Related Commands

Command	Description
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type icmp echo, on page 156	Configures an IP SLA ICMP echo operation.
type icmp path-echo, on page 157	Configures an IP SLA ICMP path-echo operation.
type icmp echo, on page 156	Configures an IP SLA ICMP echo operation.
type icmp path-echo, on page 157	Configures an IP SLA ICMP path-echo operation.
type icmp path-jitter, on page 158	Configures an IP SLA ICMP path-jitter operation.
type udp jitter, on page 164	Configures an IP SLA UDP jitter operation.

destination address (IP SLA)

To identify the address of the target device, use the **destination address** command in the appropriate configuration mode. To unset the destination address, use the **no** form of this command.

destination address *ipv4-address*
no destination address

Syntax Description	<i>ipv4-address</i> IP address of the target device.
---------------------------	--

Command Default	None
------------------------	------

Command Modes	IP SLA UDP echo configuration IP SLA UDP jitter configuration IP SLA ICMP path-jitter configuration IP SLA ICMP path-echo configuration IP SLA ICMP echo configuration
----------------------	--

Command History	Release Modification
	Release 3.3.0 This command was introduced.

Usage Guidelines	You must specify the address of the target device. The configuration for the destination address command is mandatory for all operations.
-------------------------	--

Task ID	Task ID Operations
	monitor read, write

Examples	The following example shows how to designate an IP address for the destination address command in IP SLA UDP jitter configuration mode:
-----------------	--

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# destination address 192.0.2.12
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

destination port

To identify the port of the target device, use the **destination port** command in the appropriate configuration mode. To unset the destination port, use the **no** form of this command.

destination port *port*
no destination port

Syntax Description

port Port number of the target device. Range is 1 to 65355.

Command Default

None

Command Modes

IP SLA UDP echo configuration
 IP SLA UDP jitter configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

The **destination port** command is not supported when you configure an ICMP operation; it is supported only to configure UDP operations.

You must specify the port of the target device. The configuration for the **destination port** command is mandatory for both IP SLA UDP echo and IP SLA UDP jitter configurations.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to designate a port for the **destination port** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# destination port 11111
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

distribution count

To set the number of statistics distributions that are kept for each hop during the lifetime of the IP SLA operation, use the **distribution count** command in IP SLA operation statistics configuration mode. To use the default value, use the **no** form of this command.

distribution count *slot*
no distribution count

Syntax Description	slot Number of statistics distributions that are kept. Range is 1 to 20. Default is 1.
---------------------------	---

Command Default	The default value is 1.
------------------------	-------------------------

Command Modes	IP SLA operation statistics configuration
----------------------	---

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	In most situations, you do not need to change the number of statistics distributions kept or the time interval for each distribution. Only change these parameters when distributions are needed, for example, when performing statistical modeling of your network. To set the statistics distributions interval, use the distribution interval command in IP SLA operation statistics configuration mode. The total number of statistics distributions captured is the value set by the distribution count command times the value set by the maximum hops command times the value set by the maximum path command times the value set by the buckets command.
-------------------------	---

Task ID	Task ID	Operations
	monitor	read, write

Examples	The following example shows how to set the number of statistics distribution for the distribution count command:
-----------------	---

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# statistics hourly
RP/0/RP0/CPU0:router(config-ipsla-op-stats)# distribution count 15
```

Related Commands	Command	Description
	buckets (statistics hourly), on page 11	Sets the number of hours in which statistics are kept.

Command	Description
distribution interval, on page 21	Sets the time interval (in milliseconds) for each statistical distribution.
maximum hops, on page 45	Sets the number of hops in which statistics are maintained for each path for the IP SLA operation.
maximum paths (IP SLA), on page 47	Sets the number of paths in which statistics are maintained for each hour for an IP SLA operation.
statistics, on page 130	Sets the statistics collection parameters for the operation.

distribution interval

To set the time interval (in milliseconds) for each statistical distribution, use the **distribution interval** command in IP SLA operation statistics configuration mode. To use the default value, use the **no** form of this command.

distribution interval *interval*
no distribution interval

Syntax Description

interval Number of milliseconds used for each statistics distribution that is kept. Range is 1 to 100. Default is 20.

Command Default

The default value is 20.

Command Modes

IP SLA operation statistics configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

In most situations, you do not need to change the number of statistics distributions kept or the time interval for each distribution. Only change these parameters when distributions are needed, for example, when performing statistical modeling of your network. To set the statistics distributions count, use the **distribution count** command in IP SLA operation statistics configuration mode. The total number of statistics distributions captured is the value set by the **distribution count** command times the value set by the **maximum hops** command times the value set by the **maximum path** command times the value set by the **buckets** command.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to set the time interval for the **distribution interval** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# statistics hourly
RP/0/RP0/CPU0:router(config-ipsla-op-stats)# distribution interval 50
```

Related Commands

Command	Description
buckets (statistics hourly), on page 11	Sets the number of hours in which statistics are kept.
distribution count, on page 19	Sets the number of statistics distributions that are kept for each hop during the lifetime of the IP SLA operation.

Command	Description
maximum hops, on page 45	Sets the number of hops in which statistics are maintained for each path for the IP SLA operation.
maximum paths (IP SLA), on page 47	Sets the number of paths in which statistics are maintained for each hour for an IP SLA operation.
statistics, on page 130	Sets the statistics collection parameters for the operation.

exp

To specify the MPLS experimental field (EXP) value in the header of echo request packets, use the **exp** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

exp *exp-bits*
no exp

Syntax Description	<i>exp-bits</i> Experimental field value in the header of an echo request packet. Valid values are from 0 to 7. Default is 0.						
Command Default	The experimental field value is set to 0.						
Command Modes	IP SLA MPLS LSP ping configuration IP SLA MPLS LSP trace configuration IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration						
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.4.0</td> <td>This command was introduced.</td> </tr> <tr> <td>Release 3.5.0</td> <td>This command was added to the IP SLA MPLS LSP monitor ping and monitor trace configuration modes.</td> </tr> </tbody> </table>	Release	Modification	Release 3.4.0	This command was introduced.	Release 3.5.0	This command was added to the IP SLA MPLS LSP monitor ping and monitor trace configuration modes.
Release	Modification						
Release 3.4.0	This command was introduced.						
Release 3.5.0	This command was added to the IP SLA MPLS LSP monitor ping and monitor trace configuration modes.						
Usage Guidelines	<p>Use the exp command to set the MPLS experimental field in the headers of echo request packets in an MPLS LSP ping or MPLS LSP trace operation. The experimental (EXP) field allows for eight different quality-of-service (QoS) markings that determine the treatment (per-hop behavior) that a transit LSR node gives to a request packet. You can configure different MPLS EXP levels for different operations to create differentiated levels of response.</p> <p>If the exp command is used in IP SLA operation mode, it acts on the headers of echo request packets for the specific operation being configured. If the exp command is used in IP SLA MPLS LSP monitor mode, it acts on the headers of echo request packets for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.</p>						
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write		
Task ID	Operations						
monitor	read, write						
Examples	<p>The following example shows how to use the exp command:</p> <pre>RP/0/RP0/CPU0:router# configure</pre>						

```

RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# exp 5

```

The following example shows how to use the **exp** command in MPLS LSP monitor mode:

```

RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-monitor)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-monitor-def)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-monitor-def-lsp-trace)# exp 5

```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

filter

To define the type of information that are kept in the history table for the IP SLA operation, use the **filter** command in IP SLA operation history configuration mode. To unset the history filter, use the **no** form of this command.

```
filter {all | failures}
no filter
```

Syntax Description	
all	Stores history data for all operations, if set.
failures	Stores data for operations that failed, if set.

Command Default The default is not to collect the history unless the **filter** command is enabled.

Command Modes IP SLA operation history configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines The **filter** command is supported only to configure the following operations:

- IP SLA ICMP path-echo
- IP SLA ICMP echo
- IP SLA UDP echo

If you use the **no** form of the **filter** command, the history statistics are not collected.

Task ID	Task	Operations
	monitor	read, write

Examples The following example shows how to use the **filter** command in IP SLA UDP echo configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp echo
RP/0/RP0/CPU0:router(config-ipsla-udp-echo)# history
RP/0/RP0/CPU0:router(config-ipsla-op-hist)# filter all
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.

Command	Description
schedule operation, on page 91	Schedules an IP SLA operation.

force explicit-null

To add an explicit null label to the label stack of an LSP when an echo request is sent, use the **force explicit-null** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

force explicit-null
no force explicit-null

Syntax Description This command has no keywords or arguments.

Command Default An explicit null label is not added.

Command Modes IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration
 IP SLA MPLS LSP monitor ping configuration
 IP SLA MPLS LSP monitor trace configuration

Command History	Release	Modification
	Release 3.4.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines Use the **force explicit-null** command to force an unsolicited explicit null label to be added to the MPLS label stack of the LSP when an echo request packet is sent in an MPLS LSP ping or MPLS LSP trace operation.

If the **force explicit-null** command is used in IP SLA operation mode, it acts on the label stack of the LSP for the specific operation being configured. If the **force explicit-null** command is used in IP SLA MPLS LSP monitor mode, it acts on the label stack of all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

You cannot use the **force explicit-null** command if pseudowire is specified as the target to be used in an MPLS LSP ping operation.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **force explicit-null** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
```

force explicit-null

```
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp trace  
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# force explicit-null
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

frequency (IP SLA)

To set the frequency for probing, use the **frequency** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

frequency *seconds*
no frequency

Syntax Description

seconds Rate at which the specific IP SLA operation is sent into the network. Range is 1 to 604800.

Command Default

If the **frequency** command is not used, the default value is 60 seconds.

In IP SLA MPLS LSP monitor schedule configuration mode, the default value is equal to the schedule period that is set using the **schedule period** command.

Command Modes

IP SLA UDP echo configuration
 IP SLA UDP jitter configuration
 IP SLA ICMP path-jitter configuration
 IP SLA ICMP path-echo configuration
 IP SLA ICMP echo configuration
 IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration
 IP SLA MPLS LSP monitor schedule configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Support was added for IP SLA MPLS ping and IP SLA MPLS trace configuration modes.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor schedule configuration mode.

Usage Guidelines

If this command is used in IP SLA MPLS LSP monitor schedule configuration mode, it represents the frequency for the schedule period. In other words, if the frequency is set to 1000 seconds and the schedule period is set to 600 seconds, every 1000 seconds the LSP operations are run. Each run takes 600 seconds. Use the **schedule period** command to specify the schedule period.

The frequency value must be greater than or equal to the schedule period.

This configuration is inherited automatically by all LSP operations that are created.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **frequency** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# frequency 300
```

The following example shows how to use the **frequency** command in IP SLA MPLS LSP monitor schedule configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# schedule monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-sched)# frequency 1200
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-sched)# schedule period 600
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
schedule period, on page 93	Configures the amount of time during which all LSP operations are scheduled to start or run.

history

To configure the history parameters for the IP SLA operation, use the **history** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

```
history [{buckets buckets | filter {all | failures} | lives lives}]
no history
```

Syntax Description

buckets	Sets the number of history buckets that are kept during the lifetime of the IP SLA operation.
<i>buckets</i>	Number of history buckets that are kept during the lifetime of an IP SLA operation. Range is 1 to 60.
filter	Defines the type of information that is kept in the history table for the IP SLA operation.
all	Stores history data for all operations, if set.
failures	Stores data for operations that failed, if set.
lives	Sets the number of lives that are maintained in the history table for an IP SLA operation.
<i>lives</i>	Number of lives that are maintained in the history table for an IP SLA operation. Range is 0 to 2.

Command Default

None

Command Modes

IP SLA UDP echo configuration
 IP SLA UDP jitter configuration
 IP SLA ICMP path-jitter configuration
 IP SLA ICMP path-echo configuration
 IP SLA ICMP echo configuration
 IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Support was added for IP SLA MPLS LSP ping and IP SLA MPLS LSP trace configuration modes.

Usage Guidelines

The **history** command enters IP SLA operation history configuration mode in which you can configure more history configuration parameters.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **history** command in IP SLA UDP echo configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp echo
RP/0/RP0/CPU0:router(config-ipsla-udp-echo)# history
RP/0/RP0/CPU0:router(config-ipsla-op-hist)#
```

Related Commands

Command	Description
buckets (history), on page 9	Sets the number of history buckets that are kept during the lifetime of the IP SLA operation.
filter, on page 25	Defines the type of information that are kept in the history table for the IP SLA operation.
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
lives, on page 39	Sets the number of lives that are maintained in the history table for an IP SLA operation.
samples, on page 84	Sets the number of hop entries that are kept in the history table for an IP SLA ICMP path-echo operation.

interval

To configure the refresh interval for MPLS label switched path (LSP) monitoring, use the **interval** command in IP SLA MPLS discovery VPN configuration mode. To use the default value, use the **no** form of this command.

interval *refresh-interval*
no interval

Syntax Description	<i>refresh-interval</i> Specifies the time interval, in minutes, after which routing entries that are no longer valid are removed from the Layer 3 VPN discovery database. Range is 30 to 70560.				
Command Default	The default refresh interval is 60 minutes.				
Command Modes	IP SLA MPLS discovery VPN configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.5.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.5.0	This command was introduced.
Release	Modification				
Release 3.5.0	This command was introduced.				

Usage Guidelines



Note If the total number of routes is large, there is a negative impact on the performance during the refresh of the discovery database. Therefore, the value of the *refresh-interval* argument should be large enough that router performance is not affected. If there are a very large number of routes, we recommend that you set the value of the *refresh-interval* argument to be several hours.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **interval** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls discovery vpn
RP/0/RP0/CPU0:router(config-ipsla-mpls-discovery-vpn)# interval 120
```

Related Commands	Command	Description
	mpls discovery vpn, on page 50	Configures MPLS label switched path (LSP) provider edge (PE) router discovery.

Command	Description
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.

ipsla

To enter IP SLA configuration mode and configure IP Service Level Agreements, use the **ipsla** command in Global Configuration mode. To return to the default setting, use the **no** form of this command.

ipsla
no ipsla

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes Global Configuration mode

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines The **ipsla** command enters IP SLA configuration mode where you can configure the various IP service level agreement options.

Task ID	Task	Operations
	monitor	read, write

Examples

The following example shows how to enter IP SLA configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)#
```

Related Commands

Command	Description
key-chain, on page 37	Configures MD5 authentication for IP SLA control messages.
low-memory, on page 41	Configures a low-water memory mark.
mpls discovery vpn, on page 50	Configures MPLS label switched path (LSP) provider edge (PE) router discovery.
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
operation, on page 52	Configures an IP SLA operation.
reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.

Command	Description
reaction trigger, on page 77	Defines a second IP SLA operation to make the transition from a pending state to an active state when one of the trigger-type options is defined with the reaction operation command.
responder, on page 78	Enables the IP SLA responder for UDP echo or jitter operations.
schedule operation, on page 91	Schedules an IP SLA operation.

key-chain

To configure the MD5 authentication for the IP SLA control message, use the **key-chain** command in IP SLA configuration mode. To unset the keychain name and not use MD5 authentication, use the **no** form of this command.

key-chain *key-chain-name*
no key-chain

Syntax Description	<i>key-chain-name</i> Name of the keychain.				
Command Default	No default values are defined. No authentication is used.				
Command Modes	IP SLA configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.3.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.3.0	This command was introduced.
Release	Modification				
Release 3.3.0	This command was introduced.				
Usage Guidelines	When you configure the key-chain command, you must also configure the key chain command in global configuration mode to provide MD5 authentication.				

Task ID	Task	Operations
	monitor	read, write

Examples

The following example shows how to use the **ipsla key-chain** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# key-chain ipsla-keys
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

life

To specify the length of time to execute, use the **life** command in IP SLA schedule configuration mode. To use the default value, use the **no** form of this command.

life {**forever***seconds*}

no life

Syntax Description

forever Schedules the operation to run indefinitely.

seconds Determines the number of seconds the operation actively collects information. Range is 1 to 2147483647. Default value is 3600 seconds (one hour).

Command Default

The default value is 3600 seconds.

Command Modes

IP SLA schedule configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **life** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# schedule operation 1
RP/0/RP0/CPU0:router(config-ipsla-sched)# life forever
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

lives

To set the number of lives that are maintained in the history table for an IP SLA operation, use the **lives** command in IP SLA operation history configuration mode. To use the default value, use the **no** form of this command.

lives *lives*
no **lives**

Syntax Description	<i>lives</i> Number of lives that are maintained in the history table for an IP SLA operation. Range is 0 to 2.
---------------------------	---

Command Default	The default value is 0 lives.
------------------------	-------------------------------

Command Modes	IP SLA operation history configuration
----------------------	--

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines The **lives** command is supported only to configure the following operations:

- IP SLA ICMP path-echo
- IP SLA ICMP echo
- IP SLA UDP echo

If you use the **no** form of the **lives** command, the history statistics are not collected.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **lives** command in IP SLA UDP echo configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp echo
RP/0/RP0/CPU0:router(config-ipsla-udp-echo)# history
RP/0/RP0/CPU0:router(config-ipsla-op-hist)# lives 2
```

Related Commands	Command	Description
	buckets (history), on page 9	Sets the number of history buckets that are kept during the lifetime of the IP SLA operation.

Command	Description
filter, on page 25	Defines the type of information that are kept in the history table for the IP SLA operation.
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
samples, on page 84	Sets the number of hop entries that are kept in the history table for an IP SLA ICMP path-echo operation.

low-memory

low-memory *value*

no low-memory

Syntax Description *value* Low-memory watermark value. Range is 0 to 4294967295.

Command Default The default value is 20 MB (free memory).

Command Modes IP SLA configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines IP SLA ensures that the system provides the specified memory before adding new operations or scheduling the pending operation.

When the 0 value is used, no memory limitation is enforced.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **low-memory** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# low-memory 102400
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.
	show ipsla application, on page 95	Displays the information for the IP SLA application.

lsp selector ipv4

To specify the local host IPv4 address used to select an LSP, use the **lsp selector ipv4** command in the appropriate configuration mode. To clear the host address, use the **no** form of this command.

