



Cisco Nexus 7000 Series IP SLAs Commands

This chapter describes the Cisco NX-OS IP SLAs commands for the Cisco Nexus 7000 series devices.

clock-tolerance

To set the acceptable Network Time Protocol (NTP) clock synchronization tolerance for a one-way Cisco NX-OS IP Service Level Agreements (SLAs) operation measurement, use the **clock-tolerance** command. To return to the default value, use the **no** form of this command.

clock-tolerance ntp oneway { *absolute value* | *percent value* }

no clock-tolerance ntp oneway

Syntax Description

absolute value	Sets the NTP synchronization tolerance value to an absolute number, in microseconds. The range is from 0 to 100000.
percent value	Sets the NTP synchronization tolerance value as a percentage of the one-way IP SLAs operation delay measurement. The range is from 0 to 100. The NTP clock synchronization tolerance is set to 0 percent by default.

Command Default

The NTP clock synchronization tolerance is set to 0 percent.

Command Modes

UDP jitter configuration mode (config-ip-sla-jitter)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

You must configure the **precession microseconds** command before you use the **clock-tolerance** command.

This command does not require a license.

Examples

This example shows how to enable microsecond precision, configure the NTP synchronization offset tolerance to 10 percent, and set the packet priority to high for IP SLAs UDP jitter operation 1:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-jitter 205.199.199.2 1
switch(config-ip-sla-jitter)# clock-tolerance ntp oneway percent 10
%This configuration allowed only on microsecond precision probe
switch(config-ip-sla-jitter)#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

data-pattern

To specify the data pattern in a Cisco NX-OS IP Service Level Agreements (SLAs) operation to test for data corruption, use the **data pattern** command. To remove the data pattern specification, use the **no** form of this command.

data-pattern *hex-pattern*

no data-pattern *hex-pattern*

Syntax Description

<i>hex-pattern</i>	Hexadecimal string to use for monitoring the specified operation.
--------------------	---

Defaults

The default hex-pattern is ABCD.

Command Modes

UDP echo configuration mode (config-ip-sla-udp)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

The **data-pattern** command allows you to specify an alphanumeric character string to verify that the operation payload does not get corrupted in either direction (source-to-destination or destination-to-source.).

This command does not require a license.

Examples

This example show how to specify 1234ABCD5678 as the data pattern in an IPv4 network:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 172.29.139.134 1
switch(config-ip-sla-udp)# data-pattern 1234ABCD5678
switch(config-ip-sla-udp)# ip sla schedule 1 life forever start-time now
switch(config)#
```

Related Commands

Command	Description
filter-for-history	Defines the type of information kept in the history table for the IP SLAs operation.
ip sla monitor	Begins the configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
lives-of-history-kept	Sets the number of lives maintained in the history table for the IP SLAs operation.
samples-of-history-kept	Sets the number of entries kept in the history table per bucket for the IP SLAs operation.

fabric-path echo

To configure a Cisco NX-OS IP Service Level Agreement (SLA) FabricPath echo probe operation, use the **fabric-path echo** command in the IP SLA sub-configuration mode.

fabric-path echo *switch-id* [**profile** *profile-id* [**interface** *type number*]]

Syntax Description		
	<i>switch-id</i>	Identity of the destination device.
	profile <i>profile-id</i>	(Optional) Specifies the profile on the device. <i>profile-id</i> can range from 1 to 65536.
	interface <i>type number</i>	(Optional) Specifies the interface used. If no interface is selected, the default interface on the device is used.

Command Default None.

Command Modes IP SLA sub-configuration (config-ip-sla)

Command History	Release	Modification
	7.2(0)D1(1)	This command was introduced.

Usage Guidelines Before starting the operation, install and enable the fabricpath feature set on the device.

Examples This example shows how to configure operation 6 as a Cisco NX-OS IP SLA FabricPath operation:

```
switch# configure terminal
switch(config)# feature sla sender
switch(config)# ip sla 6
switch(config-ip-sla)# fabric-path echo 1 profile 10 interface ethernet 1/0
switch(config-ip-sla-fabric)# exit
```

Related Commands	Command	Description
	show ip sla statistics	Displays the current operational status and statistics.

frequency

To set the rate at which a specified IP Service Level Agreements (SLAs) operation repeats, use the **frequency** command. To return to the default value, use the **no** form of this command.

frequency *second*

no frequency

Syntax Description	<i>seconds</i>	Number of seconds between the IP SLAs operations. The range is from 1 to 604800 seconds.
---------------------------	----------------	--

Command Default	60 seconds
------------------------	------------

Command Modes	UDP echo configuration mode (config-ip-sla-udp) UDP jitter configuration mode (config-ip-sla-jitter)
----------------------	---

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines

A single IP SLAs operation repeats at a given frequency for the lifetime of the operation. For example, a User Datagram Protocol (UDP) jitter operation with a frequency of 60 sends a collection of data packets (simulated network traffic) once every 60 seconds for the lifetime of the operation. The default simulated traffic for a UDP jitter operation consists of ten packets sent 20 milliseconds apart. This payload is sent when the operation is started and is sent again 60 seconds later.

If an individual IP SLAs operation takes longer to execute than the specified frequency value, a statistics counter called “busy” is incremented rather than immediately repeating the operation.

This command does not require a license.

Examples

This example shows how to configure an IP SLAs UDP echo operation (operation 10) to repeat every 90 seconds:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 205.199.199.2 1
switch(config-ip-sla-udp)# frequency 90
switch(config-ip-sla-udp)# ip sla schedule 10 life 300 start-time after 00:05:00
switch(config)#
```

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

history buckets-kept

To set the number of history buckets that are kept during the lifetime of a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history buckets-kept** command. To return to the default value, use the **no** form of this command.

history buckets-kept *size*

no history bucket-kept

Syntax Description	<i>size</i>	Number of history buckets kept during the lifetime of the operation. The range is from 1 to 60.
---------------------------	-------------	---

Command Default The default number of buckets kept is 15 buckets.

Command Modes TCP connect configuration mode (config-ip-sla-tcp)
UDP echo configuration mode (config-ip-sla-udp)

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines Each time that IP SLAs start an operation, a new bucket is created until the number of history buckets that matches the specified size or the lifetime of the operation expires. History buckets does not wrap (which means that the older information is not replaced by the newer information).

To define the lifetime of an IP SLAs operation, use the **ip sla schedule** command.

By default, the history for an IP SLAs operation is not collected. If history is collected, each bucket contains one or more history entries from the operation.

The type of entry stored in the history table is controlled by the **history filter** command.

The total number of entries stored in the history table is controlled by the combination of the **samples-of-history-kept**, **history buckets-kept**, and **history lives-kept** commands.

This command does not require a license.

Examples This example shows how to configure an UDP echo operation to keep 25 history buckets during the operation lifetime:

```
switch(config)# ip sla 2
switch(config-ip-sla-udp)# history buckets-kept 25
switch(config-ip-sla-udp)#
```

history distribution-of-statistics-kept

To set the number of statistics distributions kept per hop during a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history distributions-of-statistics-kept** command. To return to the default value, use the **no** form of this command.

history distributions-of-statistics-kept *size*

no history distributions-of-statistics-kept

Syntax Description	<i>size</i>	Number of statistics distribution kept per hop. The size is from 1 to 20 characters.
---------------------------	-------------	--

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

Command Modes	TCP connect configuration mode (config-ip-sla-tcp) UDP echo configuration mode (config-ip-sla-udp) UDP jitter configuration mode (config-ip-sla-jitter).
----------------------	--

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	In most situations, you does not need to change the number of statistics distributions kept or the time interval for each distribution. Change these parameters only when distributions are needed, for example, when performing statistical modeling of your network.
-------------------------	--

To set the statistics distributions interval, use the **history statistics-distribution-interval** command.

When the number of distributions reaches the size specified, no further distribution-based information is stored.

This command does not require a license.

Examples	This example shows how to set the statistics distribution to five and the distribution interval to 10 ms for an UDP echo operation. The first distribution contains statistics from 0 to 9 ms, the second distribution contains statistics from 10 to 19 ms, the third distribution contains statistics from 20 to 29 ms, the fourth distribution contain statistics from 30 to 39 ms, and the fifth distribution contains statistics from 40 ms to infinity.
-----------------	---

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 172.16.161.21
switch(config-ip-sla-udp)# history distributions-of-statistics-kept 5
switch(config-ip-sla-udp)#
```

■ history distribution-of-statistics-kept

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

history enhanced

To enable enhanced history gathering for a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history enhanced** command. To return to the default value, use the **no** form of this command.

history enhanced [*interval seconds*] [*buckets number-of-buckets*]

no history enhanced

Syntax Description

interval	(Optional) Specifies the aggregation interval.
<i>seconds</i>	Number of seconds (sec) that the enhanced history should be gathered in each bucket. When this time expires, enhanced history statistics are gathered in a new bucket. The range is from 1 to 3600 seconds.
buckets	Specifies the number of buckets to collect data.
<i>number-of-buckets</i>	Number of buckets that should be retained in the system memory. When this number is reached, statistic gathering for the operation ends. The default is 100.

Command Default

Enhanced history gathering is disabled.

Command Modes

TCP connect configuration mode (config-ip-sla-tcp)
 UDP echo configuration mode (config-ip-sla-udp)
 UDP jitter configuration mode (config-ip-sla-jitter)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

This command enables enhanced history for the IP SLAs operation.

Performance statistics are stored in buckets that separate the accumulated data. Each bucket consists of data accumulated over the specified time interval. When the interval expires, history statistics are gathered in a new bucket. When the specified number of buckets is reached, statistic gathering for the operation ends.

By default, IP SLAs maintain two hours of aggregated statistics for each operation. The value from each operation cycle is aggregated with the previously available data within a given hour. The enhanced history feature in IP SLAs allows for the aggregation interval to be shorter than one hour.

This command does not require a license.

Examples

This example shows how to enable enhanced history gathering for a Cisco NX-OS IP Service Level Agreements (SLAs) operation:

history enhanced

```
switch(config-ip-sla-udp) # history enhanced interval 900 buckets 100  
switch(config-ip-sla-udp) #
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

history filter

To define the type of information kept in the history table for a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history filter** command. To return to the default value, use the **no** form of this command.

```
history filter {all | failures | none | overThreshold}
```

```
no history filter {all | failures | none | overThreshold}
```

Syntax Description

all	Specifies that operations attempted are kept in the history table.
failures	Specifies that packets that fail for any reason are kept in the history table.
none	Specifies that no history is kept. This is the default.
all	Specifies that operations attempted are kept in the history table.
overThreshold	Specifies that only packets that are over the threshold are kept in the history table.