```
lsp selector ipv4 ip-address
no lsp selector ipv4
```

Syntax Description

ip-address A local host IPv4 address used to select the LSP.

Command Default

The local host IP address used to select the LSP is 127.0.0.1.

Command Modes

IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration
 IP SLA MPLS LSP monitor ping configuration
 IP SLA MPLS LSP monitor trace configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines

Use the **lsp selector ipv4** command to force an MPLS LSP ping or MPLS LSP trace operation to use a specific LSP when there are multiple equal cost paths between provider edge (PE) routers. This situation occurs when transit label switching routers (LSRs) use the destination address in IP packet headers for load balancing.

The IPv4 address configured with the **lsp selector ipv4** command is the destination address in the User Datagram Protocol (UDP) packet sent as the MPLS echo request. Valid IPv4 addresses are defined in the subnet 127.0.0.0/8 and used to:

- Force the packet to be consumed by the router where an LSP breakage occurs.
- Force processing of the packet at the terminal point of the LSP if the LSP is intact.
- Influence load balancing during forwarding when the transit routers use the destination address in the IP header for load balancing.

If the **lsp selector ipv4** command is used in IP SLA operation mode, it acts on the MPLS echo requests for the specific operation being configured. If the **lsp selector ipv4** command is used in IP SLA MPLS LSP monitor mode, it acts on the MPLS echo requests for all operations associated with the monitored provider edge (PE) routers.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **lsp selector ipv4** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# lsp selector ipv4 127.10.10.1
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

lsr-path

To specify a loose source routing path in which to measure the ICMP, use the **lsr-path** command in the appropriate configuration mode. To use a path other than the specified one, use the **no** form of this command.

```
lsr-path ipaddress1 [ipaddress2 [. . . [ipaddress8]]]
no lsr-path
```

Syntax Description

ip address IPv4 address of the intermediate node. Up to eight addresses can be entered.

Command Default

No path is configured.

Command Modes

IP SLA ICMP path-jitter configuration
IP SLA ICMP path-echo configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

The **lsr-path** command applies only to ICMP path-echo and ICMP path-jitter operation types. You can configure up to a maximum of eight hop addresses by using the **lsr-path** command, as shown in the following example:

```
lsr-path ipaddress1 [ipaddress2 [... [ipaddress8]]]
```

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **lsr-path** command in IP SLA ICMP Path-echo configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp path-echo
RP/0/RP0/CPU0:router(config-ipsla-icmp-path-echo)# lsr-path 192.0.2.40
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

maximum hops

To set the number of hops in which statistics are maintained for each path for the IP SLA operation, use the **maximum hops** command in IP SLA operation statistics configuration mode. To use the default value, use the **no** form of this command.

```
maximum hops hops
no maximum hops
```

Syntax Description

hops Number of hops for which statistics are maintained for each path. Range is 1 to 30. Default value is 16 for path operations; for example, *pathecho*.

Command Default

The default value is 16 hops.

Command Modes

IP SLA operation statistics configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

The **maximum hops** command is supported only when you configure path operations and the IP SLA ICMP path-echo operation.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to set the number of hops for the statistics for the **maximum** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp path-echo
RP/0/RP0/CPU0:router(config-ipsla-icmp-path-echo)# statistics hourly
RP/0/RP0/CPU0:router(config-ipsla-op-stats)# maximum hops 20
```

Related Commands

Command	Description
buckets (statistics hourly), on page 11	Sets the number of hours in which statistics are kept.
distribution count, on page 19	Sets the number of statistics distributions that are kept for each hop during the lifetime of the IP SLA operation.
distribution interval, on page 21	Sets the time interval (in milliseconds) for each statistical distribution.

Command	Description
maximum paths (IP SLA), on page 47	Sets the number of paths in which statistics are maintained for each hour for an IP SLA operation.
statistics, on page 130	Sets the statistics collection parameters for the operation.

maximum paths (IP SLA)

To set the number of paths in which statistics are maintained for each hour for an IP SLA operation, use the **maximum paths** command in IP SLA operation statistics configuration mode. To use the default value, use the **no** form of this command.

maximum paths *paths*
no maximum paths

Syntax Description	<i>paths</i> Number of paths for which statistics are maintained for each hour. Range is 1 to 128. Default value is 5 for path operations; for example, <i>pathecho</i> .				
Command Default	The default value is 5 paths.				
Command Modes	IP SLA operation statistics configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.3.0</td> <td>This command was introduced</td> </tr> </tbody> </table>	Release	Modification	Release 3.3.0	This command was introduced
Release	Modification				
Release 3.3.0	This command was introduced				
Usage Guidelines	The maximum paths command is supported only when you configure path operations and the IP SLA ICMP path-echo operation.				
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				
Examples	<p>The following example shows how to set the number of paths for the statistics for the maximum paths command:</p> <pre>RP/0/RP0/CPU0:router# configure RP/0/RP0/CPU0:router(config)# ipsla RP/0/RP0/CPU0:router(config-ipsla)# operation 1 RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp path-echo RP/0/RP0/CPU0:router(config-ipsla-icmp-path-echo)# statistics hourly RP/0/RP0/CPU0:router(config-ipsla-op-stats)# maximum paths 20</pre>				

Related Commands	Command	Description
	buckets (statistics hourly), on page 11	Sets the number of hours in which statistics are kept.
	distribution count, on page 19	Sets the number of statistics distributions that are kept for each hop during the lifetime of the IP SLA operation.
	distribution interval, on page 21	Sets the time interval (in milliseconds) for each statistical distribution.

Command	Description
maximum hops, on page 45	Sets the number of hops in which statistics are maintained for each path for the IP SLA operation.
statistics, on page 130	Sets the statistics collection parameters for the operation.

monitor

To configure an MPLS LSP monitor instance, use the **monitor** command in IP SLA LSP monitor configuration mode. To remove the monitor instance, use the **no** form of this command.

monitor *monitor-id*
no monitor [*monitor-id*]

Syntax Description	<i>monitor-id</i> Number of the IP SLA LSP monitor instance to be configured. Range is 1 to 2048.
---------------------------	---

Command Default	No monitor instance is configured.
------------------------	------------------------------------

Command Modes	IP SLA LSP monitor configuration
----------------------	----------------------------------

Command History	Release	Modification
	Release 3.5.0	This command was introduced.

Usage Guidelines	The monitor command enters IP SLA MPLS LSP monitor configuration mode so that you can set the desired monitor type for all operations associated with the monitored provider edge (PE) routers.
-------------------------	--

To remove all monitor instances, use the **no monitor** command with no argument.

Task ID	Task ID	Operations
	monitor	read, write

Examples	The following example shows how to use the monitor command:
-----------------	--

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsml-def)#
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

mpls discovery vpn

To configure MPLS label switched path (LSP) provider edge (PE) router discovery, use the **mpls discovery vpn** command in IP SLA configuration mode. To use the default value, use the **no** form of this command.

```
mpls discovery vpn [interval interval]  
no mpls discovery vpn
```

Syntax Description

interval Configures the refresh interval for MPLS label switched path (LSP) monitoring.

Command Default

None

Command Modes

IP SLA configuration

Command History

Release	Modification
Release 3.5.0	This command was introduced.

Usage Guidelines

Use the **mpls discovery vpn** command to configure provider edge (PE) router discovery. PE Discovery discovers the LSPs used to reach every routing next hop. Routing entities are stored in a Layer 3 VPN discover database.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to enter IP SLA MPLS discovery VPN mode:

```
RP/0/RP0/CPU0:router# configure  
RP/0/RP0/CPU0:router (config)# ipsla  
RP/0/RP0/CPU0:router (config-ipsla)# mpls discovery vpn  
RP/0/RP0/CPU0:router (config-ipsla-mpls-discovery-vpn)#
```

Related Commands

Command	Description
interval, on page 33	Configures the refresh interval for MPLS label switched path (LSP) monitoring.
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.

mpls lsp-monitor

To configure MPLS label switched path (LSP) monitoring, use the **mpls lsp-monitor** command in IP SLA configuration mode. To use the default value, use the **no** form of this command.

mpls lsp-monitor
no mpls lsp-monitor

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes IP SLA configuration

Command History	Release	Modification
	Release 3.5.0	This command was introduced.

Usage Guidelines Use the **mpls lsp-monitor** command to configure MPLS LSP PE monitoring on the router. This provides a means to configure all operations associated with the monitored provider edge (PE) routers. The configuration is inherited by all LSP operations that are created automatically by the PE discovery.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to enter IP SLA MPLS LSP monitor mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplslm)#
```

Related Commands	Command	Description
	monitor, on page 49	Configures an IP SLA MPLS LSP monitor instance.
	mpls discovery vpn, on page 50	Configures MPLS label switched path (LSP) provider edge (PE) router discovery.
	reaction monitor, on page 74	Configures MPLS LSP monitoring reactions.
	schedule monitor, on page 90	Schedules an IP SLA MPLS LSP monitor instance.

operation

To configure an IP SLA operation, use the **operation** command in IP SLA configuration mode. To remove the operation, use the **no** form of this command.

operation *operation-number*
no operation *operation-number*

Syntax Description	<i>operation-number</i> Operation number. Range is 1 to 2048.
---------------------------	---

Command Default	None
------------------------	------

Command Modes	IP SLA configuration
----------------------	----------------------

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	No specific guidelines impact the use of this command.
-------------------------	--

Task ID	Task	Operations
	monitor	read, write

Examples The following example shows how to use the IP SLA **operation** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)#
```

Related Commands	Command	Description
	schedule operation, on page 91	Schedules an IP SLA operation.

output interface

To specify the echo request output interface to be used for LSP ping or LSP trace operations, use the **output interface** command in IP SLA MPLS LSP ping or IP SLA MPLS LSP trace configuration mode. To return the output interface to the default, use the **no** form of this command.

```
output interface type interface-path-id
no output interface
```

Syntax Description	<i>type</i>	Interface type. For more information, use the question mark (?) online help function.
	<i>interface-path-id</i>	Physical interface or virtual interface.
	Note	Use the show interfaces command to see a list of all interfaces currently configured on the router.
		For more information about the syntax for the router, use the question mark (?) online help function.

Command Default No default behavior or values.

Command Modes

- IP SLA MPLS LSP ping configuration
- IP SLA MPLS LSP trace configuration
- IP SLA MPLS LSP monitor ping configuration
- IP SLA MPLS LSP monitor trace configuration

Command History	Release	Modification
	Release 3.5.0	This command was introduced.

Usage Guidelines

Use the **output interface** command to help monitor path-to-target over the path if there are some ECMP routes in a topology.

You cannot use the **output interface** command if pseudowire is specified as the target to be used in an MPLS LSP ping operation.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **output interface** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
```

```
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls ls output interface pos 0/1/0/0
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
output nexthop, on page 55	Configures the next-hop address to be used for LSP ping or LSP trace operations.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

output nexthop

To specify the next-hop address to be used for a Label Switched Path (LSP) ping or LSP trace operations, use the **output nexthop** command in the appropriate configuration mode. To return the output next hop to the default, use the **no** form of this command.

```
output nexthop ip-address
no output nexthop
```

Syntax Description	<i>ip-address</i> IP address of the next hop.				
Command Default	No default behavior or values				
Command Modes	IP SLA MPLS LSP ping configuration IP SLA MPLS LSP trace configuration IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.6.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.6.0	This command was introduced.
Release	Modification				
Release 3.6.0	This command was introduced.				
Usage Guidelines	When LSP Path Discovery (LPD) is enabled, the next-hop IP address is also used to filter out the paths that are not associated with the specified next-hop address.				



Note After you configure the output next hop, you must also configure the output interface.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **output nexthop** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# output nexthop 10.1.1.1
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
output interface, on page 53	Configures the echo request output interface to be used for LSP ping or LSP trace operations.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

packet count

To specify the number of packets that are to be transmitted during a probe, such as a sequence of packets being transmitted for a jitter probe, use the **packet count** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

packet count *count*
no packet count

Syntax Description

count Number of packets to be transmitted in each operation. Range for a UDP jitter operation is 1 to 60000. Range for an ICMP path-jitter operation is 1 to 100.

Command Default

The default packet count is 10.

Command Modes

IP SLA UDP jitter configuration
 IP SLA ICMP path-jitter configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **packet count** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# packet count 30
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
packet interval, on page 58	Specifies the interval between packets.

packet interval

To specify the interval between packets, use the **packet interval** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

packet interval *interval*
no packet interval

Syntax Description	<i>interval</i> Interpacket interval in milliseconds. Range is 1 to 60000 (in milliseconds).
---------------------------	--

Command Default	The default packet interval is 20 ms.
------------------------	---------------------------------------

Command Modes	IP SLA UDP jitter configuration IP SLA ICMP path-jitter configuration
----------------------	--

Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.3.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.3.0	This command was introduced.
Release	Modification				
Release 3.3.0	This command was introduced.				

Usage Guidelines	No specific guidelines impact the use of this command.
-------------------------	--

Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				

Examples The following example shows how to use the **packet interval** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# operation 1
RP/0/RP0/CPU0:router (config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router (config-ipsla-udp-jitter)# packet interval 30
```

Related Commands	<table border="1"> <thead> <tr> <th>Command</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>operation, on page 52</td> <td>Configures an IP SLA operation.</td> </tr> <tr> <td>schedule operation, on page 91</td> <td>Schedules an IP SLA operation.</td> </tr> <tr> <td>packet count, on page 57</td> <td>Specifies the number of packets that are to be transmitted during a probe.</td> </tr> </tbody> </table>	Command	Description	operation, on page 52	Configures an IP SLA operation.	schedule operation, on page 91	Schedules an IP SLA operation.	packet count, on page 57	Specifies the number of packets that are to be transmitted during a probe.
Command	Description								
operation, on page 52	Configures an IP SLA operation.								
schedule operation, on page 91	Schedules an IP SLA operation.								
packet count, on page 57	Specifies the number of packets that are to be transmitted during a probe.								

path discover

To enable path discovery and enter MPLS LSP monitor (MPLSLM) LPD submode, use the **path discover** command in IP SLA MPLS LSP monitor ping configuration mode. To use the default value, use the **no** form of this command.

path discover
no path discover

Syntax Description	None				
Command Default	No default behavior or values				
Command Modes	IP SLA MPLS LSP monitor ping configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.6.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.6.0	This command was introduced.
Release	Modification				
Release 3.6.0	This command was introduced.				
Usage Guidelines	No specific guidelines impact the use of this command.				
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				

Examples

The following example shows how to enter path discover submode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsml-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lsp-ping)# path discover
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lpd)#
```

path discover echo

To configure MPLS LSP echo parameters, use the **path discover** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

```
path discover echo {interval time | maximum lsp selector ipv4 host address | multipath bitmap
size size | retry count | timeout value}
no path discover echo {interval time | maximum lsp selector ipv4 host address | multipath
bitmap size size | retry count | timeout value}
```

Syntax Description		
interval <i>time</i>		Configures the interval (in milliseconds) between MPLS LSP echo requests sent during path discovery. Range is 0 to 3600000. Default is 0.
maximum lsp selector ipv4 <i>host-address</i>		Configures a local host IP address (127.x.x.x) that is the maximum selector value to be used during path discovery. Default is 127.255.255.255.
multipath bitmap size <i>size</i>		Configures the maximum number of selectors sent in the downstream mapping of an MPLS LSP echo request during path discovery. Range is 1 to 256. Default is 32.
retry <i>count</i>		Configures the number of timeout retry attempts for MPLS LSP echo requests sent during path discovery. Range is 0 to 10. Default is 3.
timeout <i>value</i>		Configures the timeout value (in seconds) for MPLS LSP echo requests sent during path discovery. Range is 1 to 3600. Default is 5.

Command Default	
interval <i>time</i> : 0	
maximum lsp selector ipv4 <i>host address</i> : 127.255.255.255	
multipath bitmap size <i>size</i> : 32	
retry <i>count</i> : 3	
timeout <i>value</i> : 5	

Command Modes	
	Path discover configuration
	MPLS LSP ping configuration

Command History	Release	Modification
	Release 3.6.0	This command was introduced.

Usage Guidelines A retry occurs when either an echo reply was not received on time for an outstanding echo request, or when no selectors are found for a given path by a transit router.

When a selector value is configured in MPLSLM configuration mode, the maximum selector specified must be larger than that value. In such a scenario, the range of selectors used for path discovery is set by the two values.

When the **interval** *time* is zero, a new echo request is sent after the previous echo retry was received.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to configure the path discover echo interval:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-lsp-ping)# path discover
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-lsp-lpd)# echo interval 777
```

Related Commands

Command	Description
path discover path, on page 62	Configures MPLS LSP path parameters.
path discover scan, on page 64	Configures MPLS LSP scan parameters.
path discover session, on page 66	Configures MPLS LSP session parameters.

path discover path

To configure MPLS LSP path parameters, use the **path discover path** command in MPLS LSP monitor (MPLSLM) LPD configuration submode. To use the default value, use the **no** form of this command.