Command Default

No IP SLAs history is kept for an operation.

Command Modes

TCP connect configuration mode (config-ip-sla-tcp)
UDP echo configuration mode (config-ip-sla-udp)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

Use the **history filter** command to control what gets stored in the history table for an IP SLAs operation. To control how much history gets saved in the history table, **use the history lives-kept, history buckets-kept, and the samples-of-history-kept** commands.

This command does not require a license.

Examples

This example shows how to collect only the operation packets that have failed and are kept in the history table:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 192.199.199.2 1
switch(config-ip-sla-udp)# history filter failures
switch(config-ip-sla-udp)#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

history hours-of-statistics-kept

To set the number of hours for which statistics are maintained for a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history hours-of-statistics-kept** command. To return to the default value, use the **no** form of this command.

history hours-of-statistics-kept *hours*

no history hours-of-statistics-kept

Syntax Description	<i>hours</i>	Hour group size value. The range is from 0 to 25 hours.
---------------------------	--------------	---

Command Default	2 hours
------------------------	---------

Command Modes	TCP connect configuration mode (config-ip-sla-tcp) UDP echo configuration mode (config-ip-sla-udp) UDP jitter configuration mode (config-ip-sla-jitter)
----------------------	---

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	When the number of hours exceeds the specified value, the statistics table wraps (that is, the oldest information is replaced by newer information).
-------------------------	--

This command does not require a license.

Examples	This example shows how to maintain 3 hours of statistics for an UDP echo operation:
-----------------	---

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 192.199.199.2 1
switch(config-ip-sla-udp)# history hours-of-statistics-kept 3
switch(config-ip-sla-udp)#
```

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

history lives-kept

To set the number of lives maintained in the history table for a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history lives-kept** command. To return to the default value, use the **no** form of this command.

history lives-kept *lives*

no history lives-kept

Syntax Description	<i>lives</i>	Number of lives maintained in the history table for the operation. If you specify 0 lives, history is not collected for the operation. The range is from 0 to 2 lives.
---------------------------	--------------	--

Command Default	0 lives
------------------------	---------

Command Modes	TCP connect configuration mode (config-ip-sla-tcp) UDP echo configuration mode (config-ip-sla-udp)
----------------------	---

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	<p>The following rules apply to the history lives-kept command:</p> <ul style="list-style-type: none"> • The number of lives you can specify is dependent on the type of operation that you are configuring. • The default value of 0 lives means that history is not collected for the operation. • When the number of lives exceeds the specified value, the history table wraps (that is, the oldest information is replaced by newer information). • When an operation makes a transition from a pending to an active state, a life starts. When the life of an operation ends, the operation makes a transition from an active to pending state. <p>This command does not require a license.</p>
-------------------------	--

Examples	This example shows how to maintain the history for five lives of an UDP echo operation:
-----------------	---

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 192.199.199.2 1
switch(config-ip-sla-udp)# history lives-kept 1
switch(config-ip-sla-udp)#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

history statistics-distribution-interval

To set the time interval for each statistics distribution kept for a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **history statistics-distribution-interval** command. To return to the default value, use the **no** form of this command.

history statistics-distribution-interval *milliseconds*

no history statistics-distribution-interval

Syntax Description	<i>milliseconds</i>	Distribution interval value in milliseconds (ms). The range is from 1 to 100 milliseconds.
---------------------------	---------------------	--

Command Default	The default interval used for each statistics kept is 20 milliseconds.
------------------------	--

Command Modes	TCP connect configuration mode (config-ip-sla-tcp) UDP echo configuration mode (config-ip-sla-udp)
----------------------	---

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	In most situations, you does not need to change the time interval for each statistics distribution or number of distributions kept. Change these parameters only when distributions are needed, for example, when you are performing statistical modeling of your network.
-------------------------	--

This command does not require a license.

Examples	This example shows how to set the time interval for each statistics distribution kept for a Cisco NX-OS IP Service Level Agreements (SLAs) operation:
-----------------	---

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 192.199.199.2 1
switch(config-ip-sla-udp)# history statistics-distribution-interval 10
switch(config-ip-sla-udp)#
```

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

icmp-echo

To configure a Cisco nx-OS IP Service Level Agreements (SLA) Internet Control Message Protocol (ICMP) echo probe operation, use the `icmp-echo` command. To remove the settings, use the `no` form of this command.

icmp-echo *destination-ip-address*

Syntax Description	<i>destination-ip-address</i> Destination IPv4 address of the operation.
---------------------------	--

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

Command Modes	IP SLA configuration mode (<code>config-ip-sla</code>)
----------------------	--

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples	This example shows how to configure an IP SLA Internet Control Message Protocol (ICMP) echo probe operation:
-----------------	--

```
switch# configure terminal
switch(config-ip-sla)# icmp-echo 10.3.3.2
switch(config-ip-sla)#
```

Related Commands	Command	Description
	ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
	ip sla responder udp echo ipaddress	Permanently enables the IP SLAs responder functionality on a specified IP address and port.

interface

To specify an interface type and number, use the **interface** command.

interface *type-number*

Syntax Description	<i>type-number</i>	Slot number. The range is from 1 to 253.
---------------------------	--------------------	--

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

Command Modes	Interface configuration mode (config-if)
----------------------	--

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples This example shows how to specify an interface type and number:

```
switch(config)# interface ethernet 0/0
switch(config-if)#
```

Related Commands	Command	Description
	ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
	ip sla responder udp echo ipaddress	Permanently enables the IP SLAs Responder functionality on a specified IP address and port.

ip access-list

To define an IP access list access control list (ACL) in order to enable filtering for packets, use the **ip access-list** command. To remove the settings, use the **no** form of this command.

ip access-list *access-list-name*

no ip access-list *access-list-name*

Syntax Description	<i>access-list-name</i>	Access list name. The maximum size is 64 characters.
---------------------------	-------------------------	--

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

Command Modes	Global configuration mode (config)
----------------------	------------------------------------

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples	This example shows how to define an IP ACL in order to enable filtering for packets.
-----------------	--

```
switch(config)# ip access-list acl
switch(config-acl)#
```

Related Commands	Command	Description
	ip sla schedule	Configures the scheduling parameters for a single IP SLAs operation.
	ip sla group schedule	Configures the group scheduling parameters for multiple IP SLAs operations.
	show ip sla configuration	Displays configuration values including all defaults for all IP SLAs operations or the specified operation.
	show ip sla statistics	Displays the current operational status and statistics of all IP SLAs operations or a specified operation.
	show ip sla statistics aggregated	Displays the aggregated statistical errors and distribution information for all IP SLAs operations or a specified operation.

ip address

To specify a primary IP address for an interface, use the **ip address** command. To remove the default settings, use the **no** form of this command.

```
ip address ip-address-mask
```

```
no ip address ip-address-mask
```

Syntax Description	<i>ip-address-mask</i>	IP address. The IP address format is i.i.i.i.
---------------------------	------------------------	---

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

Command Modes	Global configuration mode (config)
----------------------	------------------------------------

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples	This example shows how to specify a primary IP address for an interface:
-----------------	--

```
switch(config)# interface ethernet 2/1
switch(config-if)# ip address 10.2.2.1 255.255.255.0
switch(config-if)#
```

Related Commands	Command	Description
		ip sla schedule
	ip sla group schedule	Configures the group scheduling parameters for multiple IP SLAs operations.
	show ip sla configuration	Displays configuration values including all defaults for all IP SLAs operations or the specified operation.
	show ip sla statistics	Displays the current operational status and statistics of all IP SLAs operations or a specified operation.
	show ip sla statistics aggregated	Displays the aggregated statistical errors and distribution information for all IP SLAs operations or a specified operation.

ip sla

To begin configuring a Cisco NX-OS IP Service Level Agreements (SLAs) operation and enter IP SLA configuration mode, use the **ip sla** command. To remove all configuration information for an operation, including the schedule of the operation, reaction configuration, and reaction triggers, use the **no** form of this command.

ip sla *operation-number*

no ip sla *operation-number*

Syntax Description

<i>operation-number</i>	Operation number used for the identification of the IP SLAs operation that you want to configure. The range is from 1 to 2147483647.
-------------------------	--

Command Default

No IP SLAs operation is configured.

Command Modes

Global configuration mode (config)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

Use the **ip sla** command to specify an identification number for the operation you are about to configure. After you enter this command, the router enters IP SLA configuration mode.

The **ip sla** command is supported in IPv4 networks.

IP SLAs allow a maximum of 2000 operations.

Debugging is supported only on the first 32 operation numbers.

After you configure an operation, you must schedule the operation. For information on scheduling an operation, see the **ip sla schedule** and **ip sla group schedule** global configuration commands.

After you schedule an operation, you cannot modify the configuration of the operation. To change the operation type of an existing IP SLAs operation, you must first delete the IP SLAs operation (using the **no ip sla** command) and then reconfigure the operation with the new operation type.

This command does not require a license.

Examples

This example shows how to configure operation 99 as a UDP jitter operation in an IPv4 network and schedule it to start running in 5 hours. The example shows the **ip sla** command being used in an IPv4 network.

```
switch(config)# ip sla 99
switch(config-ip-sla)# udp-jitter 172.29.139.134 1 source-port 5000 num-packets 20
switch(config-ip-sla-jitter)# ip sla schedule 99 life 300 start-time after 00:05:00
switch(config)#
```

Related Commands

Command	Description
ip sla schedule	Configures the scheduling parameters for a single IP SLAs operation.
ip sla group schedule	Configures the group scheduling parameters for multiple IP SLAs operations.
show ip sla configuration	Displays configuration values including all defaults for all IP SLAs operations or the specified operation.
show ip sla statistics	Displays the current operational status and statistics of all IP SLAs operations or a specified operation.
show ip sla statistics aggregated	Displays the aggregated statistical errors and distribution information for all IP SLAs operations or a specified operation.

ip sla group schedule

To perform group scheduling for Cisco NX-OS IP Service Level Agreements (SLAs) operations, use the **show ip sla group schedule** command. To cause all the IP SLAs operations that belong to a multioperation schedule to become inactive, use the **no** form of this command.

```
ip sla group schedule group-id {operation-ids | add operation-ids | delete operation-ids |
reschedule} schedule-period seconds [ageout seconds] [frequency [seconds | range
random-frequency-range]] [life {forever | seconds}] [start-time {hh:mm[:ss] [month day | day
month] | pending | now | after hh:mm:ss}]
```

```
no ip sla group schedule group-id
```

Syntax Description

<i>group-id</i>	Identification number for the group of IP SLAs operation to be scheduled. The range is from 0 to 65535.
<i>operation-ids</i>	List of one or more identification (ID) numbers of the IP SLAs operations to be included in a new multioperation schedule. The maximum is up to 125 characters. Indicate ranges of operation ID numbers with a hyphen. Individual ID numbers and ranges of ID numbers are delimited by a comma. For example, enter a list of operation ID numbers in any of the following ways: <ul style="list-style-type: none"> • 2, 3, 4, 9, 20. • 10-20, 30-35, 60-70. • 2, 3, 4, 90-100, 105-115.
add <i>operation-ids</i>	Specifies the ID numbers of one or more IP SLAs operations to be added to an existing multioperation schedule.
delete <i>operation-ids</i>	Specifies the ID numbers of one or more IP SLAs operations to be removed from an existing multioperation schedule.
reschedule	Recalculates the start time for each IP SLAs operation within the multioperation schedule based on the number of operations and the schedule period. Use this keyword after an operation has been added to or removed from an existing multioperation schedule.
schedule-period <i>seconds</i>	Specifies the amount of time (in seconds) for which the group of IP SLAs operations is scheduled. The range is from 1 to 604800.
ageout <i>seconds</i>	(Optional) Specifies the number of seconds to keep the IP SLAs operations in memory when they are not actively collecting information. The default is 0 (never ages out).
frequency <i>seconds</i>	(Optional) Specifies the number of seconds after which each IP SLAs operation is restarted. The frequency of all operations that belong to the multioperation schedule is overridden and set to the specified frequency. The range is from 1 to 604800. The default frequency is the value specified for the schedule period.

range <i>randow-frequency-range</i>	(Optional) Enables the random scheduler option. See the “Usage Guidelines” section for more information. The random scheduler option is disabled by default. The frequencies at which the IP SLAs operations within the multioperation schedule restart are chosen randomly within the specified frequency range (in seconds). Separate the lower and upper values of the frequency range with a hyphen (for example, 80-100).
life forever	(Optional) Schedules the IP SLAs operations to run indefinitely.
<i>seconds</i>	(Optional) Number of seconds that the IP SLAs operations actively collect information. The default is 3600 (one hour).
start-time	(Optional) Indicates the time at which the group of IP SLAs operations start collecting information. If the start time is not specified, no information is collected until the start time is configured or a trigger occurs that performs a start time now.
<i>hh:mm[:ss]</i>	(Optional) Absolute start time for the multioperation schedule using hours, minutes, and (optionally) seconds. Use the 24-hour clock notation. For example, start-time 01:02 means “start at 1:02 a.m.,” and start-time 13:01:30 means “start at 1:01 p.m. and 30 seconds.” The current day is implied unless you specify a month and day.
<i>month</i>	(Optional) Name of the month in which to start the multioperation schedule. If the month is not specified, the current month is used. Use of this argument requires that a day be specified. You can specify the month by using either the full English name or the first three letters of the month.
<i>day</i>	(Optional) Number of the day (in the range 1 to 31) on which to start the multioperation schedule. If a day is not specified, the current day is used. Use of this argument requires that a month be specified.
pending	(Optional) Indicates that no information is being collected. This is the default value.
now	(Optional) Indicates that the multioperation schedule should start immediately.
after <i>hh:mm:ss</i>	(Optional) Indicates that the multioperation schedule should start hh hours, mm minutes, and ss seconds after this command was entered.

Command Default

The multioperation schedule is placed in a pending state (that is, the group of IP SLAs operations are enabled but are not actively collecting information).

Command Modes

Global configuration mode (config)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

Although the IP SLAs multioperation scheduling functionality helps in scheduling thousands of operations, you should be cautious when specifying the number of operations, the schedule period, and the frequency to avoid any significant CPU impact.

This command does not require a license.

Examples

This example shows how to schedule IP SLAs operations 3, 4, and 6 to 10 (identified as group 1) using multioperation scheduling. In this example, the operations are scheduled to begin at equal intervals over a scheduled period of 20 seconds. The first operation (or set of operations) is scheduled to start immediately. Because the frequency is not specified, it is set to the value of the schedule period (20 seconds) by default.

```
switch# ip sla group schedule 1 3, 4, 6-10 schedule-period 20 start-time now
switch#
```

This example shows how to schedule IP SLAs operations 1 to 3 (identified as group 2) using the random scheduler option. In this example, the operations are scheduled to begin at random intervals over a schedule period of 50 seconds. The first operation is scheduled to start immediately. The frequency at which each operation restarts is chosen randomly within 80 to 100 seconds.

```
switch# ip sla group schedule 2 1-3 schedule-period 50 frequency range 80-100 start-time now
switch#
```

Related Commands

Command	Description
ip sla schedule	Configures the scheduling parameters for a single IP SLAs operation.
show ip sla configuration	Displays the configuration details of the IP SLAs operation.
show ip sla group schedule	Displays the group scheduling details of the IP SLAs operations.

ip sla schedule

To configure the scheduling parameters for a single Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **ip sla schedule** command. To stop the operation and place it in the default state (pending), use the **no** form of this command.

```
ip sla schedule group-operation-number [life { forever | seconds }] [start-time { hh:mm[:ss]
  [month day | day month] | pending | now | after hh:mm:ss }] [ageout seconds] [recurring]
```

```
no ip sla schedule operation-number
```

Syntax Description	
<i>group-operation-number</i>	Group configuration or group schedule number of the IP SLAs operation to schedule.
life forever	(Optional) Schedules the operation to run indefinitely.
<i>seconds</i>	(Optional) Number of seconds that the operation actively collects information. The default is 3600 seconds (one hour).
start-time	Time when the operation starts.
<i>hh:mm[:ss]</i>	Specifies an absolute start time using hour, minute, and (optionally) second. Use the 24-hour clock notation. For example, start-time 01:02 means start at 1:02 a.m., and start-time 13:01:30 means start at 1:01 p.m. and 30 seconds. The current day is implied unless you specify a <i>month</i> and <i>day</i> .
month	(Optional) Specifies the name of the month to start the operation in. If the month is not specified, the current month is used. Use of this argument requires that a day be specified as well. You can specify the month by using either the full English name or the first three letters of the month.
day	(Optional) Specifies the number of the day (in the range 1 to 31) to start the operation on. If a day is not specified, the current day is used. Use of this argument requires that a month be specified as well.
pending	(Optional) Specifies that no information is collected. This is the default value.
now	(Optional) Specifies that the operation should start immediately.
after <i>hh:mm:ss</i>	(Optional) Indicates that the operation should start <i>hh</i> hours, <i>mm</i> minutes, and <i>ss</i> seconds after this command was entered.
ageout <i>seconds</i>	(Optional) Specifies the number of seconds to keep the operation in memory when it is not actively collecting information. The default is 0 seconds (never ages out).
recurring	(Optional) Specifies that the operation starts automatically at the specified time and for the specified duration everyday.

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines

After you schedule the operation with the **ip sla schedule** command, you cannot change the configuration of the operation. To change the configuration of the operation, use the **no** form of the **ip sla global** configuration and reenter the configuration information.