```
path discover path {retry range | secondary frequency {both | connection-loss | timeout} value}
no path-discover path
```

Syntax Description

retry range	Configures the number of attempts to be performed before declaring a path as down. Default is 1 (LSP group will not retry to perform the echo request if the previous attempt fails). Range is 1 to 16.
secondary frequency	Configures a secondary frequency to use after a failure condition (that is, a connection-loss or timeout) occurs.
both	Enable secondary frequency for a timeout and connection loss.
connection-loss	Enable secondary frequency for only a connection loss.
timeout	Enable secondary frequency for only a timeout.
value	Frequency value range is 1 to 604800.

Command Default

None

Command Modes

MPLSLM LPD configuration

Command History

Release	Modification
Release 3.6.0	This command was introduced.

Usage Guidelines

In the event of a path failure, the secondary frequency value is used instead of the normal frequency value. The normal frequency value is determined by a frequency value or schedule period value, and the LSP operations are scheduled to start periodically at this interval. By default, the secondary frequency value is disabled. When failure condition disappears, probing resumes at the regular frequency.



Note The **secondary** command works in tandem with the **retry** keyword. Both must be configured.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to configure MPLS LSP path parameters:

```

RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsml-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lsp-ping)# path discover
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lsp-lpd)# path retry 12
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lsp-lpd)# path secondary frequency both 10

```

Related Commands

Command	Description
path discover echo, on page 60	Configures MPLS LSP echo parameters.
path discover scan, on page 64	Configures MPLS LSP scan parameters.
path discover session, on page 66	Configures MPLS LSP session parameters.

path discover scan

To configure MPLS LSP scan parameters, use the **path discover scan** command in MPLS LSP monitor (MPLSLM) LPD configuration submode. To use the default value, use the **no** form of this command.

```
path discover scan period value
no path discover scan period value
```

Syntax Description	period <i>value</i>	Configures the time (in minutes) between consecutive cycles of path discovery requests per MPLSLM instance. Range is 0 to 7200. Default is 5.
Command Default	period <i>value</i> : 5	
Command Modes	MPLSLM LPD configuration submode	
Command History	Release	Modification
	Release 3.6.0	This command was introduced.

Usage Guidelines

MPLSLM instances periodically trigger path discovery requests for LSP groups. At certain intervals, an MPLSLM instance begins triggering path discovery requests for each group in ascending order (determined by group ID). By default, the path discovery requests are triggered sequentially, although some concurrency may occur if the session limit value is greater than 1. The cycle concludes when the last LSP group finishes path discovery.

If the duration of the discovery cycle is larger than the scan period, a new cycle starts as soon as the previous one completes.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to configure the path discovery scan period value:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor)# monitor 1
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor)# type mpls lsp ping
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor-lsp-ping)# path discover
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor-lsp-ping-lpd)# scan period 2
```

Related Commands	Command	Description
	path discover echo, on page 60	Configures MPLS LSP echo parameters.

Command	Description
path discover path, on page 62	Configures MPLS LSP path parameters.
path discover session, on page 66	Configures MPLS LSP session parameters.

path discover session

To configure MPLS LSP session parameters, use the **path discover session** command in MPLS LSP monitor (MPLSLM) LPD configuration submode. To use the default value, use the **no** form of this command.

```
path discover session {limit value | timeout value}
no path discover session {limit value | timeout value}
```

Syntax Description

limit value	Configures the number of concurrent active path discovery requests the MPLSLM instance submits to the LSPV server. Range is 1 to 15. Default is 1.
timeout value	Configures the time (in seconds) the MPLSLM instance will wait for the result of a path discovery request submitted to the LSPV server. Range is 1 to 900. Default is 120.

Command Default

```
limit value : 1
timeout value : 120
```

Command Modes

MPLSLM LPD configuration submode

Command History

Release	Modification
Release 3.6.0	This command was introduced.

Usage Guidelines

An MPLSLM instance considers the path discovery as a failure when it receives no response within the configured timeout configuration value.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to configure the path discovery session timeout value:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-lsp-ping)# path discover
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-lsp-lpd)# session timeout 22
```

Related Commands

Command	Description
path discover echo, on page 60	Configures MPLS LSP echo parameters.
path discover path, on page 62	Configures MPLS LSP path parameters.

Command	Description
path discover scan, on page 64	Configures MPLS LSP scan parameters.

react

To specify an element to be monitored for a reaction, use the **react** command in the appropriate configuration mode. To remove the specified reaction type, use the **no** form of this command.

```
react {connection-loss | jitter-average [{dest-to-source | source-to-dest}] | packet-loss {dest-to-source
| source-to-dest} | rtt | timeout | verify-error}
no react {connection-loss | jitter-average [{dest-to-source | source-to-dest}] | packet-loss {dest-to-source
| source-to-dest} | rtt | timeout | verify-error}
```

Syntax Description

connection-loss	Specifies that a reaction occurs if there is a connection-loss for the monitored operation.
jitter-average [dest-to-source source-to-dest]	Specifies that a reaction occurs if the average round-trip jitter value violates the upper threshold or lower threshold. The following options are listed for the jitter-average keyword: <ul style="list-style-type: none"> • dest-to-source—(Optional) Specifies the jitter average destination to source (DS). • source-to-dest—(Optional) Specifies the jitter average source to destination (SD).
packet-loss { dest-to-source source-to-dest }	Specifies the reaction on packet loss value violation. The following options are listed for the packet-loss keyword: <ul style="list-style-type: none"> • dest-to-source—(Optional) Specifies the packet loss destination to source (DS) violation. • source-to-dest—(Optional) Specifies the packet loss source to destination (SD) violation.
rtt	Specifies that a reaction occurs if the round-trip value violates the upper threshold or lower threshold.
timeout	Specifies that a reaction occurs if there is a timeout for the monitored operation.
verify-error	Specifies that a reaction occurs if there is an error verification violation.

Command Default

If there is no default value, no reaction is configured.

Command Modes

IP SLA reaction configuration
IP SLA MPLS LSP monitor reaction configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor reaction configuration mode.

Usage Guidelines

For the **connection-loss** keyword, **jitter-average** keyword, and **rtt** keyword, the reaction does not occur when the value violates the upper or the lower threshold. The reaction condition is set when the upper threshold is passed, and it is cleared when values go below the lower threshold.

For the **connection-loss** keyword and **verify-error** keyword, thresholds do not apply to the monitored element.

For the **jitter-average** keyword, **packet-loss** keyword, and **rtt** keyword, if the upper threshold for react threshold type average 3 is configured as 5000 ms and the last three results of the operation are 6000, 6000, and 5000 ms, the average is $6000 + 6000 + 5000 = 17000 / 3 = 5667$ —therefore violating the 5000-ms upper threshold. The threshold type average must be configured when setting the type. These keywords are not available if connection-loss, timeout, or verify-error is specified as the monitored element, because upper and lower thresholds do not apply to these options.

In IP SLA MPLS LSP monitor reaction configuration mode, only the **connection-loss** and **timeout** keywords are available. If the **react** command is used in IP SLA MPLS LSP monitor reaction configuration mode, it configures all operations associated with the monitored provider edge (PE) routers. The configuration is inherited by all LSP operations that are created automatically by the PE discovery.

This table lists the Supported Reaction Configuration, by IP SLA Operation.

Table 1: Supported Reaction Configuration, by IP SLA Operation

Operation	ICMP Echo	Path Echo	UDP Jitter	UDP Echo	ICMP Path Jitter	MPLS LSP Ping	MPLS LSP Trace
Failure	--	--	--	--	--	--	--
RTT	Y	Y	Y	Y	Y	Y	Y
RTTAvg	--	--	--	--	--	--	--
Timeout	Y	Y	Y	Y	Y	Y	Y
connectionLoss	--	--	Y	Y	--	Y	Y
verifyError	--	--	Y	Y	--	--	--
jitterSDAvg	--	--	Y	--	--	--	--
jitterDSAvg	--	--	Y	--	--	--	--
jitterAvg	--	--	Y	--	--	--	--
PacketLossDS	--	--	Y	--	--	--	--
PacketLossSD	--	--	Y	--	--	--	--
PacketLoss	--	--	Y	--	--	--	--

Task ID**Task ID Operations**

monitor read,
write

Examples

The following example shows how to use the **react** command with the **connection-loss** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router (config-ipsla-react)# react connection-loss
RP/0/RP0/CPU0:router (config-ipsla-react-cond)#
```

The following example shows how to use the **react** command with the **jitter-average** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router (config-ipsla-react)# react jitter-average
RP/0/RP0/CPU0:router (config-ipsla-react-cond)#
```

The following example shows how to use the **react** command with the **packet-loss** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router (config-ipsla-react)# react packet-loss dest-to-source
RP/0/RP0/CPU0:router (config-ipsla-react-cond)#
```

The following example shows how to use the **react** command with the **rtt** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router (config-ipsla-react)# react rtt
RP/0/RP0/CPU0:router (config-ipsla-react-cond)#
```

The following example shows how to use the **react** command with the **timeout** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router (config-ipsla-react)# react timeout
RP/0/RP0/CPU0:router (config-ipsla-react-cond)#
```

The following example shows how to use the **react** command with the **verify-error** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router (config-ipsla-react)# react verify-error
RP/0/RP0/CPU0:router (config-ipsla-react-cond)#
```

Related Commands	Command	Description
	action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs when you configure the react command or when threshold events occur.
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.
	threshold, on page 140	Sets the lower-limit and upper-limit values.
	threshold type average, on page 142	Takes action on average values to violate a threshold.
	threshold type consecutive, on page 144	Takes action after a number of consecutive violations.
	threshold type immediate, on page 146	Takes action immediately upon a threshold violation.
	threshold type xofy, on page 148	Takes action upon X violations in Y probe operations.

react lpd

To specify that a reaction should occur if there is an LSP Path Discovery (LPD) violation, use the **react lpd** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

```
react lpd {lpd-group | tree-trace} action logging
no react lpd {lpd-group | tree-trace}
```

Syntax Description

lpd-group	Specifies that a reaction should occur if there is a status violation for the monitored LPD group.
tree-trace	Specifies that a reaction should occur if there is a path discovery violation for the monitored LPD group.
action	Configures the action to be taken on threshold violation.
logging	Specifies the generation of a syslog alarm on threshold violation.

Command Default

None

Command Modes

IP SLA MPLS LSP monitor configuration

Command History

Release	Modification
Release 3.6.0	This command was introduced.

Usage Guidelines

A status violation for a monitored LPD group happens when the Label Switched Path (LSP) group status changes (with the exception of the status change from the initial state).

A path discovery violation for the monitored LPD group happens when path discovery to the target PE fails, or successful path discovery clears such a failure condition.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to specify that a reaction should occur if there is a status violation for the monitored LPD group:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# reaction monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsml-react)# react lpd lpd-group action logging
```


Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

reaction monitor

To configure MPLS label switched path (LSP) monitoring reactions, use the **reaction monitor** command in IP SLA MPLS LSP monitor configuration mode. To remove the reaction so that no reaction occurs, use the **no** form of this command.

```
reaction monitor monitor-id
no reaction monitor [monitor-id]
```

Syntax Description	<i>monitor-id</i> Number of the IP SLA MPLS LSP monitor instance for the reactions to be configured. Range is 1 to 2048.
---------------------------	--

Command Default	No reaction is configured.
------------------------	----------------------------

Command Modes	IP SLA MPLS LSP monitor configuration
----------------------	---------------------------------------

Command History	Release	Modification
	Release 3.5.0	This command was introduced.

Usage Guidelines	The reaction monitor command enters IP SLA LSP monitor reaction configuration mode so that you can set the desired threshold and action in the event of a connection loss or timeout.
-------------------------	--

To remove all reactions, use the **no reaction monitor** command with no *monitor-id* argument.

The **reaction monitor** command configures reactions for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID	Task ID	Operations
	monitor	read, write

Examples	The following example shows how to use the reaction operation command:
-----------------	---

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# reaction monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-react)#
```

Related Commands	Command	Description
	action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs when you configure the react command or when threshold events occur

Command	Description
monitor, on page 49	Configures an IP SLA MPLS LSP monitor instance.
react, on page 68	Specifies an element to be monitored for a reaction.
schedule monitor, on page 90	Schedules an IP SLA MPLS LSP monitor instance.
threshold type consecutive, on page 144	Specifies to take action after a number of consecutive violations.
threshold type immediate, on page 146	Specifies to take action immediately upon a threshold violation.

reaction operation

To configure certain actions that are based on events under the control of the IP SLA agent, use the **reaction operation** command in IP SLA configuration mode. To remove the reaction so that no reaction occurs, use the **no** form of this command.

reaction operation *operation-id*
no reaction operation *operation-id*

Syntax Description	<i>operation-id</i> Number of the IP SLA operation for the reactions to be configured. Range is 1 to 2048.
---------------------------	--

Command Default	No reaction is configured.
------------------------	----------------------------

Command Modes	IP SLA configuration
----------------------	----------------------

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	No specific guidelines impact the use of this command.
-------------------------	--

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **reaction operation** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 1
RP/0/RP0/CPU0:router(config-ipsla-react)#
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

reaction trigger

To define a second IP SLA operation to make the transition from a pending state to an active state when one of the trigger-type options is defined with the **reaction operation** command, use the **reaction trigger** command in IP SLA configuration mode. To remove the reaction trigger when the *triggering-operation* argument does not trigger any other operation, use the **no** form of this command.

reaction trigger *triggering-operation* *triggered-operation*
no reaction trigger *triggering-operation* *triggered-operation*

Syntax Description

triggering-operation Operation that contains a configured action-type trigger and can generate reaction events. Range is 1 to 2048.

triggered-operation Operation that is started when the *triggering-operation* argument generates a trigger reaction event. Range is 1 to 2048.

Command Default

No triggered operation is configured.

Command Modes

IP SLA configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

Both the *triggering-operation* and *triggered-operation* arguments must be configured. The triggered operation must be in the pending state.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **ipsla reaction trigger** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction trigger 1 2
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

responder

To enable the IP SLA responder for UDP echo or jitter operations, use the **responder** command in IP SLA configuration mode. To disable the responder, use the **no** form of this command.

responder
no responder

Syntax Description This command has no keywords or arguments.

Command Default The IP SLA **responder** command is disabled.

Command Modes IP SLA configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines An IP address and port are configured and identified as a permanent port (for example, a port to which the responder is permanently listening). If no IP address and port are configured, the responder handles only dynamic ports (for example, ports that are listened to when requested by a remote operation).

Task ID	Task	Operations
	monitor	read, write

Examples The following example shows how to enable the IP SLA responder:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# responder
RP/0/RP0/CPU0:router(config-ipsla-resp)#
```

Related Commands	Command	Description
	type udp ipv4 address, on page 165	Configures a permanent port in the IP SLA Responder for UDP echo or jitter operations.

recurring

To indicate that the operation starts automatically at the specified time and for the specified duration every day, use the **recurring** command in IP SLA schedule configuration mode. To not start the operation everyday, use the **no** form of this command.

recurring
no recurring

Syntax Description This command has no keywords or arguments.

Command Default Recurring is disabled.

Command Modes IP SLA schedule configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task	Operations ID
	monitor	read, write

Examples The following example shows how to use the **recurring** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# schedule operation 1
RP/0/RP0/CPU0:router(config-ipsla-sched)# recurring
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

reply dscp

To specify the differentiated services codepoint (DSCP) value used in echo reply packets, use the **reply dscp** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

reply dscp *dscp-bits*
no reply dscp

Syntax Description	<p><i>dscp-bits</i> Differentiated services codepoint (DSCP) value for an echo reply packet. Valid values are from 0 to 63.</p> <p>Reserved keywords such as EF (expedited forwarding) and AF11 (assured forwarding class AF11) can be specified instead of numeric values.</p>
---------------------------	---

Command Default	No default behavior or values
------------------------	-------------------------------

Command Modes	<p>IP SLA MPLS LSP ping configuration</p> <p>IP SLA MPLS LSP trace configuration</p> <p>IP SLA MPLS LSP monitor ping configuration</p> <p>IP SLA MPLS LSP monitor trace configuration</p>
----------------------	---

Command History	Release	Modification
	Release 3.4.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines	<p>Use the reply dscp command to set the DCSP value used in the headers of IPv4 UDP packets sent as echo replies in an MPLS LSP ping or MPLS LSP trace operation.</p> <p>The DSCP value consists of the six most significant bits of the 1-byte IP type of service (ToS) field. These bits determine the quality-of-service (QoS) treatment (per-hop behavior) that a transit LSR node gives to an echo reply packet. For information about how packets are classified and processed depending on the value you assign to the 6-bit DSCP field, refer to “The Differentiated Services Model (DiffServ)” at the following URL:</p>
-------------------------	--

http://www.cisco.com/en/US/products/ps6610/products_data_sheet09186a00800a3e30.html

If the **reply dscp** command is used in IP SLA operation mode, it acts on the headers of echo replies for the specific operation being configured. If the **reply dscp** command is used in IP SLA MPLS LSP monitor mode, it acts on the headers of echo replies for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **reply dscp** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-ping)# reply dscp 5
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

reply mode

To specify how to reply to echo requests, use the **reply mode** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

```
reply mode {control-channel | router-alert}
no reply mode
```

Syntax Description

control-channel Sets echo requests to reply by way of a control channel.

Note This option is available only in IP SLA MPLS LSP ping configuration mode.

router-alert Sets echo requests to reply as an IPv4 UDP packet with IP router alert.

Command Default

The default reply mode for an echo request packet is an IPv4 UDP packet without IP router alert set.

Command Modes

IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration
 IP SLA MPLS LSP monitor ping configuration
 IP SLA MPLS LSP monitor trace configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes. The control-channel keyword was added in IP SLA MPLS LSP ping configuration mode.

Usage Guidelines

Use the **reply mode** command with the **control-channel** keyword to send echo reply packets by way of a control channel in an MPLS LSP ping operation. If the target is not set to pseudowire, the configuration of the **control-channel** keyword is rejected. Refer to the **target pseudowire** command for information about setting the target.

Use the **reply mode** command with the **router-alert** keyword to set the reply mode of echo reply packets in an MPLS LSP ping or MPLS LSP trace operation. After you enter this command, echo reply packets are set to reply as an IPv4 UDP packet with the IP router alert option in the UDP packet header.