The following time line shows the aged-out process of the operation:

W-----X-----Y-----Z

where

- W is the time that the operation was configured with the **ip sla** command.
- X is the start time or start of life of the operation (that is, when the operation became active).
- Y is the end of life as configured with the **ip sla schedule** command (life seconds have counted down to zero).
- Z is the aged-out time of the operation.

When the operation is in an active state, it immediately begins collecting information.

The aged-out time starts counting down at W and Y, is suspended between X and Y, and is reset to its configured size at Y.

The operation can ageout before it executes (that is, Z can occur before X). To ensure that this situation does not happen, configure the difference between the operation's configuration time and start time (X and W) to be less than the aged-out seconds.

The **recurring** keyword is supported only for scheduling single IP SLAs operations. You cannot schedule multiple IP SLAs operations using the **ip sla schedule** command. The life value for a recurring IP SLAs operation should be less than one day. The aged-out value for a recurring operation must be "never" (which is specified with the value 0), or the sum of the life and aged-out values must be more than one day. If the recurring option is not specified, the operations are started in the existing normal scheduling mode.

This command does not require a license.

Examples

This example shows how to configure scheduling operation 3 to begin collecting data immediately and to run indefinitely:

```
switch(config)# ip sla schedule 3 start-time now life forever
switch(config)#
```

This example shows how to configure scheduling operation 15 to begin automatically collecting data every day at 1:30 a.m.:

```
switch(config)# ip sla schedule 15 start-time 01:30:00 recurring
switch(config)#
```

Related Commands

Command	Description
ip sla group schedule	Performs group scheduling for IP SLAs operations.

match ip address

To define the criteria for whether appropriate packets meet the particular policy, use the **match ip address** command. To return to default setting, use the **no** form of this command.

match ip address *access-list*

no match ip address *access-list*

Syntax Description	<i>access-list</i>	Specifies the IP access list name. The maximum size is 63 characters.
--------------------	--------------------	---

Defaults	None
----------	------

Command Modes	Route-map configuration mode (config-route-map)
---------------	---

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines

The match clauses define the criteria for whether appropriate packets meet the particular policy (that is, the condition to be met). The set clauses then explain how the packets should be routed once they have met the match criteria. To match packets based on IP address use the **match ip address** command. The IP standard or extended ACLs can be used to establish the match criteria. The standard IP access lists can be used to specify the match criteria based on application, protocol type, type of service (ToS), and precedence.

This command does not require a license.

Examples

This example shows how to define the criteria for whether appropriate packets meet the particular policy:

```
switch(config)# route-map PBR
switch(config-route-map)# match ip address ACL
switch(config-ip-sla)#
```

Related Commands	Command	Description
	filter-for-history	Defines the type of information kept in the history table for the IP SLAs operation.
	ip sla monitor	Begins the configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

Command	Description
lives-of-history-kept	Sets the number of lives maintained in the history table for the IP SLAs operation.
samples-of-history-kept	Sets the number of entries kept in the history table per bucket for the IP SLAs operation.

next-hop-address

To specify match address of route or match packet, use the **match ip address** command. To return to the default setting, use the **no** form of this command.

match ip address *access-list*

no match ip address *access-list*

Syntax Description	<i>access-list</i>	IP access list name. The maximum size is 63 characters.
---------------------------	--------------------	---

Defaults	None.
-----------------	-------

Command Modes	Route-map configuration mode (config-route-map)
----------------------	---

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples This example show how to specify match address of route or match packet:

```
switch(config)# route-map PBR
switch(config-route-map)# match ip address ACL
switch(config-ip-sla)#
```

Related Commands	Command	Description
	filter-for-history	Defines the type of information kept in the history table for the IP SLAs operation.
	ip sla monitor	Begins the configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.
	lives-of-history-kept	Sets the number of lives maintained in the history table for the IP SLAs operation.
	samples-of-history-kept	Sets the number of entries kept in the history table per bucket for the IP SLAs operation.

operation-packet-priority

To specify the packet priority in a Cisco NX-OS IP Service Level Agreements (SLAs) operation template, use the **operation-packet priority** command. To return to the default value, use the **no** form of this command.

operation-packet-priority {normal | high}

no operation-packet-priority

Syntax Description

normal	Specifies that the packet priority is normal.
high	Specifies that the packet priority is high.

Command Default

Packet priority is normal.

Command Modes

UDP jitter configuration (config-ip-sla-jitter)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

Increasing the packet priority of an IP SLAs operation can reduce the delay time for the packets in the queue. This command is supported by the IP SLAs User Datagram Protocol (UDP) jitter operation only. This command does not require a license.

Examples

The following example shows how to enable microsecond precision, configure the Network Time Protocol (NTP) synchronization offset tolerance to 10 percent, and set the packet priority to high for an IP SLAs UDP jitter operation:

```
switch# ip sla configuration
switch(config)# ip sla 1
switch(config-ip-sla)# udp-jitter 205.199.199.2 dest-port 9006
switch(config-ip-sla-jitter)# clock-tolerance ntp oneway percent 10
switch(config-ip-sla-jitter)# operation-packet-priority high
%This configuration allowed only on microsecond precision probe
switch(config-ip-sla-jitter)# ip sla schedule 1 life forever start-time after 00:00:06
switch(config)#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

owner

To configure the Simple Network Management Protocol (SNMP) owner of a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **owner** command in the appropriate submode of IP SLA configuration. To return to the default value, use the **no** form of this command.

owner *string*

no owner

Syntax Description

<i>string</i>	Name of the SNMP owner. The maximum size is 127 characters.
---------------	---

Command Default

No owner is specified.

Command Modes

IP SLA configuration mode (config-ip-sla)
 UDP echo configuration mode (config-ip-sla-udp)
 UDP jitter configuration mode (config-ip-sla-jitter)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

The owner name contains one or more of the following: ASCII form of the network management station's transport address, network management station name (that is, the domain name), and network management personnel's name, location, or phone number. In some cases, the agent itself will be the owner of the operation. In these cases, the name can begin with "agent."

This command does not require a license.

Examples

This example shows how to set the owner of IP SLAs UDP echo operation 1 to 1234:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 192.168.202.169 9006
switch(config-ip-sla-udp)# owner 1234
switch(config-ip-sla-jitter)# ip sla schedule 1 life forever start-time after 00:00:06
switch(config)#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

permit ip

To create an access control list (ACL) rule that permits traffic matching its conditions, use the **permit ip** command. To return to the default value, use the **no** form of this command.

permit ip *source destination*

no permit ip *source destination*

Syntax Description	<i>source destination</i> Source network address and the destination network address.				
Command Default	None.				
Command Modes	IP ACL configuration mode				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>6.2(2)</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	6.2(2)	This command was introduced.
Release	Modification				
6.2(2)	This command was introduced.				
Usage Guidelines	This command does not require a license.				
Examples	<p>This example shows how to create an access control list (ACL) rule that permits traffic matching its conditions:</p> <pre>switch(config)# ip access-list acl switch(config-acl)# permit ip 10.2.2.20/24 10.1.1.1/32 switch(config-acl)#</pre>				
Related Commands	<table border="1"> <thead> <tr> <th>Command</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>show ip sla auto group</td> <td>Displays the configuration including default values of IP SLAs auto-measure groups.</td> </tr> </tbody> </table>	Command	Description	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.
Command	Description				
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.				

precision

To set the level of precision at which the statistics for a Cisco NX-OS IP Service Level Agreements (SLAs) operation are measured, use the **precision** command. To return to the default value, use the **no** form of this command.

precision { **millisecond** | **microseconds** }

no precision

Syntax Description

milliseconds	Sets the precision of IP SLAs operation measurements to 1 millisecond (ms).
microseconds	Sets the precision of IP SLAs operation measurements to 1 microsecond (usec).

Command Default

Measurements for the IP SLAs operation are displayed in milliseconds.

Command Modes

IP SLA configuration mode
UDP jitter configuration mode (config-ip-sla)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

If the **milliseconds** keyword is configured (default), the measurements for an IP SLAs operation are displayed with the granularity of 1 ms. For example, a value of 22 equals 22 ms. If you use the **microseconds** keyword, the measurements for an IP SLAs operation are displayed with the granularity of 1 microsecond. For example, a value of 202 equals 202 microseconds.

This command is supported by the IP SLAs User Datagram Protocol (UDP) jitter operation only.

Examples

This example shows how to enable microsecond precision, configure the Network Time Protocol (NTP) synchronization offset tolerance to 10 percent, and set the packet priority to high for an IP SLAs UDP jitter operation.

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-jitter 192.168.202.169 9006
switch(config-ip-sla-jitter)# precision microseconds
switch(config-ip-sla-jitter)# clock-tolerance ntp oneway percent 10
switch(config-ip-sla-jitter)# ip sla schedule 1 life forever start-time after 00:00:06
switch(config)#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

request-data-size

To set the protocol data size in the payload of a Cisco NXOS IP Service Level Agreements (SLAs) operation's request packet, use the **request-data-size** command. To return to the default value, use the **no** form of this command.

request-data-size *bytes*

no request-data-size

Syntax Description	<i>bytes</i>	Size of the protocol data in the payload of the request packet of the operation, in bytes. The range is from 4 to 1500.
---------------------------	--------------	---

Command Default	The default data size varies depending on the type of IP SLAs operation that you are configuring.	
------------------------	---	--

Command Modes	IP SLA configuration mode (config-ip-sla) UDP echo configuration mode (config-ip-sla-udp)
----------------------	--

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	The request-data-size command can be used to set the padding size for the data frame of an IP SLAs Ethernet operation. This command does not require a license.
-------------------------	---

Examples	This example shows how to set the request packet size to 40 bytes for an IP SLAs UDP echo operation: <pre>switch(config)# ip sla 1 switch(config-ip-sla)# udp-echo 172.16.1.175 1 switch(config-ip-sla-udp)# request-data-size 40 switch(config-ip-sla-udp)# ip sla schedule 3 life forever start-time now life forever switch(config)#</pre>
-----------------	--

Related Commands	Command	Description
	auto ip sla mpls-lsp-monitor	Begins the configuration for an IP SLAs LSP Health Monitor operation and enters auto IP SLA MPLS configuration mode.

route-map

To specify a route map, use the **route-map** command. To return to the default value, use the **no** form of this command.

```
route-map map-tag
```

```
no route-map map-tag
```

Syntax Description	map-tag	Route map name. The maximum size is 63 characters.
--------------------	---------	--

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

Command Modes	Route-map configuration mode (config-route-map)
---------------	---

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines	This command does not require a license.
------------------	--

Examples	This example shows how to specify a route map:
----------	--

```
switch# configure terminal
switch(config)# route-map PBR
switch(config-route-map)#
```

Related Commands	Command	Description
	auto ip sla mpls-lsp-monitor	Begins the configuration for an IP SLAs LSP Health Monitor operation and enters auto IP SLA MPLS configuration mode.

set ip default next-hop

To configure a route map that sets the next-hop IPv4 address as the default, use the **set ip default next-hop** command. To delete an entry, use the **no** form of this command.

```
set ip default next-hop ip-address [...ip-address] [load-share | verify-availability]
```

```
no set ip default next-hop ip-address [...ip-address]
```

Syntax Description		
<i>ip-address</i>	IPv4 address of the next hop to which packets are output. The next hop must be an adjacent router. You can configure up to 32 IP addresses.	
load-share	(Optional) Enables load sharing.	
verify-availability	Verifies the reachability of the tracked object.	

Defaults	
Disabled	

Command Modes	
Route-map configuration (config-route-map)	

Supported User Roles	
network-admin vdc-admin	

Command History	Release	Modification
	4.0(1)	This command was introduced.

Usage Guidelines	
An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the <i>ip-address</i> argument.	

Use this command to provide certain users a different default route. If the software has no explicit route for the destination in the packet, it routes the packet to this next hop. The first next hop specified with the **set ip default next-hop** command needs to be adjacent to the router. The optional specified IP addresses are tried in turn.

Use the **ip policy route-map** command, the **route-map** global configuration command, and the **match** and **set** commands to define the conditions for policy routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

The set clauses can be used with one another. They are evaluated in the following order:

1. **set ip next-hop**
2. **set ip default next-hop**



Note

The **set ip next-hop** and **set ip default next-hop** command are similar but have a different order of operations. Configuring the **set ip next-hop** command causes the system to use policy routing first and then use the routing table. Configuring the **set ip default next-hop** command causes the system to use the routing table first and then policy route the specified next hop.

For software-forwarded traffic, the route that is present in the unicast routing table (of the VRF in which packet was received) for the packet-specified destination takes preference over what is specified in the **set ip default next-hop** command when there is condition match. Even if there is a default route present in the VRF, that default route overrides what is set in the command. This applies to software-forwarded traffic only.

This command does not require a license.

Examples

This example shows how to configure a route map that sets the IPv4 default next-hop address as the default:

```
switch(config)# ip access-list test
switch(config-ip-acl)# permit ip 192.0.2.0/24 any
switch(config-ip-acl)# exit
switch(config)# route-map equal-access
switch(config-route-map)# match ip address test
switch(config-route-map)# set ip default next-hop ip 192.0.2.3
switch(config-route-map)# exit
switch(config)# interface ethernet 2/1
switch(config-if)# ip policy route-map equal-access
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or expanded access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric	Redistributes routes with the metric specified.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.

Command	Description
set community	Sets the BGP communities attribute.
set level	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

set ip next-hop verify-availability

To configure the route map to verify the reachability of the tracked object, use the **set ip next-hop verify-availability** command. To return to the default value, use the **no** form of this command.

```
set ip next-hop verify-availability next-hop-address [track object] [load-share]
```

```
no set ip next-hop verify-availability next-hop-address [track object] [load-share]
```

Syntax Description		
<i>next-hop-address</i>		IP address of the next hop to which packets will be forwarded.
track		(Optional) The tracking method is track.
<i>object</i>		Object number that the tracking subsystem is tracking. The acceptable range is from 1 to 500.
load-share		(Optional) Enables load sharing.

Command Default The NTP clock synchronization tolerance is set to 0 percent.

Command Modes UDP jitter configuration mode (config-ip-sla-jitter)
Route-map configuration (config-route-map)

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines This command does not require a license.

Examples This example shows how to configure the route map to verify the reachability of the tracked object:

```
switch(config-route-map)# set ip next-hop verify-availability 10.3.3.2
track 1
```

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

set ipv6 default next-hop

To indicate where to output packets that pass a match clause of a route map for policy routing and for which the Cisco NX-OS software has no explicit route to a destination, use the **set ipv6 default next-hop** command. To delete an entry, use the **no** form of this command.

```
set ipv6 default next-hop ipv6-address [...ipv6-address] [load-share | verify-availability]
```

```
no set ipv6 default next-hop ipv6-address [...ipv6-address] [load-share | verify-availability]
```

Syntax Description

<i>ipv6-address</i>	IPv6 address of the next hop to which packets are output. The next hop must be an adjacent router. You can configure up to 32 IPv6 addresses.
load-share	(Optional) Enables load sharing.
verify-availability	Verifies the reachability of the tracked object.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration (config-route-map)

Supported User Roles

network-admin
vdc-admin

Command History

Release	Modification
4.2(1)	This command was introduced.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *ipv6-address* argument.

Use this command to provide certain users a different default route. If the software has no explicit route for the destination in the packet, then it routes the packet to this next hop. The first next hop specified with the **set ipv6 default next-hop** command needs to be adjacent to the router. The optional specified IP addresses are tried in turn.

Use the **ipv6 policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands to define the conditions for policy routing packets. The **ipv6 policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

The set clauses can be used with one another. They are evaluated in the following order:

1. **set ipv6 next-hop**
2. **set ipv6 default next-hop**



Note

The **set ipv6 next-hop** and **set ipv6 default next-hop** are similar commands but have a different order of operations. Configuring the **set ipv6 next-hop** command causes the system to use policy routing first and then use the routing table. Configuring the **set ipv6 default next-hop** command causes the system to use the routing table first and then policy route the specified next hop.

This command does not require a license.

Examples

This example shows how to configure a route map that sets the IPv6 default next-hop address:

```
switch(config)# ipv6 access-list test
switch(config-ipv6-acl)# permit ipv6 2001:0DB8::/48 any
switch(config-ipv6-acl)# exit
switch(config)# route-map equal-access
switch(config-route-map)# match ipv6 address test
switch(config-route-map)# set ipv6 default next-hop 2001:0DB8::3
switch(config-route-map)# exit
switch(config)# interface ethernet 2/1
switch(config-if)# ipv6 policy route-map equal-access
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match ipv6 address	Distributes any routes that have a destination network number address that is permitted by a standard or expanded access list, and performs policy routing on packets.
match ipv6 next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ipv6 route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric	Redistributes routes with the metric specified.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set community	Sets the BGP communities attribute.
set level	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.

■ set ipv6 default next-hop

Command	Description
set tag	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

set ipv6 next-hop verify-availability

To configure the route map to verify the reachability of the tracked object, use the **set ipv6 next-hop verify-availability** command. To return to the default value, use the **no** form of this command.

```
set ipv6 next-hop verify-availability next-hop-address track object
```

```
no set ipv6 next-hop verify-availability
```

Syntax Description		
	<i>next-hop-address</i>	IPv6 address of the next hop to which packets will be forwarded.
	track	(Optional) The tracking method is track.
	<i>object</i>	Object number that the tracking subsystem is tracking. The acceptable range is from 1 to 500.

Command Default The NTP clock synchronization tolerance is set to 0 percent.

Command Modes UDP jitter configuration mode (config-ip-sla-jitter)
Route-map configuration (config-route-map)

Command History	Release	Modification
	6.2(2)	This command was introduced.

Usage Guidelines This command does not require a license.

Examples This example shows how to configure the route map to verify the reachability of the tracked object:

```
switch(config-route-map)# set ipv6 next-hop verify-availability 2001:DB8:1::1
track 1
```

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

show ip sla application

To display global information about the Cisco NX-OS IP Service Level Agreements (SLAs) application, use the **show ip sla application** command.

show ip sla application

Syntax Description This command has no arguments or keywords.

Command Default Displays output for all running IP SLAs operations.

Command Modes User EXEC
Privileged EXEC

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines Use the **show ip sla application** command to display information such as the supported operation types and supported protocols.

This command does not require a license.

Examples This example shows how to display information about the IP SLA application:

```
switch# show ip sla application
IP Service Level Agreements
Version: Round Trip Time MIB 2.2.0, Infrastructure Engine-III

Supported Operation Types:
    udpEcho, tcpConnect, udpJitter

Supported Features:

IP SLAs low memory water mark: 82503446
Estimated system max number of entries: 60427