If the **reply mode** command is used in IP SLA operation mode, it sets the reply mode of echo reply packets for the specific operation being configured. If the **reply mode** command is used in IP SLA MPLS LSP monitor mode, it sets the reply mode of echo reply packets for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

The router-alert reply mode forces an echo reply packet to be specially handled by the transit LSR router at each intermediate hop as it moves back to the destination. Because this reply mode is more expensive, it is recommended only if the headend router does not receive echo replies using the default reply mode.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **reply mode** command with the **router-alert** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# reply mode router-alert
```

The following example shows how to use the **reply mode** command with the **control-channel** keyword:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-ping)# target pseudowire 192.168.1.4 4211
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-ping)# reply mode control-channel
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

samples

To set the number of hop entries that are kept in the history table for an IP SLA ICMP path-echo operation, use the **samples** command in IP SLA operation ICMP path-echo history configuration mode. To use the default value, use the **no** form of this command.

samples *sample-count*

no samples

Syntax Description	<i>sample-count</i> Number of history samples that are kept in the history table for an IP SLA ICMP path-echo operation. Range is 1 to 30.
---------------------------	--

Command Default	The default value is 16.
------------------------	--------------------------

Command Modes	IP SLA operation ICMP path-echo history configuration
----------------------	---

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	The samples command is supported only when you configure an IP SLA ICMP path-echo operation.
-------------------------	---

Task ID	Task	Operations
	monitor	read, write

Examples The following example shows how to use the **samples** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp path-echo
RP/0/RP0/CPU0:router(config-ipsla-icmp-path-echo)# history
RP/0/RP0/CPU0:router(config-ipsla-op-hist)# samples 30
```

Related Commands	Command	Description
	buckets (history), on page 9	Sets the number of history buckets that are kept during the lifetime of the IP SLA operation.
	filter, on page 25	Defines the type of information that are kept in the history table for the IP SLA operation.
	history, on page 31	Configures the history parameters for the IP SLA operation.
	operation, on page 52	Configures an IP SLA operation.

Command	Description
schedule operation, on page 91	Schedules an IP SLA operation.

scan delete-factor

To specify the frequency with which the MPLS LSP monitor (MPLSLM) instance searches for provider edge (PE) routers to delete, use the **scan delete-factor** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

scan delete-factor *factor-value*

no scan delete-factor

Syntax Description	<i>factor-value</i> Specifies a factor that is multiplied by the scan interval to determine the frequency at which the MPLS LSP monitor instance deletes the provider edge (PE) routers that are no longer valid. Range is 0 to 2147483647.
---------------------------	---

Command Default	<i>factor-value</i> : 1
------------------------	-------------------------

Command Modes	IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration
----------------------	---

Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.5.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.5.0	This command was introduced.
Release	Modification				
Release 3.5.0	This command was introduced.				

Usage Guidelines	The scan delete-factor command specifies a factor value for automatic PE deletion. The specified <i>factor-value</i> is multiplied by the scan interval to acquire the frequency at which the MPLS LSP monitoring instance deletes not-found PEs. A scan delete factor of zero (0) means that provider edge (PE) routers that are no longer valid are never removed.
-------------------------	---

Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				

Examples	The following example shows how to use the scan delete-factor command:
-----------------	---

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplslm)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplslm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplslm-lsp-ping)# scan delete-factor 214
```

Related Commands	<table border="1"> <thead> <tr> <th>Command</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>monitor, on page 49</td> <td>Configures an IP SLA MPLS LSP monitor instance.</td> </tr> </tbody> </table>	Command	Description	monitor , on page 49	Configures an IP SLA MPLS LSP monitor instance.
Command	Description				
monitor , on page 49	Configures an IP SLA MPLS LSP monitor instance.				

Command	Description
scan interval, on page 88	Specifies the frequency at which the MPLSLM instance checks the scan queue for updates
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

scan interval

To specify the frequency at which the MPLS LSP monitor (MPLSLM) instance checks the scan queue for updates, use the **scan interval** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

scan interval *scan-interval*

no scan interval

Syntax Description	<i>scan-interval</i> Time interval between provider edge (PE) router updates. Range is 1 to 70560.
---------------------------	--

Command Default	<i>interval</i> : 240 minutes
------------------------	-------------------------------

Command Modes	IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration
----------------------	---

Command History	Release Modification
	Release 3.5.0 This command was introduced.

Usage Guidelines	Use the scan interval command to specify a frequency value in minutes at which the MPLS LSP monitoring instance checks the scan queue for PE updates. Updates from PE discovery are not processed immediately, but rather stored in a scan queue for batched processing at periodic intervals, specified by this value.
-------------------------	--

Task ID	Task ID Operations
	monitor read, write

Examples

The following example shows how to use the **scan** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplslm)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplslm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplslm-lsp-ping)# scan interval 120
```

Related Commands

Command	Description
operation , on page 52	Configures an IP SLA operation.
scan delete-factor , on page 86	Specifies the frequency with which the MPLSLM instance searches for PE routers to delete.

Command	Description
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

schedule monitor

To schedule MPLS LSP monitoring instances, use the **schedule monitor** command in IP SLA LSP monitor configuration mode. To unschedule the monitoring instances, use the **no** form of this command.

schedule monitor *monitor-id*
no schedule monitor [*monitor-id*]

Syntax Description

monitor-id Number of the monitoring instance to schedule. Range is 1 to 2048.

Command Default

No schedule is configured.

Command Modes

IP SLA MPLS LSP monitor configuration

Command History

Release	Modification
Release 3.5.0	This command was introduced.

Usage Guidelines

The **schedule monitor** command enters IP SLA MPLS LSP monitor schedule configuration mode so that you can set the desired schedule parameters for the MPLS LSP monitor instance. This schedules the running of all operations created for the specified monitor instance.

To remove all configured schedulers, use the **no schedule monitor** command with no *monitor-id* argument.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to access and use the **schedule monitor** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# schedule monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-sched)#
```

Related Commands

Command	Description
frequency (IP SLA), on page 29	Configures the frequency interval during which LSP groups and operations are scheduled to start.
schedule period, on page 93	Configures the amount of time during which all LSP operations are scheduled to start or run.
start-time , on page 128	Determines the time when an operation starts.

schedule operation

To enter schedule configuration mode, use the **schedule operation** command in IP SLA configuration mode. To remove the scheduler, use the **no** form of this command.

schedule operation *operation-number*
no schedule operation *operation-number*

Syntax Description	operation-number Configuration number or schedule number that is used to schedule an IP SLA operation. Range is 1 to 2048.
---------------------------	--

Command Default	None
------------------------	------

Command Modes	IP SLA configuration
----------------------	----------------------

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	The schedule operation command enters the IP SLA schedule configuration mode. You can configure more schedule configuration parameters to schedule the operation. When an operation is scheduled, it continues collecting information until the configured life expires.
-------------------------	---

Task ID	Task ID	Operations
	monitor	read, write

Examples	The following example shows how to use the ipsla schedule operation command:
-----------------	---

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# schedule operation 1
RP/0/RP0/CPU0:router(config-ipsla-sched)#
```

Related Commands	Command	Description
	ageout, on page 8	Specifies the number of seconds to keep the operation in memory when it is not actively collecting information.
	operation, on page 52	Configures an IP SLA operation.
	life, on page 38	Specifies the length of time to execute.
	recurring, on page 79	Indicates that the operation starts automatically at the specified time and for the specified duration every day.

Command	Description
start-time , on page 128	Determines the time when the operation starts.

schedule period

To configure the amount of time during which all LSP operations are scheduled to start or run, use the **schedule period** command in IP SLA MPLS LSP monitor schedule configuration mode. To remove the scheduler, use the **no** form of this command.

schedule period *seconds*
no schedule period

Syntax Description	<i>seconds</i> Amount of time in seconds for which label switched path (LSP) operations are scheduled to run. Range is 1 to 604800.				
Command Default	None				
Command Modes	IP SLA MPLS LSP monitor schedule configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.5.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.5.0	This command was introduced.
Release	Modification				
Release 3.5.0	This command was introduced.				
Usage Guidelines	<p>Use the schedule period command to specify the amount of time in seconds during which all LSP operations are scheduled to start running. All LSP operations are scheduled equally spaced throughout the schedule period.</p> <p>For example, if the schedule period is 600 seconds and there are 60 operations to be scheduled, they are scheduled at 10-second intervals.</p> <p>Use the frequency command to specify how often the entire set of operations is performed. The frequency value must be greater than or equal to the schedule period.</p> <p>You must configure the schedule period before you can start MPLS LSP monitoring. Start MPLS LSP monitoring using the start-time command.</p>				
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				

Examples

The following example shows how to use the **schedule period** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# schedule monitor 20
RP/0/RP0/CPU0:router(config-ipsla-mplsml-sched)# schedule period 6000
```

Related Commands

Command	Description
frequency (IP SLA), on page 29	Configures the frequency interval during which LSP groups and operations are scheduled to start.
start-time , on page 128	Determines the time when the operation starts.

show ipsla application

To display the information for the IP SLA application, use the **show ipsla application** command in EXEC mode.

show ipsla application

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes EXEC mode

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	monitor	read

Examples

The following sample output is from the **show ipsla application** command:

```
RP/0/RP0/CPU0:router# show ipsla application
```

```
Estimated system max number of entries: 2048
Number of Entries configured: 1
Number of active Entries      : 0
Number of pending Entries     : 0
Number of inactive Entries    : 1
```

```
Supported Operation Types: 7
```

```
    Type of Operation: ICMP ECHO
    Type of Operation: ICMP PATH JITTER
    Type of Operation: ICMP PATH ECHO
    Type of Operation: UDP JITTER
    Type of Operation: UDP ECHO
    Type of Operation: MPLS LSP PING
    Type of Operation: MPLS LSP TRACE
```

```
Number of configurable probes : 2047
SA Agent low memory water mark: 20480 (KB)
```

This table describes the significant fields shown in the display.

Table 2: show ipsla application Field Descriptions

Field	Description
Estimated system max number of entries	Maximum number of operations that are configured in the system. The low-memory configured parameter and the available memory in the system are given.
Number of Entries configured	Total number of entries that are configured, such as active state, pending state, and inactive state.
Number of active Entries	Number of entries that are in the active state. The active entries are scheduled and have already started a life period.
Number of pending Entries	Number of entries that are in pending state. The pending entries have a start-time scheduled in the future. These entries either have not started the first life, or the entries are configured as recurring and completed one of its life.
Number of inactive Entries	Number of entries that are in the inactive state. The inactive entries do not have a start-time scheduled. Either the start-time has never been scheduled or life has expired. In addition, the entries are not configured as recurring.
Supported Operation Types	Types of operations that are supported by the system.
Number of configurable probes	Number of remaining entries that can be configured. The number is just an estimated value and it may vary over time according to the available resources.
SA Agent low memory water mark	Available memory for the minimum system below which the IP SLA feature does not configure any more operations.

Related Commands

Command	Description
low-memory, on page 41	Configures a low-water memory mark.
operation, on page 52	Configures an IP SLA operation.

show ipsla history

To display the history collected for all IP SLA operations or for a specified operation, use the **show ipsla history** command in EXEC mode.

```
show ipsla history [operation-number]
```

Syntax Description	<i>operation-number</i> (Optional) Number of the IP SLA operation.
---------------------------	--

Command Default	None
------------------------	------

Command Modes	EXEC mode
----------------------	-----------

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines By default, history statistics are not collected. To have any data displayed by using the **show ipsla history** command, you must configure the history collection.

This table lists the response return values that are used in the **show ipsla history** command.

Table 3: Response Return Values for the show ipsla history Command

Code	Description
1	Okay
2	Disconnected
3	Over Threshold
4	Timeout
5	Busy
6	Not Connected
7	Dropped
8	Sequence Error
9	Verify Error
10	Application Specific

If the default tabular format is used, the response return description is displayed as code in the Sense column. The Sense field is always used as a return code.

show ipsla history

Task ID	Task ID	Operations
	monitor	read

Examples

The following sample output is from the **show ipsla history** command:

```
RP/0/RP0/CPU0:router# show ipsla history 1

Point by point History
Multiple Lines per Entry
Line 1:
Entry      = Entry number
LifeI      = Life index
BucketI    = Bucket index
SampleI    = Sample index
SampleT    = Sample start time
CompT     = RTT (milliseconds)
Sense     = Response return code
Line 2 has the Target Address
Entry LifeI      BucketI    SampleI    SampleT      CompT      Sense      TargetAddr
1      0              0          0          1134419252539  9          1          192.0.2.6
1      0              1          0          1134419312509  6          1          192.0.2.6
1      0              2          0          1134419372510  6          1          192.0.2.6
1      0              3          0          1134419432510  5          1          192.0.2.6
```

This table describes the significant fields shown in the display.

Table 4: show ipsla history Field Descriptions

Field	Description
Entry number	Entry number.
LifeI	Life index.
BucketI	Bucket index.
SampleI	Sample index.
SampleT	Sample start time.
CompT	Completion time in milliseconds.
Sense	Response return code.
TargetAddr	IP address of intermediate hop device or destination device.

Related Commands

Command	Description
show ipsla statistics aggregated, on page 113	Displays the statistical errors for all the IP SLA operations or for a specified operation.

show ipsla mpls discovery vpn

To display routing information relating to the BGP next-hop discovery database in the MPLS VPN network, use the **show ipsla mpls discovery vpn** command in EXEC mode.

show ipsla mpls discovery vpn

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes EXEC mode

Command History

Release	Modification
Release 3.5.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
monitor	read

Examples

The following sample output is from the **show ipsla mpls discovery vpn** command:

```
RP/0/RP0/CPU0:router# show ipsla mpls discovery vpn

Next refresh after: 46 seconds

BGP next hop      Prefix                VRF                PfxCount
192.255.0.4       192.255.0.4/32       red                 10
                  blue                  5
                  green                 7
192.255.0.5       192.255.0.5/32       red                 5
                  green                 3
192.254.1.6       192.254.1.0/24      yellow              4
```

This table describes the significant fields shown in the display.

Table 5: show ipsla mpls discovery vpn Field Descriptions

Field	Description
BGP next hop	Identifier for the BGP next-hop neighbor.
Prefix	IPv4 Forward Equivalence Class (FEC) of the BGP next-hop neighbor to be used by the MPLS LSP ping or trace operation.

Field	Description
VRF	Names of the virtual routing and forwarding instances (VRFs) that contain routing entries for the specified BGP next-hop neighbor.
PfxCount	Count of the routing entries that participate in the VRF for the specified BGP next-hop neighbor.

show ipsla mpls lsp-monitor lpd

To display LSP Path Discovery (LPD) operational status, use the **show ipsla mpls lsp-monitor lpd** command in EXEC mode.

show ipsla mpls lsp-monitor lpd {**statistics** [*group-ID* | **aggregated** *group-ID*]} | **summary** *group*}

statistics <i>group-ID</i>	Displays statistics for the specified LPD group, including the latest LPD start time, return code, completion time, and paths.
aggregated <i>group-ID</i>	Displays the aggregated statistics of the LPD group.
summary <i>group-ID</i>	Displays the current LPD operational status, which includes LPD start time, return code, completion time, and all ECMP path information.

Command Default None

Command Modes EXEC mode

Command History	Release	Modification
	Release 3.6.0	This command was introduced.

Usage Guidelines For the aggregated group ID, a maximum of two buckets are allowed.

Task ID	Task ID	Operations
	monitor	read

Examples

The following sample output is from the **show ipsla mpls lsp-monitor lpd statistics** command:

```
RP/0/RP0/CPU0:router# show ipsla mpls lsp-monitor lpd statistics 10001

Group ID: 100001
Latest path discovery start time      : 00:41:01.129 UTC Sat Dec 10 2005
Latest path discovery return code     : OK
Latest path discovery completion time (ms): 3450
Completion Time Values:
  NumOfCompT: 1      CompTMin: 3450      CompTMax : 3450      CompTAvg: 3450
Number of Paths Values:
  NumOfPaths: 10    MinNumOfPaths: 10    MaxNumOfPaths: 10
```

This table describes the significant fields shown in the display.

Table 6: show ipsla mpls lsp-monitor lpd statistics Field Descriptions

Field	Description
Group ID	LPD group ID number.
Latest path discovery start time	LPD start time.
Latest path discovery return code	LPD return code.
Latest path discovery completion time	LPD completion time.
Completion Time Values	Completion time values, consisting of Number of Completion Time samples and Minimum Completion Time.
Number of Paths Values	Number of paths values, consisting of Minimum number of paths and Maximum number of paths.

show ipsla mpls lsp-monitor scan-queue

To display information about BGP next-hop addresses that are waiting to be added to or deleted from the MPLS label switched path (LSP) monitor instance, use the **show ipsla mpls lsp-monitor scan-queue** command in EXEC mode.