Estimated number of configurable operations: 60417
Number of Entries configured      : 10
Number of active Entries          : 4
Number of pending Entries         : 0
Number of inactive Entries        : 6
Time of last change in whole IP SLAs: 02:43:20 UTC Fri Apr 13 2012
switch#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

show ip sla configuration

To display configuration values including all defaults for all Cisco NX-OS IP Service Level Agreements (SLAs) operations or a specified operation, use the **show ip sla configuration** command.

show ip sla configuration [operation]

Syntax Description	operation	(Optional) Displays the number of the IP SLAs operation for which the details are displayed. The range is from 1 to 2147483647.
---------------------------	------------------	---

Command Default	User EXEC Privileged EXEC
------------------------	------------------------------

Command Modes	None
----------------------	------

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples This example shows how to display the configuration values including all defaults for all Cisco NX-OS IP Service Level Agreements (SLAs) operations or a specified operation:

```
switch# show ip sla configuration 3
IP SLAs Infrastructure Engine-III
Entry number: 3
Owner: 12345
Tag:
Operation timeout (milliseconds): 5000
Type of operation to perform: udp-echo
Target address/Source address: 172.16.1.176/0.0.0.0
Target port/Source port: 1/0
Type Of Service parameter: 0x80
Request size (ARR data portion): 16
Verify data: No
Data pattern:
Vrf Name: default
Control Packets: enabled
Schedule:
  Operation frequency (seconds): 60 (not considered if randomly schedule
  Next Scheduled Start Time: Pending trigger
  Group Scheduled : FALSE
  Randomly Scheduled : FALSE
  Life (seconds): 3600
  Entry Ageout (seconds): never
  Recurring (Starting Everyday): FALSE
  Status of entry (SNMP RowStatus): notInService
```

```
Threshold (milliseconds): 5000
Distribution Statistics:
  Number of statistic hours kept: 2
  Number of statistic distribution buckets kept: 1
  Statistic distribution interval (milliseconds): 20
History Statistics:
  Number of history Lives kept: 0
  Number of history Buckets kept: 15
  History Filter Type: None
switch#
```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

show ip sla group schedule

To display the group schedule details for Cisco NX-OS IP Service Level Agreements (SLAs) operations, use the **show ip sla group schedule** command.

```
show ip sla group schedule group-operation-number
```

Syntax Description	<i>group-operation-number</i> (Optional) Number of the IP SLAs group operation. The range is from 1 to 2147483647.
---------------------------	--

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

Command Modes	User EXEC mode Privileged EXEC mode
----------------------	--

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	This command does not require a license.
-------------------------	--

Examples	This example shows how to display the information about group (multiple) scheduling. The last line in this example indicates that the IP SLAs operations are multiple times scheduled (TRUE):
-----------------	---

```
switch# show ip sla group schedule
Multi-Scheduling Configuration:
Group Entry Number: 1
Probes to be scheduled: 2,3,4,9-30,89
Schedule period :60
Group operation frequency: 30
Multi-scheduled: TRUE
switch#
```

Related Commands	Command	Description
	show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

show ip sla statistics

To display the current operational status and statistics of all Cisco NX-OS IP Service Level Agreements (SLAs) operations or a specified operation over the last one hour, use the **show ip sla statistics** command.

show ip sla statistics [*operation-number*] [**aggregated**] [**details**]

Syntax Description		
	<i>operation-number</i>	(Optional) Number of the operation for which operational status and statistics are displayed.
	aggregated	(Optional) Displays detailed aggregated information about the IP SLAs statistics.
	details	(Operational) Operational status and statistics are displayed in greater detail.

Command Default	
	User EXEC Privileged EXEC

Command Modes	
	Displays output for all running IP SLAs operations.

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	
	Use the show ip sla statistics command to display the current state of IP SLAs operations, including how much life the operation has left, whether the operation is active, and the completion time. The output also includes the monitoring data returned for the last (most recently completed) operation.
	This command does not require a license.

Examples	
	This example shows how to display the operational status and statistics over the last one hour:

```
switch# show ip sla statistics
IPSLAs Latest Operation Statistics
IPSLA operation id: 1
    Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: 02:53:02 UTC Fri Apr 13 2012
Latest operation return code: No connection
Number of successes: 0
Number of failures: 17
Operation time to live: forever
IPSLA operation id: 2
Number of successes: Unknown
Number of failures: Unknown
Operation time to live: 0 sec

IPSLA operation id: 3
Number of successes: Unknown
```

```

Number of failures: Unknown
Operation time to live: 0 sec

IPSLA operation id: 4
Number of successes: Unknown
Number of failures: Unknown
Operation time to live: 0 sec

IPSLA operation id: 5
  Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: 02:52:40 UTC Fri Apr 13 2012
Latest operation return code: No connection
Number of successes: 0
Number of failures: 59
Operation time to live: forever

IPSLA operation id: 6
Number of successes: Unknown
Number of failures: Unknown
Operation time to live: 0 sec

IPSLA operation id: 10
  Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: 02:52:50 UTC Fri Apr 13 2012
Latest operation return code: Timeout
Number of successes: 0
Number of failures: 4
Operation time to live: 0 sec

IPSLA operation id: 11
  Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: 02:52:55 UTC Fri Apr 13 2012
Latest operation return code: No connection
Number of successes: 0
Number of failures: 30
Operation time to live: forever

IPSLA operation id: 12
  Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: 02:52:20 UTC Fri Apr 13 2012
Latest operation return code: No connection
Number of successes: 0
Number of failures: 31
Operation time to live: forever

IPSLA operation id: 99
Type of operation: udp-jitter
  Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: 01:36:53 UTC Fri Apr 13 2012
Latest operation return code: No connection
RTT Values:
  Number Of RTT: 0                RTT Min/Avg/Max: 0/0/0 milliseconds
Latency one-way time:
  Number of Latency one-way Samples: 0
  Source to Destination Latency one way Min/Avg/Max: 0/0/0 milliseconds
  Destination to Source Latency one way Min/Avg/Max: 0/0/0 milliseconds
Jitter Time:
  Number of SD Jitter Samples: 0
  Number of DS Jitter Samples: 0
  Source to Destination Jitter Min/Avg/Max: 0/0/0 milliseconds
  Destination to Source Jitter Min/Avg/Max: 0/0/0 milliseconds
Packet Loss Values:
  Loss Source to Destination: 0
  Source to Destination Loss Periods Number: 0

```

```

Source to Destination Loss Period Length Min/Max: 0/0
Source to Destination Inter Loss Period Length Min/Max: 0/0
Loss Destination to Source: 0
Destination to Source Loss Periods Number: 0
Destination to Source Loss Period Length Min/Max: 0/0
Destination to Source Inter Loss Period Length Min/Max: 0/0
Out Of Sequence: 0      Tail Drop: 0
Packet Late Arrival: 0  Packet Skipped: 0
Voice Score Values:
  Calculated Planning Impairment Factor (ICPIF): 0
  Mean Opinion Score (MOS): 0
Number of successes: 0
Number of failures: 5
Operation time to live: 0 sec
switch#

```

This example shows how to display the aggregated statistics:

```

switch# show ip sla statistics aggregated
IPSLAs aggregated statistics
IPSLA operation id: 1
Start Time Index: 01:37:02 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 60
Start Time Index: 02:37:02 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 23
IPSLA operation id: 2
Operation has not started
IPSLA operation id: 3
Operation has not started
IPSLA operation id: 4
Operation has not started
IPSLA operation id: 5
Start Time Index: 01:54:40 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 60
Start Time Index: 02:54:40 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 5
IPSLA operation id: 6
Operation has not started
IPSLA operation id: 10
Start Time Index: 02:48:20 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 4
IPSLA operation id: 11
Type of operation: tcp-connect
Start Time Index: 01:23:55 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 60
Start Time Index: 02:23:55 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 36
IPSLA operation id: 12
Start Time Index: 01:22:20 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 60
Start Time Index: 02:22:20 UTC Fri Apr 13 2012
Number of successes: 0
Number of failures: 37
IPSLA operation id: 99
Start Time Index: 01:32:53 UTC Fri Apr 13 2012

```

show ip sla statistics

```

Type of operation: udp-jitter
Voice Scores:
    MinOfICPIF: 0    MaxOfICPIF: 0    MinOfMOS: 0    MaxOfMOS: 0
RTT Values:
    Number Of RTT: 0          RTT Min/Avg/Max: 0/0/0 millisecond
Latency one-way time:
    Number of Latency one-way Samples: 0
    Source to Destination Latency one way Min/Avg/Max: 0/0/0 milliseco
    Destination to Source Latency one way Min/Avg/Max: 0/0/0 milliseco
Jitter Time:
    Number of SD Jitter Samples: 0
    Number of DS Jitter Samples: 0
    Source to Destination Jitter Min/Avg/Max: 0/0/0 milliseconds
    Destination to Source Jitter Min/Avg/Max: 0/0/0 milliseconds
Packet Loss Values:
    Loss Source to Destination: 0
    Source to Destination Loss Periods Number: 0
    Source to Destination Loss Period Length Min/Max: 0/0
    Source to Destination Inter Loss Period Length Min/Max: 0/0
    Loss Destination to Source: 0
    Destination to Source Loss Periods Number: 0
    Destination to Source Loss Period Length Min/Max: 0/0
    Destination to Source Inter Loss Period Length Min/Max: 0/0
    Out Of Sequence: 0      Tail Drop: 0
    Packet Late Arrival: 0  Packet Skipped: 0
Number of successes: 0
Number of failures: 5
switch#

```

Related Commands

Command	Description
show ip sla auto group	Displays the configuration including default values of IP SLAs auto-measure groups.

tag

To specify the data pattern in a Cisco NX-OS IP Service Level Agreements (SLAs) operation to test for data corruption, use the **tag** command. To remove the data pattern specification, use the **no** form of this command.

tag *text*

no tag

Syntax Description

<i>text</i>	Name of a group to which the operation belongs.
-------------	---

Defaults

No tag identifier is specified.