```
show ipsla mpls lsp-monitor scan-queue [monitor-id]
```

Syntax Description	<i>monitor-id</i> (Optional) Number of the IP SLA MPLS LSP monitor instance.				
Command Default	None				
Command Modes	EXEC mode				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.5.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.5.0	This command was introduced.
Release	Modification				
Release 3.5.0	This command was introduced.				
Usage Guidelines	If the <i>monitor-id</i> argument is not specified, the scan-queue is displayed for all MPLS LSP monitor instances.				
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read
Task ID	Operations				
monitor	read				

Examples

The following sample output is from the **show ipsla mpls lsp-monitor scan-queue** command:

```
RP/0/RP0/CPU0:router# show ipsla mpls lsp-monitor scan-queue 1

IPSLA MPLS LSP Monitor : 1

  Next scan Time after      : 23 seconds
  Next Delete scan Time after: 83 seconds

BGP Next hop   Prefix           Add/Delete?
192.255.0.2    192.255.0.2/32    Add
192.255.0.3    192.255.0.5/32    Delete
```

This table describes the significant fields shown in the display.

Table 7: show ipsla responder statistics port Field Descriptions

Field	Description
IPSLA MPLS LSP Monitor	Monitor identifier.
Next scan Time after	Amount of time before the MPLS LSP monitor instance checks the scan queue for adding BGP next-hop neighbors. At the start of each scan time, IP SLA operations are created for all newly discovered neighbors.

Field	Description
Next delete Time after	Amount of time left before the MPLS LSP monitor instance checks the scan queue for deleting BGP next-hop neighbors. At the start of each delete scan time, IP SLAs operations are deleted for neighbors that are no longer valid.
BGP next hop	Identifier for the BGP next-hop neighbor.
Prefix	IPv4 Forward Equivalence Class (FEC) of the BGP next-hop neighbor to be used.
Add/Delete	Indicates that the specified BGP next-hop neighbor will be added or removed.

show ipsla mpls lsp-monitor summary

To display the list of operations that have been created automatically by the specified MPLS LSP monitor (MPLSLM) instance, use the **show ipsla mpls lsp-monitor summary** command in EXEC mode.

```
show ipsla mpls lsp-monitor summary [monitor-id [group [group id]]]
```

Syntax Description	monitor-id	(Optional) Displays a list of LSP group, ping, and trace operations created automatically by the specified MPLSLM instance.
	group group-id	(Optional) Displays the ECMP LSPs found through ECMP path discovery within the specified LSP group.

Command Default None

Command Modes EXEC mode

Command History	Release	Modification
	Release 3.5.0	This command was introduced.
	Release 3.7.0	Show output response was expanded to add a pending status when waiting for an LSP ping or trace response.

Usage Guidelines The **show ipsla mpls lsp-monitor summary** command shows the list of LSP operations that were created automatically by the specified MPLS LSP monitor instance. It also shows the current status and the latest operation time of each operation.

If the *monitor-id* argument is not specified, the list of operations is displayed for all MPLS LSP monitor instances.

The **show ipsla mpls lsp-monitor summary** command with the **group** option shows the list of ECMP paths that are found automatically by the specified LSP path discovery (LPD). In addition, this command with option shows the current status; the number of successes, failures; the most recent round trip time (RTT); and the latest operation time of each path.

If the *group-id* argument is not specified, the list of paths is displayed for all operations created by the MPLS LSP monitor instance.

Task ID	Task ID	Operations
	monitor	read

Examples

The following sample output is from the **show ipsla mpls lsp-monitor summary** command. This output shows a pending status when an MPLS LSP ping operation is waiting to receive the timeout response from the LSP Verification (LSPV) process.

```
RP/0/RP0/CPU0:router# show ipsla mpls lsp-monitor summary 1
```

show ipsla mpls lsp-monitor summary

```

MonID Op/GrpID TargetAddress      Status  Latest Operation Time
1      100001  192.255.0.4/32      up      19:33:37.915 EST Mon Feb 28 2005
1      100002  192.255.0.5/32      down    19:33:47.915 EST Mon Feb 28 2005
1      100003  192.255.0.6/32      pending 19:33:35.915 EST Mon Feb 28 2005

```

The following sample output shows that a down status is displayed after a timeout response is received.

```
RP/0/RP0/CPU0:router# show ipsla mpls lsp-monitor summary 1
```

```

MonID Op/GrpID TargetAddress      Status  Latest Operation Time
1      100001  193.100.0.1/32     down    12:47:16.417 PST Tue Oct 23 2007
1      100002  193.100.0.2/32     partial 12:47:22.418 PST Tue Oct 23 2007
1      100003  193.100.0.3/32     partial 12:47:22.429 PST Tue Oct 23 2007
1      100004  193.100.0.4/32     down    12:47:16.429 PST Tue Oct 23 2007
1      100005  193.100.0.5/32     down    12:47:21.428 PST Tue Oct 23 2007

```

This table describes the significant fields shown in the display.

Table 8: show ipsla mpls lsp-monitor summary Field Descriptions

Field	Description
MonID	Monitor identifier.
Op/GrpID	Operation identifiers that have been created by this MPLS LSP monitor instance.
TargetAddress	IPv4 Forward Equivalence Class (FEC) to be used by this operation.
Status	Status of the paths. Values can be as follows: <ul style="list-style-type: none"> • up—Indicates that the latest operation cycle was successful. • down—Indicates that the latest operation cycle was not successful. • pending—Indicates that the latest operation cycle is waiting for an LSP ping or trace response.
Latest Operation Time	Time the latest operation cycle was issued.

The following sample output is from the **show ipsla mpls lsp-monitor summary group** command:

```
RP/0/RP0/CPU0:router# show ipsla mpls lsp-monitor summary 1 group 100001
```

```

GrpID  LSP-Selector  Status  Failure  Success  RTT  Latest Operation Time
100001 127.0.0.13    up      0        78       32   20:11:37.895 EST Feb 28 2005
100001 127.0.0.15    retry   1        77       0    20:11:37.995 EST Feb 28 2005
100001 127.0.0.16    up      0        78       32   20:11:38.067 EST Feb 28 2005
100001 127.0.0.26    up      0        78       32   20:11:38.175 EST Feb 28 2005

```

This table describes the significant fields shown in the display.

Table 9: show ipsla mpls lsp-monitor summary group Field Descriptions

Field	Description
GrpID	Group identifier that has been created by this MPLS LSP monitor instance.
LSP-Selector	LSP selector address.

Field	Description
Status	Status of the paths. Values can be as follows: <ul style="list-style-type: none">• up—Indicates that all the paths were successful.• down—Indicates that all the paths were not successful.• partial—Indicates that only some paths were successful.• unknown—Indicates that some (or all) of the paths did not complete a single LSP echo request so the group status could not be identified.
Failure	Number of failures.
Success	Number of successes.
RTT	Round Trip Time (RTT) in milliseconds of the latest LSP echo request for the path.
Latest Operation Time	Time the latest operation cycle was issued for the path.

show ipsla responder statistics

To display the number of probes that are received or handled by the currently active ports on the responder, use the **show ipsla responder statistics ports** command in EXEC mode.

show ipsla responder statistics {all | permanent} ports

Syntax Description	all	Port statistics is displayed for all ports.
	permanent	Port statistics is displayed only for permanent ports.

Command Default None

Command Modes EXEC mode

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines The output of the **show ipsla responder statistics port** command is available only for specific intervals of time in which only nonpermanent ports are being used at the responder. The reason is that the responder closes the nonpermanent ports after each operation cycle. However, if both permanent and nonpermanent ports are used, the output always contains rows for the permanent ports. The rows for the nonpermanent ports are displayed only if those nonpermanent ports are enabled at the instant the command is issued.

Task ID	Task ID	Operations
	monitor	read

Examples The following sample output is from the **show ipsla responder statistics port** command:

```
RP/0/RP0/CPU0:router# show ipsla responder statistics all port

Port Statistics
-----

Local Address  Port  Port Type  Probes  Drops  CtrlProbes  Discard
172.16.5.1    3001  Permanent  0        0        0
172.16.5.1    10001 Permanent  728160   0        24272
172.16.5.5    8201  Dynamic    12132    0        12135       ON
172.16.5.1    4441  Dynamic    207216   0        3641        ON
```

This table describes the significant fields shown in the display.

Table 10: show ipsla responder statistics port Field Descriptions

Field	Description
Local Address	Local IP address of the responder device used to respond to IPSLA probes.
Port	UDP socket local to the responder device used to respond to IPSLA probes.
Port Type	It could be "permanent" or "dynamic"; depends upon whether a permanent port configuration is done.
Probes	Number of probe packets the responder has received.
Drops	Number of probes dropped.
CtrlProbes	Number of control packets the responder has received.
Discard	If the state is ON, the responder will not respond to probes.

show ipsla statistics

To display the operational data and the latest statistics for the IP SLA operation in tabular format, use the **show ipsla statistics** command in EXEC mode.

show ipsla statistics [*operation-number*]

Syntax Description	<i>operation-number</i> (Optional) Operation for which the latest statistics are to be displayed. Range is 1 to 2048.
---------------------------	---

Command Default	None
------------------------	------

Command Modes	EXEC mode
----------------------	-----------

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.6.0	Show output was expanded to include path information for LSP groups.

Usage Guidelines	No specific guidelines impact the use of this command.
-------------------------	--

Task ID	Task ID	Operations
	monitor	read

Examples

The output of the **show ipsla statistics** command varies depending on the operation type.

The following sample output is from the **show ipsla statistics** command for an ICMP echo operation:

```
RP/0/RP0/CPU0:router# show ipsla statistics 100025

Entry number: 100025
  Modification time: 00:36:58.602 UTC Sat Dec 10 2007
  Start time       : 00:36:58.605 UTC Sat Dec 10 2007
  Number of operations attempted: 5
  Number of operations skipped  : 0
  Current seconds left in Life  : Forever
  Operational state of entry    : Active
  Connection loss occurred     : FALSE
  Timeout occurred             : FALSE
  Latest RTT (milliseconds)    : 3
  Latest operation start time   : 00:41:01.129 UTC Sat Dec 10 2007
  Latest operation return code  : OK
  RTT Values:
    RTTAvg  : 71          RTTMin: 71          RTTMax : 71
    NumOfRTT: 1          RTTSum: 71         RTTSum2: 729
  Path Information:
    Path Path LSP          Outgoing   Nexthop    Downstream
    Idx  Sense Selector      Interface  Address    Label Stack
    1    1    127.0.0.13         PO0/2/5/0  192.12.1.2  38
```

2	1	127.0.0.6	PO0/2/5/0	192.12.1.2	38
3	1	127.0.0.1	PO0/2/5/0	192.12.1.2	38
4	1	127.0.0.2	PO0/2/5/0	192.12.1.2	38
5	1	127.0.0.13	PO0/2/5/1	192.12.2.2	38
6	1	127.0.0.6	PO0/2/5/1	192.12.2.2	38
7	1	127.0.0.1	PO0/2/5/1	192.12.2.2	38
8	1	127.0.0.2	PO0/2/5/1	192.12.2.2	38
9	1	127.0.0.4	Gi0/2/0/0	192.15.1.2	38
10	1	127.0.0.5	Gi0/2/0/0	192.15.1.2	38

This table describes the significant fields shown in the display.

Table 11: show ipsla statistics Field Descriptions

Field	Description
Entry number	Entry number.
Modification time	Latest time the operation was modified.
Start time	Time the operation was started.
Number of operations attempted	Number of operation cycles that were issued.
Number of operations skipped	Number of operation cycles that were not issued because one of the cycles extended over the configured time interval.
Current seconds left in Life	Time remaining until the operation stops execution.
Operational state of entry	State of the operation, such as active state, pending state, or inactive state.
Connection loss occurred	Whether or not a connection-loss error happened.
Timeout occurred	Whether or not a timeout error happened.
Latest RTT (milliseconds)	Value of the latest RTT sample.
Latest operation start time	Time the latest operation cycle was issued.
Latest operation return code	Return code of the latest operation cycle
RTTAvg	Average RTT value that is observed in the last cycle.
RTTMin	Minimum RTT value that is observed in the last cycle.
RTTMax	Maximum RTT value that is observed in the last cycle.
NumOfRTT	Number of successful round trips.
RTTSum	Sum of all successful round-trip values in milliseconds.
RTTSum2	Sum of squares of the round-trip values in milliseconds.
Path Idx	Path index number.
Path Sense	Response return code for the path. (See Table 3: Response Return Values for the show ipsla history Command , on page 97, in <code>show ipsla history</code> command.)

show ipsla statistics

Field	Description
LSP Selector	LSP selector address of the path.
Outgoing Interface	Outgoing interface of the path.
Nexthop Address	Next hop address of the path.
Downstream Label Stack	MPLS label stacks of the path.

Related Commands

Command	Description
show ipsla statistics aggregated, on page 113	Displays the statistical errors for all the IP SLA operations or for a specified operation.

show ipsla statistics aggregated

To display the hourly statistics for all the IP SLA operations or specified operation, use the **show ipsla statistics aggregated** command in EXEC mode.

```
show ipsla statistics aggregated [detail] [operation-number]
```

Syntax Description	detail Displays detailed information.						
	<i>operation-number</i> (Optional) Number of IP SLA operations. Range is 1 to 2048.						
Command Default	None						
Command Modes	EXEC mode						
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.3.0</td> <td>This command was introduced.</td> </tr> <tr> <td>Release 3.6.0</td> <td>Show output was expanded to include detailed information when path discovery is enabled.</td> </tr> </tbody> </table>	Release	Modification	Release 3.3.0	This command was introduced.	Release 3.6.0	Show output was expanded to include detailed information when path discovery is enabled.
Release	Modification						
Release 3.3.0	This command was introduced.						
Release 3.6.0	Show output was expanded to include detailed information when path discovery is enabled.						
Usage Guidelines	<p>The show ipsla statistics aggregated command displays information such as the number of failed operations and the reason for failure. Unless you configured a different amount of time for the buckets command (statistics command with hourly keyword), the show ipsla statistics aggregated command displays the information collected over the past two hours.</p> <p>For one-way delay and jitter operations to be computed for UDP jitter operations, the clocks on local and target devices must be synchronized using NTP or GPS systems. If the clocks are not synchronized, one-way measurements are discarded. If the sum of the source to destination (SD) and the destination to source (DS) values is not within 10 percent of the round-trip time, the one-way measurement values are assumed to be faulty, and are discarded.</p>						
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read		
Task ID	Operations						
monitor	read						

Examples

The output of the **show ipsla statistics aggregated** command varies depending on operation type. The following sample output shows the aggregated statistics for UDP echo operation from the **show ipsla statistics aggregated** command:

```
RP/0/RP0/CPU0:router# show ipsla statistics aggregated 1

Entry number: 1
Hour Index: 0
  Start Time Index: 21:02:32.510 UTC Mon Dec 12 2005
  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
```

show ipsla statistics aggregated

```

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
RTT Values:
  RTTAvg : 6           RTTMin: 4           RTTMax : 38
  NumOfRTT: 36        RTTSum: 229          RTTSum2: 2563

```

The following sample output is from the **show ipsla statistics aggregated** command in which operation 10 is a UDP jitter operation:

```
RP/0/RP0/CPU0:router# show ipsla statistics aggregated 10
```

```

Entry number: 10
Hour Index: 0
Start Time Index: 00:35:07.895 UTC Thu Mar 16 2006
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
RTT Values:
  RTTAvg : 14           RTTMin: 2           RTTMax : 99
  NumOfRTT: 70         RTTSum: 1034        RTTSum2: 60610
Packet Loss Values:
  PacketLossSD : 0           PacketLossDS: 0
  PacketOutOfSequence: 0     PacketMIA : 0
  PacketLateArrival : 0
  Errors : 0           Busies : 0
Jitter Values :
  MinOfPositivesSD: 1           MaxOfPositivesSD: 19
  NumOfPositivesSD: 17         SumOfPositivesSD: 65
  Sum2PositivesSD : 629
  MinOfNegativesSD: 1           MaxOfNegativesSD: 16
  NumOfNegativesSD: 24         SumOfNegativesSD: 106
  Sum2NegativesSD : 914
  MinOfPositivesDS: 1           MaxOfPositivesDS: 7
  NumOfPositivesDS: 17         SumOfPositivesDS: 44
  Sum2PositivesDS : 174
  MinOfNegativesDS: 1           MaxOfNegativesDS: 8
  NumOfNegativesDS: 24         SumOfNegativesDS: 63
  Sum2NegativesDS : 267
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

```

This table describes the significant fields shown in the display.

Table 12: show ipsla statistics aggregated Field Descriptions

Field	Description
Busies	Number of times that the operation cannot be started because the previously scheduled run was not finished.
Entry Number	Entry number.

Field	Description
Hop in Path Index	Hop in path index.
Errors	Number of internal errors.
Jitter Values	Jitter statistics appear on the specified lines. Jitter is defined as interpacket delay variance.
NumOfJitterSamples	Number of jitter samples that are collected. The number of samples are used to calculate the jitter statistics.
Number of Failed Operations due to a Disconnect	Number of failed operations due to a disconnect.
Number of Failed Operations due to a Timeout	Number of failed operations due to a timeout.
Number of Failed Operations due to a Busy	Number of failed operations due to a busy error.
Number of Failed Operations due to a No Connection	Error that refers to the case in which the control connection cannot be established.
Number of Failed Operations due to an Internal Error	Number of failed operations due to an internal error.
Number of Failed Operations due to a Sequence Error	Number of failed operations due to a sequence error.
Number of Failed Operations due to a Verify Error	Number of failed operations due to a verify error.
MaxOfNegativesSD	Maximum negative jitter values from the source to the destination. The absolute value is given.
MaxOfPositivesSD	Maximum jitter values from the source to the destination in milliseconds.
MaxOfPositivesDS	Maximum jitter values from the destination to the source in milliseconds.
MaxOfNegativesDS	Maximum negative jitter values from destination-to-source. The absolute value is given.
MinOfPositivesDS	Minimum jitter values from the destination to the source in milliseconds.
MinOfNegativesSD	Minimum negative jitter values from the source to the destination. The absolute value is given.
MinOfPositivesSD	Minimum jitter values from the source to the destination in milliseconds.

Field	Description
MinOfNegativesDS	Minimum negative jitter values from the destination to the source. The absolute value is given.
NumOfOW	Number of successful one-way time measurements.
NumOfNegativesDS	Number of jitter values from the destination to the source that are negative; for example, network latency decreases for two consecutive test packets.
NumOfNegativesSD	Number of jitter values from the source to the destination that are negative; for example, network latency decreases for two consecutive test packets.
NumOfPositivesDS	Number of jitter values from the destination to the source that are positive; for example, network latency increases for two consecutive test packets.
NumOfPositivesSD	Number of jitter values from the source to the destination that are positive; for example, network latency increases for two consecutive test packets.
NumOfRTT	Number of successful round trips.
One Way Values	One-way measurement statistics appear on the specified lines. One Way (OW) values are the amount of time that it took the packet to travel from the source router to the target router or from the target router to the source router.
OWMaxDS	Maximum time from the destination to the source.
OWMaxSD	Maximum time from the source to the destination.
OWMinDS	Minimum time from the destination to the source.
OWMinSD	Minimum time from the source to the destination.
OWSumDS	Sum of one-way delay values from the destination to the source.
OWSumSD	Sum of one-way delay values from the source to the destination.
OWSum2DS	Sum of squares of one-way delay values from the destination to the source.
OWSum2SD	Sum of squares of one-way delay values from the source to the destination.
PacketLateArrival	Number of packets that arrived after the timeout.
PacketLossDS	Number of packets lost from the destination to the source (DS).
PacketLossSD	Number of packets lost from the source to the destination (SD).

Field	Description
PacketMIA	Number of packets lost in which the SD direction or DS direction cannot be determined.
PacketOutOfSequence	Number of packets that are returned out of order.
Path Index	Path index.
Port Number	Target port number.
RTTSum	Sum of all successful round-trip values in milliseconds.
RTTSum2	Sum of squares of the round-trip values in milliseconds.
RTT Values	Round-trip time statistics appear on the specified lines.
Start Time	Start time, in milliseconds.
Start Time Index	Statistics that are aggregated for over 1-hour intervals. The value indicates the start time for the 1-hour interval that is displayed.
SumOfPositivesDS	Sum of the positive jitter values from the destination to the source.
SumOfPositivesSD	Sum of the positive jitter values from the source to the destination.
SumOfNegativesDS	Sum of the negative jitter values from the destination to the source.
SumOfNegativesSD	Sum of the negative jitter values from the source to the destination.
Sum2PositivesDS	Sum of squares of the positive jitter values from the destination to the source.
Sum2PositivesSD	Sum of squares of the positive jitter values from the source to the destination.
Sum2NegativesDS	Sum of squares of the negative jitter values from the destination to the source.
Sum2NegativesSD	Sum of squares of the negative jitter values from the source to the destination.
Target Address	Target IP address.

The output of the **show ipsla statistics aggregated detail** command varies depending on operation type. The following sample output is from the **show ipsla statistics aggregated detail** command in tabular format, when the output is split over multiple lines:

```
RP/0/RP0/CPU0:router# show ipsla statistics aggregated detail 2
```

```
Captured Statistics
      Multiple Lines per Entry
Line1:
Entry   = Entry number
StartT  = Start time of entry (hundredths of seconds)
Pth     = Path index
```

show ipsla statistics aggregated

```

Hop      = Hop in path index
Dst      = Time distribution index
Comps    = Operations completed
SumCmp   = Sum of RTT (milliseconds)

Line2:
SumCmp2H = Sum of RTT squared high 32 bits (milliseconds)
SumCmp2L = Sum of RTT squared low 32 bits (milliseconds)
TMax     = RTT maximum (milliseconds)
TMin     = RTT minimum (milliseconds)

Entry StartT          Pth Hop Dst Comps      SumCmp
      SumCmp2H      SumCmp2L  TMax  TMin
2      1134423910701 1  1  0  12      367
      0              1231      6      6
2      1134423851116 1  1  1  2      129
      0              2419      41     41
2      1134423070733 1  1  2  1      101
      0              1119      16     16
2      0              1  1  3  0      0
      0              0          0      0

```

This table describes the significant fields shown in the display.

Table 13: show ipsla statistics aggregated detail Field Descriptions

Field	Description
Entry	Entry number.
StartT	Start time of entry, in hundredths of seconds.
Pth	Path index.
Hop	Hop in path index.
Dst	Time distribution index.
Comps	Operations completed.
SumCmp	Sum of completion times, in milliseconds.
SumCmp2L	Sum of completion times squared low 32 bits, in milliseconds.
SumCmp2H	Sum of completion times squared high 32 bits, in milliseconds.
TMax	Completion time maximum, in milliseconds.
TMin	Completion time minimum, in milliseconds.

The following sample output is from the **show ipsla statistics aggregated** command when a path discovery operation is enabled. Data following the hourly index is aggregated for all paths in the group during the given hourly interval.

```

RP/0/RP0/CPU0:router# show ipsla statistics aggregated 100041

Entry number: 100041

Hour Index: 13

```

<The following data after the given hourly index is aggregated for all paths in the group during the given hourly interval.>

```

Start Time Index: 12:20:57.323 UTC Tue Nov 27 2007
Number of Failed Operations due to a Disconnect      : 0
Number of Failed Operations due to a Timeout        : 249
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

```

<end>

```

RTT Values:
RTTAvg   : 21           RTTMin: 19           RTTMax : 73
NumOfRTT: 2780        RTTSum: 59191       RTTSum2: 1290993

```

<The following data for LSP path information is available after path discovery is enabled.>

```

Path Information:
Path Path LSP           Outgoing      Nexthop      Downstream
Idx  Sense Selector      Interface     Address      Label Stack
 1   1   127.0.0.1          Gi0/4/0/0    192.39.1.1   677
 2   1   127.0.0.1          Gi0/4/0/0.1  192.39.2.1   677
 3   1   127.0.0.1          Gi0/4/0/0.2  192.39.3.1   677
 4   1   127.0.0.1          Gi0/4/0/0.3  192.39.4.1   677
 5   1   127.0.0.8          Gi0/4/0/0    192.39.1.1   677
 6   1   127.0.0.8          Gi0/4/0/0.1  192.39.2.1   677
 7   1   127.0.0.8          Gi0/4/0/0.2  192.39.3.1   677
 8   1   127.0.0.8          Gi0/4/0/0.3  192.39.4.1   677

```

<end>

Hour Index: 14

```

Start Time Index: 13:20:57.323 UTC Tue Nov 27 2007
Number of Failed Operations due to a Disconnect      : 0
Number of Failed Operations due to a Timeout        : 122
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

```

```

RTT Values:
RTTAvg   : 21           RTTMin: 19           RTTMax : 212
NumOfRTT: 3059        RTTSum: 65272       RTTSum2: 1457612

```

```

Path Information:
Path Path LSP           Outgoing      Nexthop      Downstream
Idx  Sense Selector      Interface     Address      Label Stack
 1   1   127.0.0.1          Gi0/4/0/0    192.39.1.1   677
 2   1   127.0.0.1          Gi0/4/0/0.1  192.39.2.1   677
 3   1   127.0.0.1          Gi0/4/0/0.2  192.39.3.1   677
 4   1   127.0.0.1          Gi0/4/0/0.3  192.39.4.1   677
 5   1   127.0.0.8          Gi0/4/0/0    192.39.1.1   677
 6   1   127.0.0.8          Gi0/4/0/0.1  192.39.2.1   677
 7   1   127.0.0.8          Gi0/4/0/0.2  192.39.3.1   677
 8   1   127.0.0.8          Gi0/4/0/0.3  192.39.4.1   677

```

This table describes the significant fields shown in the display.

Table 14: show ipsla statistics aggregated (with Path Discovery enabled) Field Descriptions

Field	Description
Entry Number	Entry number.

show ipsla statistics aggregated

Field	Description
Start Time Index	Start time.
Number of Failed Operations due to a Disconnect	Number of failed operations due to a disconnect.
Number of Failed Operations due to a Timeout	Number of failed operations due to a timeout.
Number of Failed Operations due to a Busy	Number of failed operations due to a busy error.
Number of Failed Operations due to a No Connection	Error that refers to the case in which the control connection cannot be established.
Number of Failed Operations due to an Internal Error	Number of failed operations due to an internal error.
Number of Failed Operations due to a Sequence Error	Number of failed operations due to a sequence error.
Number of Failed Operations due to a Verify Error	Number of failed operations due to a verify error.
RTT Values	Round-trip time statistics appear on the specified lines.
RTT Min/Avg/Max	Maximum values of the RTT that are observed in the latest cycle (*).
NumOfRTT	Number of successful round trips.
RTT Sum	Sum of all successful round-trip values, in milliseconds.
RTT Sum2	Sum of squares of the round-trip values, in milliseconds.
RTT Min/Avg/Max	Maximum values of the RTT that are observed in the latest cycle (*).
NumOfRTT	Number of successful round trips.
Path Idx	Path index number.
Path Sense	Response return code for the path. (See Table 3: Response Return Values for the show ipsla history Command , on page 97, in show ipsla history command.)
LSP Selector	LSP selector address of the path.
Outgoing Interface	Outgoing interface name of the path.
NextHop Address	Next hop address of the path.
Downstream Label Stack	MPLS label stacks of the path.

Related Commands

Command	Description
show ipsla statistics, on page 110	Displays the operational data for the IP SLA operation.
show ipsla statistics enhanced aggregated, on page 122	Displays the statistical errors for all the IP SLA operations or for a specified operation.

show ipsla statistics enhanced aggregated

To display the enhanced history statistics for all collected enhanced history buckets for the specified IP SLA operation, use the **show ipsla statistics enhanced aggregated** command in EXEC mode.

show ipsla statistics enhanced aggregated [*operation-number*] [*interval seconds*]

Syntax Description

operation-number (Optional) Operation number for which to display the enhanced history distribution statistics.

interval seconds (Optional) Specifies the aggregation interval in seconds for which to display the enhanced history distribution statistics.

Command Default

None

Command Modes

EXEC mode

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

The **show ipsla statistics enhanced aggregated** command displays data for each bucket of enhanced history data shown individually; for example, one after the other. The number of buckets and the collection interval is set using the **interval** keyword, *seconds* argument, **buckets** keyword, and *number-of-buckets* argument.

Task ID

Task ID	Operations
monitor	read

Examples

The output of the **show ipsla statistics enhanced aggregated** command varies depending on the operation type.

The following sample output is from the **show ipsla statistics enhanced aggregated** command for the UDP echo operation:

```
RP/0/RP0/CPU0:router# show ipsla statistics enhanced aggregated 20
```

```
Entry number: 20
Interval : 300 seconds
Bucket : 1 (0 - 300 seconds)
  Start Time Index: 00:38:14.286 UTC Thu Mar 16 2006
  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
  RTT Values:
```

```

RTTAvg : 2           RTTMin: 2           RTTMax : 5
NumOfRTT: 5         RTTSum: 13          RTTSum2: 41
Bucket : 2 (300 - 600 seconds)
Start Time Index: 00:43:12.747 UTC Thu Mar 16 2006
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
RTT Values:
RTTAvg : 2           RTTMin: 2           RTTMax : 2
NumOfRTT: 1         RTTSum: 2           RTTSum2: 4

```

This table describes the significant fields shown in the display.

Table 15: show ipsla statistics enhanced aggregated Field Descriptions

Field	Description
Entry Number	Entry number.
Interval	Multiple of the frequency of the operation. The Enhanced interval field defines the interval in which statistics displayed by the show ipsla statistics enhanced aggregated command are aggregated. This field must be configured so that the enhanced aggregated statistics are displayed.
Bucket	Bucket index.
Start Time Index	Statistics that are aggregated depend on the interval configuration mode. The value depends on the interval configuration that is displayed.
RTT Values	Round-trip time statistics appear on the specified lines.
RTT Min/Avg/Max	Maximum values of the RTT that are observed in the latest cycle (*).
NumOfRTT	Number of successful round trips.
RTT Sum	Sum of all successful round-trip values, in milliseconds.
RTT Sum2	Sum of squares of the round-trip values, in milliseconds.
Number of Failed Operations due to a Disconnect	Number of failed operations due to a disconnect.
Number of Failed Operations due to a Timeout	Number of failed operations due to a timeout.
Number of Failed Operations due to a Busy	Number of failed operations due to a busy error.
Number of Failed Operations due to a No Connection	Error that refers to the case in which the control connection cannot be established.

 show ipsla statistics enhanced aggregated

Field	Description
Number of Failed Operations due to an Internal Error	Number of failed operations due to an internal error.
Number of Failed Operations due to a Sequence Error	Number of failed operations due to a sequence error.
Number of Failed Operations due to a Verify Error	Number of failed operations due to a verify error.

Related Commands

Command	Description
show ipsla statistics, on page 110	Displays the operational data for the IP SLA operation.
show ipsla statistics aggregated, on page 113	Displays the statistical errors for all the IP SLA operations or for a specified operation.

source address

To identify the address of the source device, use the **source address** command in the appropriate configuration mode. To use the best local address, use the **no** form of this command.

```
source address ipv4-address
no source address
```

Syntax Description

ipv4-address IP address or hostname of the source device.

Command Default

IP SLA finds the best local address to the destination and uses it as the source address.

Command Modes

IP SLA UDP echo configuration
 IP SLA UDP jitter configuration
 IP SLA ICMP path-jitter configuration
 IP SLA ICMP path-echo configuration
 IP SLA ICMP echo configuration
 IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Support was added for IP SLA MPLS LSP Ping and IP SLA MPLS LSP Trace configuration modes.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to designate an IP address for the **source address** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# source address 192.0.2.9
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

source port

To identify the port of the source device, use the **source port** command in the appropriate configuration mode. To use the unused port number, use the **no** form of this command.

```
source port port
no source port
```

Syntax Description

port <i>port</i>	Identifies the port number of the source device. Range is 1 to 65535.
----------------------------	---

Command Default

IP SLA uses an unused port that is allocated by system.

Command History

Releas	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

The **source port** command is not supported to configure ICMP operations; it is supported only to configure UDP operations.

The specified source port should not be used in other IPSLA operations configured on the same source IP address and source VRF.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to designate a port for the **source port** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# source port 11111
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

start-time

To determine the time when the operation or MPLS LSP monitor instance starts, use the **start-time** command in the appropriate configuration mode. To stop the operation and place it in the default state, use the **no** form of this command.

start-time *{hh:mm:ss [{day | month day year}] | after hh:mm:ss | now | pending}*
no start-time

Syntax Description	
<i>hh:mm:ss</i>	Absolute start time in hours, minutes, and seconds. You can use the 24-hour clock notation. For example, the start-time <i>01:02</i> is defined as 1:02 am, or start-time <i>13:01:30</i> is defined as start at 1:01 pm. and 30 seconds. The current day is used; unless, you specify a <i>month</i> and <i>day</i> .
<i>month</i>	(Optional) Name of the month to start the operation. When you use the <i>month</i> argument, you are required to specify a day. You can specify the month by using the full English name or the first three letters of the month.
<i>day</i>	(Optional) Number of the day, in the range of 1 to 31, to start the operation. In addition, you must specify a month.
<i>year</i>	(Optional) Year in the range of 1993 to 2035.
after <i>hh:mm:ss</i>	Specifies that the operation starts at <i>hh</i> hours, <i>mm</i> minutes, and <i>ss</i> seconds after the start-time command is used.
now	Specifies that the operation should start immediately.
pending	Specifies that no information is collected. The default value is the pending keyword.

Command Default If a month and day are not specified, the current month and day are used.

Command Modes IP SLA schedule configuration
 IP SLA MPLS LSP monitor schedule configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor schedule configuration mode.
	Release 3.7.0	Added the ability to specify a year.

Usage Guidelines If the **start-time** command is used in IP SLA operation mode, it configures the start time for the specific operation being configured. If the **start-time** command is used in IP SLA MPLS LSP monitor mode, it configures the start time for all monitor instances associated with the monitored provider edge (PE) routers.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **start-time** command option for the schedule operation:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# schedule operation 1
RP/0/RP0/CPU0:router(config-ipsla-sched)# start-time after 01:00:00
```

The following example shows how to use the **start-time** command in IP SLA MPLS LSP monitor schedule configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# schedule monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsml-sched)# start-time after 01:00:00
```

The following example shows how to use the **start-time** command and specify a year for a scheduled operation:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla operation 2
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp echo
RP/0/RP0/CPU0:router(config-ipsla-icmp-echo)# destination address 192.0.2.9
RP/0/RP0/CPU0:router(config-ipsla-icmp-echo)# exit
RP/0/RP0/CPU0:router(config-ipsla-op)# exit

RP/0/RP0/CPU0:router(config-ipsla)# schedule operation 2
RP/0/RP0/CPU0:router(config-ipsla-sched)# start 20:0:0 february 7 2008
RP/0/RP0/CPU0:router(config-ipsla-sched)#
```

Related Commands

Command	Description
life, on page 38	Specifies the length of time to execute.
operation, on page 52	Configures an IP SLA operation.
recurring, on page 79	Indicates that the operation starts automatically at the specified time and for the specified duration every day.
schedule monitor, on page 90	Schedules an IP SLA MPLS LSP monitoring instance.
schedule operation, on page 91	Schedules an IP SLA operation.

statistics

To set the statistics collection parameters for the operation, use the **statistics** command in the appropriate configuration mode. To remove the statistics collection or use the default value, use the **no** form of this command.

```
statistics {hourly | interval seconds}
no statistics {hourly | interval seconds}
```

Syntax Description	hourly	interval seconds
	Sets the distribution for statistics configuration that is aggregated for over an hour.	Collects statistics over a specified time interval. Interval (in seconds) over which to collect statistics. Range is 1 to 3600 seconds.

Command Default None

Command Modes

- IP SLA operation UDP jitter configuration
- IP SLA MPLS LSP ping configuration
- IP SLA MPLS LSP trace configuration
- IP SLA MPLS LSP monitor ping configuration
- IP SLA MPLS LSP monitor trace configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines The **statistics interval** command is not supported for the configuration of ICMP path-echo and ICMP path-jitter operations, nor for the configuration of MPLS LSP monitor instances.