Command Modes

IP SLA configuration (ip-sla-config).

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

An operation tag is used to logically link operations in a group.

Tags can be used to support automation (for example, by using the same tag for two different operations on two different routers echoing the same target).

Examples

This example shows how to specify the data pattern in an IPv4 network in UDP echo configuration mode within IP SLA configuration mode:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 172.16.1.176 1
switch(config-ip-sla-udp)# tag testoperation
switch(config-ip-sla-udp)# ip sla schedule 1 life forever start-time now life forever
switch(config)#
```

Related Commands

Command	Description
ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
ip sla monitor	Begins the configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

tcp-connect

To define a Cisco NX-OS IP Service Level Agreements (SLAs) Transmission Control Protocol (TCP) connection operation, use the **tcp-connect** command.

```
tcp-connect {destination-ip-address | destination-hostname} destination-port [source-ip
  {ip-address | hostname} source-port port-number] [control {enable | disable}]
```

Syntax Description	
<i>destination-ip-address</i>	Destination IPv4 address.
<i>destination-hostname</i>	Destination IPv4 hostname.
<i>destination-port</i>	Destination port number.
source-ip	(Optional) Specifies the source IPv4 address. When a source IP address is not specified, IP SLAs choose the IP address nearest to the destination.
<i>ip-address</i>	Source IPv4 hostname.
<i>hostname</i>	Hostname.
source-port	(Optional) Specifies the source port.
<i>port-number</i>	Source port number. When a port number is not specified, IP SLAs choose an available port.
control	(Optional) Controls the IP SLAs control protocol to send a control message to the IP SLAs responder prior to sending an operation packet. By default, IP SLAs control messages are sent to the destination device to establish a connection with the responder.
enable	Enables the IP SLAs control protocol to send a control message to the IP SLAs responder prior to sending an operation packet.
disable	Disables the IP SLAs control protocol to send a control message to the IP SLAs responder prior to sending an operation packet.

Command Default No IP SLAs operation type is associated with the operation number being configured.

Command Modes IP SLA configuration (config-ip-sla)

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines The TCP connection operation is used to discover the time required to connect to the target device. This operation can be used to test virtual circuit availability or application availability. If the target is a Cisco router, IP SLAs make a TCP connection to any port number specified by the user. If the destination is a non-Cisco IP host, you must specify a known target port number (for example, 21 for FTP, 23 for Telnet, or 80 for an HTTP server). This operation is useful in testing Telnet or HTTP connection times.

You must enable the IP SLAs responder on the target router before you can configure a TCP Connect operation.

The control protocol is required when the target device is a Cisco router that does not natively provide the UDP or TCP Connect service. Prior to sending an operation packet to the target router, IP SLAs sends a control message to the IP SLAs responder to enable the destination port. If you disable control by using the **control disable** keyword combination with this command, you must define the IP address of the source for the responder by using the **ip sla responder tcp-connect ipaddress** command on the destination device.

This command does not require a license.

Examples

This example shows how to configure IP SLAs operation 11 as a TCP connection operation using the destination IP address 172.16.1.175 and the destination port 2400:

```
switch(config)# ip sla 11
switch(config-ip-sla)# tcp-connect 172.16.1.175 2400
!
switch(config-ip-sla-tcp)# ip sla schedule 11 start-time now life forever
switch(config)#
```

Related Commands

Command	Description
ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
ip sla responder udp echo ipaddress	Permanently enables the IP SLAs Responder functionality on a specified IP address and port.

threshold

To set the class of service (CoS) for a Cisco NX-OS IP Service Level Agreements (SLAs) Ethernet operation, use the **threshold** command. To return to the default value, use the **no** form of this command.

threshold *milliseconds*

no threshold

Syntax Description	<i>milliseconds</i>	Length of time required for a rising threshold to be declared, in milliseconds (ms). The range is from 0 to 60000. The default is 5000.
---------------------------	---------------------	---

Command Default	5000 ms
------------------------	---------

Command Modes	UDP echo configuration mode (config-ip-sla-udp) UDP jitter configuration mode (config-ip-sla-jitter).
----------------------	--

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	<p>The value specified for this command must not exceed the value specified for the timeout command.</p> <p>The threshold value configured by this command is used only to calculate network monitoring statistics created by a Cisco NX-OS IP SLAs operation. This value is not used for generating Simple Network Management Protocol (SNMP) trap notifications. Use the ip sla reaction-configuration command to configure the thresholds for generating IP SLAs SNMP trap notifications.</p> <p>This command does not require a license.</p>
-------------------------	--

Examples	This example shows how to configure the threshold of the IP SLAs UDP echo operation to 4000:
-----------------	--

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 172.16.1.176 1
switch(config-ip-sla-udp)# threshold 4000
switch(config-ip-sla-udp)# ip sla schedule 1 start-time now life forever
switch(config)#
```

Related Commands	Command	Description
	ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
	ip sla ethernet-monitor	Begins the configuration for an IP SLAs auto Ethernet operation and enters IP SLA Ethernet monitor configuration mode.

timeout

To enable or disable control messages in an auto IP Service Level Agreements (SLAs) operation template, use the **control** command. To return to the default value, use the **no** form of this command.

timeout *milliseconds*

no timeout

Syntax Description	<i>milliseconds</i>	Length of time that the operation waits to receive a response from its request packet, in milliseconds (ms). The range is from 0 to 604800000. The value of the milliseconds argument should be based on the sum of both the maximum round-trip time (RTT) value for the packets and the processing time of the IP SLAs operation.
---------------------------	---------------------	---

Command Default The default timeout value varies depending on the type of IP SLAs operation that you are configuring.

Command Modes

- IP SLA configuration mode (config-ip-sla)
- UDP echo configuration mode (config-ip-sla-udp)
- UDP jitter configuration mode (config-ip-sla-jitter)
- TCP connect configuration (config-tplt-tcp-conn)
- UDP echo configuration (config-tplt-udp-ech)

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines

The value of the milliseconds argument should be based on the sum of both the maximum round-trip time (RTT) value for the packets and the processing time of the IP SLAs operation.

Use the **timeout** command to set how long the operation waits to receive a response from its request packet, and use the **frequency** command to set the rate at which the IP SLAs operation restarts. The value specified for the **timeout** command cannot be greater than the value specified for the **frequency** command.

This command does not require a license.

Examples This example shows how to set the timeout value for an IP SLAs operation 1 from 5000 ms:

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 172.16.1.176 1
switch(config-ip-sla-udp)# timeout 5000
switch(config-ip-sla-udp)# ip sla schedule 1 start-time now
switch(config)#
```

Related Commands	Command	Description
	ip sla auto template	Enters IP SLA template configuration mode for defining an auto IP SLAs operation template.
	ip sla responder tcp-connect ipaddress	Defines the IP address of the source for the Cisco NX-OS IP SLAs responder for TCP connect operations.
	ip sla responder udp-echo ipaddress	Defines the IP address of the source for the Cisco NX-OS IP SLAs responder for UDP echo or jitter operations.
	show ip sla auto template	Displays the configuration including default values of auto IP SLAs operation templates.

tos

To define a type of service (ToS) byte in the IPv4 header of a Cisco NX-OS IP Service Level Agreements (SLAs) operation, use the **tos** command. To return to the default value, use the **no** form of this command.

tos *number*

no tos

Syntax Description	<i>number</i>	Service type byte in the IPv4 header. The range is from 1 to 255.
--------------------	---------------	---

Defaults	None
----------	------

Command Modes	UDP jitter configuration mode (config-ip-sla-jitter) IP SLA configuration mode (ip-sla-config) UDP echo configuration mode (config-ip-sla-udp).
---------------	---

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines	The ToS value is stored in an 8-bit field in the IPv4 packet header. This value contains information such as precedence and ToS. This information is useful for policy routing and for features like Committed Access Rate (CAR), where routers examine ToS values.
------------------	---

This command does not require a license.

Examples	This example shows how to configure IP SLAs operation 1 as an UDP echo operation with destination IP address 172.16.1.176. The ToS value is set to 0x80.
----------	--

```
switch(config)# ip sla 1
switch(config-ip-sla)# udp-echo 172.16.1.176 1
switch(config-ip-sla-udp)# tos 0x80
switch(config-ip-sla-udp)# ip sla schedule 1 start-time now
switch(config)#
```

Related Commands	Command	Description
	ip sla auto template	Enters IP SLA template configuration mode for defining an auto IP SLAs operation template.
	show ip sla auto template	Displays the configuration including default values of auto IP SLAs operation templates.

track

To track the reachability of an object, use the **track** command. To remove the settings, use the **no** form of this command.

track *object-number* **ip sla** *entry-number* **reachability**

no track *object-number*

Syntax Description

<i>object-number</i>	Tracked object. The range is from 1 to 500.
ip	Specifies the IPv4 protocol.
sla	Specifies the IP Service Level Agreement (SLA)
<i>entry-number</i>	Entry number. The range is from 1 to 2147483647.
reachability	Specifies the reachability.

Defaults

None

Command Modes

Tracking configuration mode (config-track)

Command History

Release	Modification
6.2(2)	This command was introduced.

Usage Guidelines

This command does not require a license

Examples

This example shows how to track the reachability of an object:

```
switch(config)# track 1 ip sla 1 reachability
switch(config-track)#
```

Related Commands

Command	Description
ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
ip sla monitor	Begins the configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

udp-echo

To define a Cisco NX-OS IP Service Level Agreements (SLAs) User Datagram Protocol (UDP) echo operation, use the **udp-echo** command. To remove the list, use the **no** form of this command.