If the **statistics** command is used in IP SLA operation mode, it configures the statistics collection for the specific operation being configured. If the **statistics** command is used in IP SLA MPLS LSP monitor mode, it configures the statistics collection for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to set the number of hours in which statistics are maintained for the IP SLA UDP jitter operation for the **statistics** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# statistics hourly
RP/0/RP0/CPU0:router(config-ipsla-op-stats)#
```

The following example shows how to collect statistics for a specified time interval, using the **statistics** command in an IP SLA UDP jitter operation:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# statistics interval 60
RP/0/RP0/CPU0:router(config-ipsla-op-stats)#
```

The following example shows how to set the number of hours in which statistics are maintained for the IP SLA MPLS LSP monitor ping operation, using the **statistics** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsml-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lsp-ping)# statistics hourly
RP/0/RP0/CPU0:router(config-ipsla-mplsml-stats)#
```

Related Commands

Command	Description
buckets (statistics hourly), on page 11	Sets the number of hours in which statistics are kept.
buckets (statistics interval), on page 12	Refers to the data buckets in which the enhanced history statistics are kept.
distribution count, on page 19	Sets the number of statistics distributions that are kept for each hop during the lifetime of the IP SLA operation.
distribution interval, on page 21	Sets the time interval (in milliseconds) for each statistical distribution.
monitor, on page 49	Configures an IP SLA MPLS LSP monitor instance.
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
maximum hops, on page 45	Sets the number of hops in which statistics are maintained for each path for the IP SLA operation.
maximum paths (IP SLA), on page 47	Sets the number of paths in which statistics are maintained for each hour for an IP SLA operation.

tag (IP SLA)

To create a user-specified identifier for an IP SLA operation, use the **tag** command in the appropriate configuration mode. To unset the tag string, use the **no** form of this command.

tag [*text*]

no tag

Syntax Description

text (Optional) Specifies a string label for the IP SLA operation.

Command Default

No tag string is configured.

Command Modes

IP SLA UDP echo configuration
 IP SLA UDP jitter configuration
 IP SLA ICMP path-jitter configuration
 IP SLA ICMP path-echo configuration
 IP SLA ICMP echo configuration
 IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration
 IP SLA MPLS LSP monitor ping configuration
 IP SLA MPLS LSP monitor trace configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.0	Support was added for IP SLA MPLS LSP ping and IP SLA MPLS LSP trace configuration modes.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines

If the **tag** command is used in IP SLA operation mode, it configures the user-defined tag string for the specific operation being configured. If the **tag** command is used in IP SLA MPLS LSP monitor mode, it configures the user-defined tag string for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **tag** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# tag ipsla
```

The following example shows how to use the **tag** command in IP SLA MPLS LSP monitor ping configuration mode:

```
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# monitor 1
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-lsp-ping)# tag mplsmlm-tag
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

target ipv4

To specify the IPv4 address of the target router to be used in an MPLS LSP ping or MPLS LSP trace operation, use the **target ipv4** command in the appropriate configuration mode. To unset the address, use the **no** form of this command.

target ipv4 *destination-address destination-mask*
no target ipv4

Syntax Description

destination-address IPv4 address of the target device to be tested.

destination-mask Number of bits in the network mask of the target address. The network mask can be specified in either of two ways:

- The network mask can be a four-part dotted decimal address. For example, 255.0.0.0 indicates that each bit equal to 1 means the corresponding address bit belongs to the network address.
- The network mask can be indicated as a slash (/) and number. For example, /8 indicates that the first 8 bits of the mask are ones, and the corresponding bits of the address are network address.

Command Default

None

Command Modes

IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.

Usage Guidelines

Use the **target ipv4** command to specify the IPv4 address of the target router at the end of the LSP to be tested or traced and to indicate the destination as an Label Distribution Protocol (LDP) IPv4 address. The target IPv4 address identifies the appropriate label stack associated with the LSP.



Note Using the **target ipv4** command, you can configure only one LDP IPv4 address as the target in an MPLS LSP ping or trace operation. If you enter the command a second time and configure a different IPv4 target address, you overwrite the first IPv4 address.

An MPLS LSP ping operation tests connectivity in the LSP using verification on the specified Forwarding Equivalence Class (FEC)— in this case, LDP IPv4 prefix—between the ping origin and the egress node identified with the **target ipv4** command. This test is carried out by sending an MPLS echo request along the same data path as other packets belonging to the FEC. When the ping packet reaches the end of the path, it is sent to the control plane of the egress label switching router (LSR), which then verifies that it is indeed an egress for the LSP. The MPLS echo request contains information about the LSP that is being verified.

In an MPLS network, an MPLS LSP trace operation traces LSP paths to the target router identified with the **target ipv4** command. In the verification of LSP routes, a packet is sent to the control plane of each transit

LSR, which performs various checks, including one that determines if it is a transit LSR for the LSP path. Each transit LSR also returns information related to the LSP being tested (that is, the label bound to the LDP IPv4 prefix).

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **target ipv4** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-ping)# target ipv4 192.168.1.4 255.255.255.255
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

target pseudowire

To specify the pseudowire as the target to be used in an MPLS LSP ping operation, use the **target pseudowire** command in IP SLA MPLS LSP ping configuration mode. To unset the target, use the **no** form of this command.

```
target pseudowire destination-address circuit-id
no target pseudowire
```

Syntax Description

destination-address IPv4 address of the target device to be tested.

circuit-id Virtual circuit identifier. Range is 1 to 4294967295.

Command Default

No default behavior or values

Command Modes

IP SLA MPLS LSP ping configuration

Command History

Release	Modification
Release 3.5.0	This command was introduced.

Usage Guidelines

Use the **target pseudowire** command to specify a target router and to indicate the destination as a Layer 2 VPN pseudowire in an MPLS LSP ping operation. The **target pseudowire** command identifies the target address and the virtual circuit (VC) identifier.



Note Using the **target pseudowire** command, you can configure only one pseudowire address as the target in an MPLS LSP ping operation. If you use the command a second time and configure a different pseudowire target address, the first pseudowire address is overwritten.

A pseudowire target of the LSP ping operation allows active monitoring of statistics on Pseudowire Edge-to-Edge (PWE3) services across an MPLS network. PWE3 connectivity verification uses the Virtual Circuit Connectivity Verification (VCCV).

For more information on VCCV, refer to the VCCV draft, “Pseudowire Virtual Circuit Connectivity Verification (VCCV)” on the IETF web page.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **target pseudowire** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# operation 1
```



```
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp ping  
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# target pseudowire 192.168.1.4 4211
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.

target traffic-eng

To specify the target MPLS traffic engineering tunnel to be used in an MPLS LSP ping or MPLS LSP trace operation, use the **target traffic-eng** command in the appropriate configuration mode. To unset the tunnel, use the **no** form of this command.

target traffic-eng tunnel *tunnel-interface*
no target traffic-eng

Syntax Description	tunnel <i>tunnel-interface</i> Tunnel ID of an MPLS traffic-engineering tunnel (for example, tunnel 10) configured on the router. Range is 0 to 65535.				
Command Default	No default behavior or values				
Command Modes	IP SLA MPLS LSP ping configuration IP SLA MPLS LSP trace configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.4.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.4.0	This command was introduced.
Release	Modification				
Release 3.4.0	This command was introduced.				
Usage Guidelines	Use the target traffic-eng command to specify a target router and to indicate the destination as an MPLS traffic-engineering (TE) tunnel in an MPLS LSP ping or MPLS LSP trace operation. The target traffic-eng command identifies the tunnel interface and the appropriate label stack associated with the LSP to be pinged or traced. An LSP tunnel interface is the head-end of a unidirectional virtual link to a tunnel destination.				



Note Using the **target traffic-eng** command, you can configure only one MPLS TE tunnel as the target in an MPLS LSP ping or trace operation. If you enter the command a second time and configure a different tunnel interfaces, you overwrite the first tunnel ID.

An IP SLA ping operation tests connectivity in the LSP using verification on the specified Forwarding Equivalence Class (FEC)—in this case, MPLS TE tunnel—between the ping origin and the egress node identified with the **target traffic-eng** command. This test is carried out by sending an MPLS echo request along the same data path as other packets belonging to the tunnel. When the ping packet reaches the end of the path, it is sent to the control plane of the egress label switching router (LSR), which then verifies that it is indeed an egress for the MPLS TE tunnel. The MPLS echo request contains information about the tunnel whose LSP path is being verified.

In an MPLS network, an IP SLA trace operation traces the LSP paths to a target router identified with the **target traffic-eng** command. In the verification of LSP routes, a packet is sent to the control plane of each transit LSR, which performs various checks, including one that determines if it is a transit LSR for the LSP path. Each transit LSR also returns information related to the MPLS TE tunnel to see if the local forwarding information matches what the routing protocols determine as the LSP path.

MPLS traffic engineering automatically establishes and maintains LSPs across the backbone. The path that an LSP uses is determined by the LSP resource requirements and network resources, such as bandwidth.

For more information on MPLS traffic-engineering tunnels, refer to *MPLS Traffic Engineering and Enhancements*.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **target traffic-eng tunnel** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-trace)# target traffic-eng tunnel 101
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

threshold

To set the lower-limit and upper-limit values, use the **threshold** command in IP SLA reaction condition configuration mode. To use the default value, use the **no** form of this command.

threshold lower-limit *value* **upper-limit** *value*
no threshold lower-limit *value* **upper-limit** *value*

Syntax Description

lower-limit *value* Specifies the threshold lower-limit value. Range is 1 to 4294967295 ms. Default **lower-limit** value is 3000 ms.

upper-limit *value* Specifies the threshold upper-limit value. Range is 5000 to 4294967295 ms. Default **upper-limit** value is 5000 ms.

Command Default

lower-limit *value*: 3000 ms

upper-limit *value*: 5000 ms

Command Modes

IP SLA reaction condition configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

The **threshold** command is supported only when used with the **react** command and **jitter-average** and **packet-loss** keywords.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to set the lower-limit and upper-limit values for the **react** command with the **jitter-average** keyword for the **threshold** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react jitter-average
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold lower-limit 8000 upper-limit 10000
```

The following example shows how to set the lower-limit and upper-limit values for the **react** command with the **packet-loss** keyword for the **threshold** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
```

```
RP/0/RP0/CPU0:router(config-ipsla-react)# react packet-loss dest-to-source
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold lower-limit 8000 upper-limit 10000
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.
	reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.
	react, on page 68	Specifies an element to be monitored for a reaction.
	threshold type average, on page 142	Takes action on average values to violate a threshold.
	threshold type consecutive, on page 144	Takes action after a number of consecutive violations.
	threshold type immediate, on page 146	Takes action immediately upon a threshold violation.
	threshold type xofy, on page 148	Takes action upon X violations in Y probe operations.

threshold type average

To take action on average values to violate a threshold, use the **threshold type average** command in IP SLA reaction condition configuration mode. To clear the threshold type (reaction will never happen), use the **no** form of this command.

threshold type average *number-of-probes*
no threshold type

Syntax Description	<i>number-of-probes</i> When the average of the last five values for the monitored element exceeds the upper threshold or the average of the last five values for the monitored element drops below the lower threshold, the action is performed as defined by the action command. Range is 1 to 16.
---------------------------	---

Command Default	If there is no default value, no threshold type is configured.
------------------------	--

Command Modes	IP SLA reaction condition configuration
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Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	The threshold type average command is supported only when used with the react command and jitter-average , packet-loss , and rtt keywords.
-------------------------	---

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to set the number of probes for the **react** command with the **jitter-average** keyword for the **threshold type average** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react jitter-average
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold type average 8
```

The following example shows how to set the number of probes for the **react** command with the **packet-loss** keyword for the **threshold type average** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react packet-loss dest-to-source
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold type average 8
```

Related Commands	Command	Description
	action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs.
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.
	reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.
	react, on page 68	Specifies an element to be monitored for a reaction.
	threshold, on page 140	Sets the lower-limit and upper-limit values.
	threshold type consecutive, on page 144	Takes action after a number of consecutive violations.
	threshold type immediate, on page 146	Takes action immediately upon a threshold violation.
	threshold type xofy, on page 148	Takes action upon X violations in Y probe operations.

threshold type consecutive

To take action after a number of consecutive violations, use the **threshold type consecutive** command in the appropriate configuration mode. To clear the threshold type (reaction will never happen), use the **no** form of this command.

threshold type consecutive *occurrences*
no threshold type

Syntax Description	<i>occurrences</i> When the reaction condition is set for a consecutive number of occurrences, there is no default value. The number of occurrences is set when specifying the threshold type. The number of consecutive violations is 1 to 16.
---------------------------	---

Command Default	No default behavior or values
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Command Modes	IP SLA reaction condition configuration IP SLA MPLS LSP monitor reaction condition configuration
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Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.3.0</td> <td>This command was introduced.</td> </tr> <tr> <td>Release 3.5.0</td> <td>This command was added to IP SLA MPLS LSP monitor reaction condition configuration mode.</td> </tr> </tbody> </table>	Release	Modification	Release 3.3.0	This command was introduced.	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor reaction condition configuration mode.
Release	Modification						
Release 3.3.0	This command was introduced.						
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor reaction condition configuration mode.						

Usage Guidelines	If the threshold type consecutive command is used in IP SLA reaction condition mode, it configures the threshold for the specific operation being configured. If the threshold type consecutive command is used in IP SLA MPLS LSP monitor reaction condition configuration mode, it configures the threshold for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.
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Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				

Examples The following example shows how to use the **threshold type consecutive** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react jitter-average
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold type consecutive 8
```

The following example shows how to use the **threshold type consecutive** command in IP SLA MPLS LSP monitor reaction condition configuration mode:


```

RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm) # reaction monitor 2
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-react) # react connection-loss
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-react-cond) # threshold type consecutive 2

```

Related Commands	Command	Description
	action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs.
	mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.
	reaction monitor, on page 74	Configures MPLS LSP monitoring reactions.
	reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.
	react, on page 68	Specifies an element to be monitored for a reaction.
	threshold, on page 140	Sets the lower-limit and upper-limit values.
	threshold type average, on page 142	Takes action on average values to violate a threshold.
	threshold type immediate, on page 146	Takes action immediately upon a threshold violation.
	threshold type xofy, on page 148	Takes action upon X violations in Y probe operations.

threshold type immediate

To take action immediately upon a threshold violation, use the **threshold type immediate** command in the appropriate configuration mode. To clear the threshold type (reaction will never happen), use the **no** form of this command.

threshold type immediate
no threshold type

Syntax Description	This command has no keywords or arguments.
Command Default	If there is no default value, no threshold type is configured.
Command Modes	IP SLA reaction condition configuration IP SLA MPLS LSP monitor reaction condition configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor reaction condition configuration mode.

Usage Guidelines When the reaction conditions, such as threshold violations, are met for the monitored element, the action is immediately performed as defined by the **action** command.

If the **threshold type immediate** command is used in IP SLA reaction condition mode, it configures the threshold for the specific operation being configured. If the **threshold type immediate** command is used in IP SLA MPLS LSP monitor reaction condition configuration mode, it configures the threshold for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID	Task	Operations
	monitor	read, write

Examples

The following example shows how to use the **threshold type immediate** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react jitter-average
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold type immediate
```

The following example shows how to use the **threshold type immediate** command in IP SLA MPLS LSP monitor reaction condition configuration mode:

```

RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplslm)# reaction monitor 2
RP/0/RP0/CPU0:router(config-ipsla-mplslm-react)# react connection-loss
RP/0/RP0/CPU0:router(config-ipsla-mplslm-react-cond)# threshold type immediate

```

Related Commands	Command	Description
	action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs.
	mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.
	reaction monitor, on page 74	Configures MPLS LSP monitoring reactions.
	reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.
	react, on page 68	Specifies an element to be monitored for a reaction.
	threshold, on page 140	Sets the lower-limit and upper-limit values.
	threshold type average, on page 142	Takes action on average values to violate a threshold.
	threshold type consecutive, on page 144	Takes action after a number of consecutive violations.
	threshold type xofy, on page 148	Takes action upon X violations in Y probe operations.

threshold type xofy

To take action upon X violations in Y probe operations, use the **threshold type xofy** command in IP SLA reaction condition configuration mode. To clear the threshold type (reaction will never happen), use the **no** form of this command.

```
threshold type xofy x-value y-value
no threshold type
```

Syntax Description	<i>x-value</i> <i>y-value</i> When the reaction conditions, such as threshold violations, are met for the monitored element after some <i>x</i> number of violations within some other <i>y</i> number of probe operations (for example, <i>x</i> of <i>y</i>), the action is performed as defined by the action command. Default is 5 for both <i>x-value</i> and <i>y-value</i> ; for example, xofy 5 5 . Range is 1 to 16.
---------------------------	--

Command Default	If there is no default value, no threshold type is configured.
------------------------	--

Command Modes	IP SLA reaction condition configuration
----------------------	---

Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.3.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.3.0	This command was introduced.
Release	Modification				
Release 3.3.0	This command was introduced.				

Usage Guidelines	No specific guidelines impact the use of this command.
-------------------------	--

Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>monitor</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	monitor	read, write
Task ID	Operations				
monitor	read, write				

Examples The following example shows how to use the **threshold type xofy** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# reaction operation 432
RP/0/RP0/CPU0:router(config-ipsla-react)# react jitter-average
RP/0/RP0/CPU0:router(config-ipsla-react-cond)# threshold type xofy 1 5
```

Related Commands	<table border="1"> <thead> <tr> <th>Command</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>action (IP SLA), on page 6</td> <td>Specifies what action or combination of actions the operation performs.</td> </tr> <tr> <td>operation, on page 52</td> <td>Configures an IP SLA operation.</td> </tr> <tr> <td>schedule operation, on page 91</td> <td>Schedules an IP SLA operation.</td> </tr> </tbody> </table>	Command	Description	action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs.	operation, on page 52	Configures an IP SLA operation.	schedule operation, on page 91	Schedules an IP SLA operation.
Command	Description								
action (IP SLA), on page 6	Specifies what action or combination of actions the operation performs.								
operation, on page 52	Configures an IP SLA operation.								
schedule operation, on page 91	Schedules an IP SLA operation.								

Command	Description
reaction operation, on page 76	Configures certain actions that are based on events under the control of the IP SLA agent.
react, on page 68	Specifies an element to be monitored for a reaction.
threshold, on page 140	Sets the lower-limit and upper-limit values.
threshold type average, on page 142	Takes action on average values to violate a threshold.
threshold type consecutive, on page 144	Takes action after a number of consecutive violations.
threshold type immediate, on page 146	Takes action immediately upon a threshold violation.

timeout (IP SLA)

To set the probe or control timeout interval, use the **timeout** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

timeout *milliseconds*
no timeout

Syntax Description	<i>milliseconds</i> Sets the amount of time (in milliseconds) that the IP SLA operation waits for a response from the request packet. Range is 1 to 604800000.
---------------------------	--

Command Default	None.
------------------------	-------

Command Modes	IP SLA UDP echo configuration IP SLA UDP jitter configuration IP SLA ICMP path-jitter configuration IP SLA ICMP path-echo configuration IP SLA ICMP echo configuration IP SLA MPLS LSP ping configuration IP SLA MPLS LSP trace configuration IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration
----------------------	--

Command History	Release	Modification
	Release 3.3.0	This command was introduced.
	Release 3.4.0	Support was added for IP SLA MPLS LSP ping and IP SLA MPLS LSP trace configuration modes.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines	If the timeout command is used in IP SLA operation mode, it configures the amount of time that a specific IP SLA operation waits for a response from the request packet. If the timeout command is used in IP SLA MPLS LSP monitor mode, it configures the amount of time that all operations associated with the monitored provider edge (PE) routers wait for a response from the request packet. This configuration is inherited by all LSP operations that are created automatically.
-------------------------	---



Note	The IP SLA responder needs at least one second to open a socket and program Local Packet Transport Services (LPTS). Therefore, configure the IP SLA timeout to at least 2000 milli seconds.
-------------	---

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **timeout** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# timeout 10000
```

The following example shows how to use the **timeout** command in IP SLA MPLS LSP monitor configuration mode:

```
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm)# monitor 2
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mplsmlm-lsp-ping)# timeout 10000
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

tos

To set the type of service (ToS) in a probe packet, use the **tos** command in the appropriate configuration mode. To use the default value, use the **no** form of this command.

tos *number*
no **tos**

Syntax Description	<i>number</i> Type of service number. Range is 0 to 255.
---------------------------	--

Command Default	The type of service number is 0.
------------------------	----------------------------------

Command Modes	IP SLA UDP echo configuration IP SLA UDP jitter configuration IP SLA ICMP path-jitter configuration IP SLA ICMP path-echo configuration IP SLA ICMP echo configuration
----------------------	--

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines	The ToS value is an 8-bit field in IP headers. The field contains information, such as precedence and ToS. The information is useful for policy routing and for features like Committed Access Rate (CAR) in which routers examine ToS values. When the type of service is defined for an operation, the IP SLA probe packet contains the configured tos value in the IP header.
-------------------------	--

Task ID	Task ID	Operations
	monitor	read, write

Examples	The following example shows how to use the tos command in IP SLA UDP jitter configuration mode:
-----------------	--

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# tos 60
```


Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

ttl

To specify the time-to-live (TTL) value in the MPLS label of echo request packets, use the **ttl** command in the appropriate configuration mode. To return to the default value, use the **no** form of this command.

ttl *time-to-live*
no ttl

Syntax Description

time-to-live Maximum hop count for an echo request packet. Valid values are from 1 to 255.

Command Default

For an MPLS LSP ping operation, the default time-to-live value is 255.
 For an MPLS LSP trace operations, the default time-to-live value is 30.

Command Modes

IP SLA MPLS LSP ping configuration
 IP SLA MPLS LSP trace configuration
 IP SLA MPLS LSP monitor ping configuration
 IP SLA MPLS LSP monitor trace configuration

Command History

Release	Modification
Release 3.4.0	This command was introduced.
Release 3.5.0	This command was added to IP SLA MPLS LSP monitor ping and monitor trace configuration modes.

Usage Guidelines

Use the **ttl** command to set the maximum number of hops allowed for echo request packets in an MPLS LSP ping or MPLS LSP trace operation. Note that the number of possible hops differs depending the type of IP SLA operation:

- For MPLS LSP ping operations, valid values are from 1 to 255 and the default is 255.
- For MPLS LSP trace operations, valid values are from 1 to 30 and the default is 30.

If the **ttl** command is used in IP SLA operation mode, it configures the time-to-live value for the specific operation being configured. If the **ttl** command is used in IP SLA MPLS LSP monitor mode, it configures the time-to-live value for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to use the **ttl** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-ping)# ttl 200
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

type icmp echo

To use the ICMP echo operation type, use the **type icmp echo** command in IP SLA operation configuration mode. To remove the operation, use the **no** form of this command.

type icmp echo
no type icmp echo

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes IP SLA operation configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task	Operations ID
	monitor	read, write

Examples The following example shows how to use the **type icmp echo** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp echo
RP/0/RP0/CPU0:router(config-ipsla-icmp-echo)#
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

type icmp path-echo

To use the ICMP path-echo operation type, use the **type icmp path-echo** command in IP SLA operation configuration mode. To remove the operation, use the **no** form of this command.

```
type icmp path-echo
no type icmp path-echo
```

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes IP SLA operation configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **type icmp path-echo** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp path-echo
RP/0/RP0/CPU0:router(config-ipsla-icmp-path-echo)#
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

type icmp path-jitter

To use the ICMP path-jitter operation type, use the **type icmp path-jitter** command in IP SLA operation configuration mode. To remove the operation, use the **no** form of this command.

type icmp path-jitter
no type icmp path-jitter

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes IP SLA operation configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task	Operations ID
	monitor	read, write

Examples The following example shows how to use the **type icmp path-jitter** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type icmp path-jitter
RP/0/RP0/CPU0:router(config-ipsla-icmp-path-jitter)#
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

type mpls lsp ping

To verify the end-to-end connectivity of a label switched path (LSP) and the integrity of an MPLS network, use the **type mpls lsp ping** command in the appropriate configuration mode. To remove the operation, use the **no** form of this command.

```
type mpls lsp ping
no type mpls lsp ping
```

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes IP SLA operation configuration
IP SLA MPLS LSP monitor definition configuration

Command History	Release	Modification
	Release 3.4.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor configuration mode.

Usage Guidelines Use the **type mpls lsp ping** command to configure parameters for an IP SLA LSP ping operation. After you enter the command, you enter IP SLA MPLS LSP Ping configuration mode.

An MPLS LSP ping operation tests connectivity between routers along an LSP path in an MPLS network and measures round-trip delay of the LSP by using an echo request and echo reply.

The MPLS LSP ping operation verifies LSP connectivity by using one of the supported Forwarding Equivalence Class (FEC) entities between the ping origin and egress node of each FEC. The following FEC types are supported for an MPLS LSP ping operation:

- IPv4 LDP prefixes (configured with the [target ipv4, on page 134](#) command)
- MPLS TE tunnels (configured with the [target traffic-eng , on page 138](#) command)
- Pseudowire (configured with the [target pseudowire, on page 136](#) command)

For MPLS LSP monitor ping operations, only IPv4 LDP prefixes are supported.

If the **type mpls lsp ping** command is used in IP SLA operation configuration mode, it configures the parameters for the specific operation being configured. If the **type mpls lsp ping** command is used in IP SLA MPLS LSP monitor configuration mode, it configures the parameters for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **type mpls lsp ping** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-ping)#
```

The following example shows how to use the **type mpls lsp ping** command in IP SLA MPLS LSP monitor configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-monitor)# monitor 2
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-monitor-def)# type mpls lsp ping
RP/0/RP0/CPU0:router(config-ipsla-mpls-lsp-monitor-lsp-ping)#
```

Related Commands

Command	Description
monitor, on page 49	Configures an IP SLA MPLS LSP monitor instance.
mpls lsp-monitor, on page 51	Configures MPLS label switched path (LSP) monitoring.
operation, on page 52	Configures an IP SLA operation.
schedule monitor, on page 90	Schedules an IP SLA MPLS LSP monitoring instance.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

type mpls lsp trace

To trace LSP paths and localize network faults in an MPLS network, use the **type mpls lsp trace** command in the appropriate configuration mode. To remove the operation, use the **no** form of this command.

type mpls lsp trace
no type mpls lsp trace

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes IP SLA operation configuration
 IP SLA MPLS LSP monitor definition configuration

Command History	Release	Modification
	Release 3.4.0	This command was introduced.
	Release 3.5.0	This command was added to IP SLA MPLS LSP monitor configuration mode.

Usage Guidelines Use the **type mpls lsp trace** command to configure parameters for an IP SLA LSP trace operation. After you enter the command, you enter IP SLA MPLS LSP Trace configuration mode.

An MPLS LSP trace operation traces the hop-by-hop route of LSP paths to a target router and measures the hop-by-hop round-trip delay for IPv4 LDP prefixes and TE tunnel FECs in an MPLS network. Echo request packets are sent to the control plane of each transit label switching router (LSR). A transit LSR performs various checks to determine if it is a transit LSR for the LSP path. A trace operation allows you to troubleshoot network connectivity and localize faults hop-by-hop.

In an MPLS LSP trace operation, each transit LSR returns information related to the type of Forwarding Equivalence Class (FEC) entity that is being traced. This information allows the trace operation to check if the local forwarding information matches what the routing protocols determine as the LSP path.

An MPLS label is bound to a packet according to the type of FEC used for the LSP. The following FEC types are supported for an MPLS LSP trace operation:

- LDP IPv4 prefixes (configured with the [target ipv4, on page 134](#) command)
- MPLS TE tunnels (configured with the [target traffic-eng , on page 138](#) command)

For MPLS LSP monitor trace operations, only IPv4 LDP prefixes are supported.

If the **type mpls lsp trace** command is used in IP SLA operation configuration mode, it configures the parameters for the specific operation being configured. If the **type mpls lsp trace** command is used in IP SLA MPLS LSP monitor configuration mode, it configures the parameters for all operations associated with the monitored provider edge (PE) routers. This configuration is inherited by all LSP operations that are created automatically.

type mpls lsp trace

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **type mpls lsp trace** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# operation 1
RP/0/RP0/CPU0:router (config-ipsla-op)# type mpls lsp trace
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-trace)#
```

The following example shows how to use the **type mpls lsp trace** command in IP SLA MPLS LSP monitor configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor)# monitor 2
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor-def)# type mpls lsp trace
RP/0/RP0/CPU0:router (config-ipsla-mpls-lsp-monitor-def-lsp-trace)#
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule monitor, on page 90	Schedules an IP SLA MPLS LSP monitoring instance.
schedule operation, on page 91	Schedules an IP SLA operation.
type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.

type udp echo

To use the UDP echo operation type, use the **type udp echo** command in IP SLA operation configuration mode. To remove the operation, use the **no** form of this command.

type udp echo
no type udp echo

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes IP SLA operation configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **type udp echo** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp echo
RP/0/RP0/CPU0:router(config-ipsla-udp-echo)#
```

Related Commands	Command	Description
	operation, on page 52	Configures an IP SLA operation.
	schedule operation, on page 91	Schedules an IP SLA operation.

type udp jitter

To use the UDP jitter operation type, use the **type udp jitter** command in IP SLA operation configuration mode. To remove the operation, use the **no** form of this command.

type udp jitter
no type udp jitter

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes IP SLA operation configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task	Operations ID
	monitor	read, write

Examples The following example shows how to use the **type udp jitter** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)#
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

type udp ipv4 address

To configure a permanent port in the IP SLA responder for UDP echo or jitter operations, use the **type udp ipv4 address** command in IP SLA responder configuration mode. To remove the specified permanent port, use the **no** form of this command.

```
type udp ipv4 address ip-address port port
no type udp ipv4 address ip-address port port
```

Syntax Description

ip-address Specifies the IPv4 address at which the operation is received.

port port Specifies the port number at which the operation is received. Range is identical to the one used for the subagent that is, 1 to 65355.

Command Default

If there is no default value, no permanent port is configured.

Command Modes

IP SLA responder configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
monitor	read, write

Examples

The following example shows how to configure a permanent port for the **type udp ipv4 address** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# responder
RP/0/RP0/CPU0:router(config-ipsla-resp)# type udp ipv4 address 192.0.2.11 port 10001
```

Related Commands

Command	Description
responder, on page 78	Enables the IP SLA responder for a UDP echo or jitter operation.

verify-data

To check each IP SLA response for corruption, use the **verify-data** command in the appropriate configuration mode. To disable data corruption checking, use the **no** form of this command.

verify-data
no verify-data

Syntax Description This command has no keywords or arguments.

Command Default The **verify-data** command is disabled.

Command Modes IP SLA UDP echo configuration
 IP SLA UDP jitter configuration

Command History	Release	Modification
	Release 3.3.0	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	monitor	read, write

Examples The following example shows how to use the **verify-data** command in IP SLA UDP jitter configuration mode:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router (config)# ipsla
RP/0/RP0/CPU0:router (config-ipsla)# operation 1
RP/0/RP0/CPU0:router (config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router (config-ipsla-udp-jitter)# verify-data
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.

vrf (IP SLA)

To enable the monitoring of a Virtual Private Network (VPN) in an ICMP echo, ICMP path-echo, ICMP path-jitter, UDP echo, or UDP jitter operation, use the **vrf** command in the appropriate configuration mode. To disable VPN monitoring, use the **no vrf** form of this command.

vrf *vrf-name*
no vrf

Syntax Description	<i>vrf-name</i> Name of the VPN. Maximum length is 32 alphanumeric characters.				
Command Default	VPN monitoring is not configured for an IP SLA operation.				
Command Modes	IP SLA ICMP path-jitter configuration IP SLA ICMP path-echo configuration IP SLA ICMP echo configuration IP SLA UDP echo configuration IP SLA UDP jitter configuration IP SLA MPLS LSP ping configuration IP SLA MPLS LSP trace configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 3.4.0</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 3.4.0	This command was introduced.
Release	Modification				
Release 3.4.0	This command was introduced.				

Usage Guidelines Use the **vrf** command to configure a non-default VPN routing and forwarding (VRF) table for an IP SLA operation. A VPN is commonly identified using the name of a VRF table. If you use the **vrf** command in the configuration of an IP SLA operation, the *vrf-name* value is used to identify the VPN for the particular operation.

The default VRF table is used if no value is specified with the **vrf** command. If you enter a VPN name for an unconfigured VRF, the IP SLA operation fails and the following information is displayed in the results for the [show ipsla statistics, on page 110](#) command:

```
Latest operation return code : VrfNameError
```

The **vrf** command is supported only to configure the following IP SLA operations:

- IP SLA ICMP echo
- IP SLA ICMP path-echo
- IP SLA ICMP path-jitter
- IP SLA UDP echo
- IP SLA UDP jitter
- IP SLA MPLS LSP ping

- IP SLA MPLS LSP trace

Task ID	Task ID	Operations
	monitor	read, write

Examples

The following example shows how to use the **vrf** command:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# operation 1
RP/0/RP0/CPU0:router(config-ipsla-op)# type udp jitter
RP/0/RP0/CPU0:router(config-ipsla-udp-jitter)# vrf vpn2
```

Related Commands

Command	Description
operation, on page 52	Configures an IP SLA operation.
schedule operation, on page 91	Schedules an IP SLA operation.
type udp jitter, on page 164	Configures an IP SLA UDP jitter operation.
type icmp echo, on page 156	Configures an IP SLA ICMP echo operation.
type icmp path-echo, on page 157	Configures an IP SLA ICMP path-echo operation.
type icmp path-jitter, on page 158	Configures an IP SLA ICMP path-jitter operation.
type udp echo, on page 163	Configures an IP SLA UDP echo operation.

vrf (IP SLA MPLS LSP monitor)

To specify which virtual routing and forwarding instance (VRF) is monitored in an IP SLA MPLS LSP monitor ping or trace, use the **vrf** command in the appropriate configuration mode. To revert to the monitoring of all VRFs, use the **no vrf** form of this command.

```
vrf vrf-name
no vrf
```

Syntax Description	<i>vrf-name</i> Name of the VRF. Maximum length is 32 alphanumeric characters.
---------------------------	--

Command Default	All VRFs are monitored.
------------------------	-------------------------

Command Modes	IP SLA MPLS LSP monitor ping configuration IP SLA MPLS LSP monitor trace configuration
----------------------	---

Command History	Release Modification
	Release 3.5.0 This command was introduced.

Usage Guidelines	The vrf command in IP SLA MPLS LSP monitor configuration mode specifies to monitor a specific VRF in ping and trace operations. The default is that all VRFs are monitored.
-------------------------	--

Task ID	Task ID Operations
	monitor read, write

Examples	The following example shows how to use the vrf command in IP SLA MPLS LSP monitor configuration mode:
-----------------	--

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# ipsla
RP/0/RP0/CPU0:router(config-ipsla)# mpls lsp-monitor
RP/0/RP0/CPU0:router(config-ipsla-mplsml)# monitor 2
RP/0/RP0/CPU0:router(config-ipsla-mplsml-def)# type mpls lsp trace
RP/0/RP0/CPU0:router(config-ipsla-mplsml-lsp-trace)# vrf vpn-lsp
```

Related Commands	Command	Description
	monitor, on page 49	Configures an IP SLA MPLS LSP monitor instance.
	type mpls lsp ping, on page 159	Tests connectivity in an LSP path in an MPLS VPN.
	type mpls lsp trace, on page 161	Traces the hop-by-hop route of an LSP path in an MPLS VPN.