```
udp-echo {destination-ip-address | destination-hostname} destination-port [source-ip {ip-address | hostname} source-port port-number] [control {enable | disable}]
```

Syntax Description

<i>destination-ip-address</i>	Destination IPv4 address of the operation.
<i>destination-hostname</i>	Destination IPv4 hostname of the operation.
<i>destination-port</i>	Destination port number. The range is from 1 to 65535.
source-ip	(Optional) Specifies the source IPv4 address. When a source IP address is not specified, IP SLAs choose the IP address nearest to the destination.
<i>ip-address</i>	IPv4 IP address.
<i>hostname</i>	IPv4 IP hostname.
source-port	(Optional) Specifies the source port.
<i>port-number</i>	Port number. The range is from 1 to 65535. When a port number is not specified, IP SLAs choose an available UDP port.
control	(Optional) Controls the IP SLAs control protocol to send a control message to the IP SLAs responder prior to sending an operation packet. By default, IP SLAs control messages are sent to the destination device to establish a connection with the responder.
enable	Enables the IP SLAs control protocol to send a control message to the responder prior to sending an operation packet.
disable	Disables the IP SLAs control protocol to send a control message to the responder prior to sending an operation packet.

Command Default

No IP SLAs operation type is associated with the operation number being configured.

Command Modes

IP SLA configuration mode (config-ip-sla)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

You must configure the type of IP SLAs operation (such as User Datagram Protocol [UDP] jitter) before you can configure any of the other parameters of the operation. To change the operation type of an existing IP SLAs operation, you must first delete the IP SLAs operation (using the **no ip sla global** configuration command) and then reconfigure the operation with the new operation type.

IP SLAs UDP echo operations support IPv4 addresses.

The control protocol is required when the target device is a Cisco router that does not natively provide the UDP or TCP Connect service. If you disable control by using the **control disable** keyword combination, you must define the IP address of the source for the IP SLAs Responder by using the **ip sla responder udp-echo ipaddress** command on the destination device.

This command does not require a license.

Examples

This example shows how to configure an IP SLAs operation as a UDP echo operation using the destination IPv4 address 172.16.1.175 and destination port 2400:

```
switch(config)# ip sla 12
switch(config-ip-sla)# udp-echo 172.16.1.175 2400
switch(config-ip-sla-udp)#
```

Related Commands

Command	Description
ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
ip sla responder udp echo ipaddress	Permanently enables the IP SLAs responder functionality on a specified IP address and port.

udp-jitter

To configure a Cisco NX-OS IP Service Level Agreements (SLA) User Datagram Protocol (UDP) operation that returns Voice over IP (VoIP) scores, use the **udp-jitter** command with codec option.

```
udp-jitter {destination-ip-address | destination-hostname} destination-port codec codec-type
[codec-numpackets number-of-packets] [codec-size number-of-bytes] [codec-interval
milliseconds] [advantage-factor value] [source-ip {ip-address | hostname}] [source-port
port-number] [control {enable | disable}]
```

Syntax Description

<i>destination-ip-address</i>	Destination IPv4 IP address.
<i>destination-hostname</i>	Destination IPv4 hostname.
<i>destination-port</i>	Destination port number.
codec	Specifies the codec type to be configured. Enables the generation of estimated voice-quality scores in the form of Calculated Planning Impairment Factor (ICPIF) and mean opinion score (MOS) values.
<i>codec-type</i>	Codec type that should match the encoding algorithm that you are using for VoIP transmissions. The following codec-type keywords are available: <ul style="list-style-type: none"> • og711alaw—The G.711 a-law codec (64-kbps transmission) • og711ulaw—The G.711 muHm-law codec (64-kbps transmission) • og729a—The G.729A codec (8-kbps transmission) Configuring the codec type sets default values for the variables codec-numpackets , codec-size , and codec-interval in this command.
codec-numpackets	(Optional) Specifies the number of packets to be transmitted per operation.
<i>number-of-packets</i>	Number of packets. The range is from 1 to 60000. The default is 1000.
codec-size	(Optional) Specifies the number of bytes in each packet transmitted. (Also called the payload size or request size.)
<i>number-of-bytes</i>	Number of bytes in the payload. The range is from 16 to 16384. The default varies by the codec.
codec-interval	(Optional) Specifies the interval (delay) between packets that should be used for the operation.
<i>milliseconds</i>	Interpacket interval in milliseconds (ms). The range is from 4 to 60000. The default is 20.
advantage-factor	(Optional) Specifies the expectation factor to be used for ICPIF calculations. This value is subtracted from the measured impairments to yield the final ICPIF value (and corresponding MOS value).
<i>value</i>	Advantage factor. The range is from 0 to 20.
source-ip	(Optional) Specifies the source IPv4 or IPv6 address. When a source IP address is not specified, IP SLAs choose the IP address nearest to the destination.
<i>ip-address</i>	Source IPv4 IP address.
<i>hostname</i>	Source IPv4 hostname.
source-port	(Optional) Specifies the source port.

<i>port-number</i>	Port number. The range is from 1 to 65535. When a port number is not specified, IP SLAs choose an available port.
control	(Optional) Controls the sending of IP SLAs control messages to the IP SLAs responder.
enable	(Optional) Enables the sending of IP SLAs control messages to the IP SLAs responder.
disable	(Optional) Disables the sending of IP SLAs control messages to the IP SLAs responder.

Command Default

The default number of packets sent by the udp-jitter operation without codec is 10 packets.

Command Modes

IP SLA configuration mode (config-ip-sla)

Command History

Release	Modification
6.1(1)	This command was introduced.

Usage Guidelines

The **udp-jitter** command configures an IP SLAs UDP Plus operation. The UDP Plus operation is a superset of the UDP echo operation. In addition to measuring the UDP round-trip time, the UDP Plus operation measures per-direction packet loss and jitter. Jitter is an interpacket delay variance. Jitter statistics are useful for analyzing traffic in a Voice over IP (VoIP) network.

You must configure the type of IP SLAs operation (such as User Datagram Protocol [UDP] jitter) before you can configure any of the other parameters of the operation. To change the operation type of an existing IP SLAs operation, you must first delete the IP SLAs operation (using the **no ip sla** global configuration command) and then reconfigure the operation with the new operation type.

You must enable the IP SLAs responder on the target router before you can configure a UDP jitter operation. Prior to sending an operation packet to the target router, IP SLAs send a control message to the responder to enable the destination port. The control protocol is required when the target device is a Cisco router that does not natively provide the UDP or TCP Connect service. If you disable the control by using the **control disable** keyword combination with this command, you must define the IP address of the source for the IP SLAs responder by using the **ip sla responder udp-echo ipaddress** command on the destination device.

The default request packet data size for an IP SLAs UDP jitter operation is 32 bytes. Use the **request-data-size** command to modify this value.

IP SLAs UDP jitter operations support IPv4 addresses.

When you specify the codec in the command syntax of the **udp-jitter** command, the standard configuration options are replaced with codec-specific keywords and arguments. The codec-specific command syntax is documented separately from the command syntax for the standard implementation of the **udp-jitter** command.

This command does not require a license.

Examples

This example shows how to configure operation 6 as a UDP jitter operation with the destination IPv4 address 172.30.125.15, the destination port number 2000, 20 packets, and an interpacket interval of 20 ms:

```
switch(config)# ip sla 6
switch(config-ip-sla)# udp-jitter 172.30.125.15 2000 num-packets 20 interval 20
!
switch(config-ip-sla-jitter)#
```

Related Commands

Command	Description
ip sla responder udp echo ipaddress	Permanently enables the IP SLAs responder functionality on a specified IP address and port.
ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
request-data-size	Sets the payload size for IP SLAs operation request packets.

verify-data

To cause a Cisco NX-OS IP Service Level Agreements (SLAs) operation to check each reply packet for data corruption, use the **verify-data** command. To return to the default value, use the **no** form of this command.

verify-data

no verify-data

Syntax Description This command has no arguments or keywords.

Command Default Data is not checked for corruption.

Command Modes UDP echo configuration mode (config-ip-sla-udp)
UDP jitter configuration mode (config-ip-sla-jitter)
IP SLA configuration mode (config-ip-sla)

Command History	Release	Modification
	6.1(1)	This command was introduced.

Usage Guidelines Use the **verify-data** (IP SLA) command only when data corruption may be an issue. does not enable this feature during normal operation because it can cause unnecessary network overhead.

The **verify-data** command is supported in IPv4 networks.

This command does not require a license.

Examples This example shows how to cause an IP SLAs operation to check each reply packet for data corruption:

```
switch(config)# ip sla 5
switch(config-ip-sla-udp)# verify-data
switch(config-ip-sla-udp)# ip sla schedule 5 start-time now life forever
switch(config)#
```

Related Commands	Command	Description
	ip sla	Begins the configuration for an IP SLAs operation and enters IP SLA configuration mode.
	ip sla auto template	Begins the configuration for an IP SLAs operation template and enters IP SLA template configuration mode.
	ip sla monitor	Begins the configuration for an IP SLAs operation and enters IP SLA monitor configuration mode.

