IP SLAs Random Scheduler

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The IP SLAs Random Scheduler feature is an enhancement to the existing IP SLAs Multiple Operation Scheduling feature. The IP SLAs Multiple Operation Scheduling feature provided the capability to easily schedule multiple IP SLAs operations to begin at intervals equally distributed over a specified duration of time and to restart at a specified frequency. With the IP SLAs Random Scheduler feature, you can now schedule multiple IP SLAs operations to begin at random intervals uniformly distributed over a specified duration of time and to restart at uniformly distributed random frequencies within a specified frequency range. Random scheduling improves the statistical metrics for assessing network performance.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for the IP SLAs Random Scheduler" section on page 12.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Contents

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Restrictions for the IP SLAs Random Scheduler

This feature is not in compliance with RFC2330, because it does not account for inter-packet randomness.

Information About the IP SLAs Random Scheduler

To enable the IP SLAs random scheduler option, you should understand the following concept:

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IP SLAs Random Scheduler

The IP SLAs random scheduler option is disabled by default. To enable the random scheduler option, you must set a frequency range when configuring the **ip sla group schedule** command in global configuration mode. The group of operations restarts at uniformly distributed random frequencies within the specified frequency range. The following guidelines apply for setting the frequency range:

- The starting value of the frequency range should be greater than the timeout values of all the operations in the group operation.
- The starting value of the frequency range should be greater than the schedule period (amount of time for which the group operation is scheduled). This guideline ensures that the same operation does not get scheduled more than once within the schedule period.

The following guidelines apply if the random scheduler option is enabled:

- The individual operations in a group operation will be uniformly distributed to begin at random intervals over the schedule period.
- The group of operations restarts at uniformly distributed random frequencies within the specified frequency range.
- The minimum time interval between the start of each operation in a group operation is 100 milliseconds (0.1 seconds). If the random scheduler option is disabled, the minimum time interval is 1 second.
- Only one operation can be scheduled to begin at any given time. If the random scheduler option is disabled, multiple operations can begin at the same time.
- The first operation will always begin at 0 milliseconds of the schedule period.
- The order in which each operation in a group operation begins is random.

How to Enable the IP SLAs Random Scheduler

This section contains the following task:

- Enabling the IP SLAs Random Scheduler, page 3

Enabling the IP SLAs Random Scheduler

Perform this task to schedule multiple IP SLAs operations to begin at random intervals uniformly distributed over a specified duration of time and to restart at uniformly distributed random frequencies within a specified frequency range.

Prerequisites

Before scheduling a group of operations, you should configure all the IP SLAs operations that will be used in that group. For information on configuring IP SLAs operations, see the "Related Documents" section on page 5.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla group schedule** *group-operation-number operation-id-numbers* **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*}]
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip sla group schedule** *group-operation-number operation-id-numbers* **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*}] **Example:** `Router# ip sla group schedule 2 1-3 schedule-period 50 frequency range 80-100`	Specifies the scheduling parameters of a group of IP SLAs operations. • To enable the IP SLAs random scheduler option, you must configure the **frequency range** *random-frequency-range* keywords and argument.
Step 4	**exit** **Example:** `Router# exit`	Exits global configuration mode and returns to privileged EXEC mode.

Configuration Examples for the IP SLAs Random Scheduler

This section provides the following configuration example:

- Enabling the IP SLAs Random Scheduler: Example, page 4

Enabling the IP SLAs Random Scheduler: Example

The following example shows how to schedule IP SLAs operations 1 to 3 as a group (identified as group 2). In this example, the operations are scheduled to begin at uniformly distributed random intervals over a schedule period of 50 seconds. The first operation is scheduled to start immediately. The random scheduler option is enabled and the uniformly distributed random frequencies at which the group of operations will restart is chosen within the range of 80-100 seconds.

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

Additional References

The following sections provide references related to the IP SLAs Random Scheduler feature.

Related Documents

Related Topic	Document Title
How to use the Cisco IOS IP SLAs Multiple Operation Scheduling feature to schedule multiple operations at once	"IP SLAs—Multioperation Scheduling of IP SLAs Operations" chapter of the *Cisco IOS IP SLAs Configuration Guide*, Release 12.4T
Cisco IOS IP SLAs configuration tasks	*Cisco IOS IP SLAs Configuration Guide*, Release 12.4T
Cisco IOS IP SLAs commands	*Cisco IOS IP SLAs Command Reference*, Release 12.2SR

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIB	MIBs Link
CISCO-RTTMON-MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Command Reference

This section documents only one modified command.

- **ip sla group schedule**

ip sla group schedule

To perform multioperation scheduling for Cisco IOS IP Service Level Agreements (SLAs) operations, use the **ip sla group schedule** command in global configuration mode. To cause all the IP SLAs operations belonging 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

group-id	Identification number for the group of IP SLAs operation to be scheduled. Valid values are from 0 to 65535.
operation-ids	List of identification (ID) numbers of the IP SLAs operations to be included in a new multioperation schedule. 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: • 2, 3, 4, 9, 20 • 10-20, 30-35, 60-70 • 2, 3, 4, 90-100, 105-115 The *operation-ids* argument can include a maximum of 125 characters.
add *operation-ids*	Specifies the ID numbers of one or more IP SLAs operations to be added to an existing multioperation schedule.
delete *operation-ids*	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 *seconds*	Specifies the amount of time (in seconds) for which the group of IP SLAs operations is scheduled. Valid values are from 1 to 604800 seconds.
ageout *seconds*	(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 seconds (never ages out).
frequency *seconds*	(Optional) Specifies the number of seconds after which each IP SLAs operation is restarted. The frequency of all operations belonging to the multioperation schedule is overridden and set to the specified frequency. Valid values are from 1 to 604800 seconds. **Note** The default frequency is the value specified for the schedule period.

frequency range *random-frequency-range*	(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 will 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.
life *seconds*	(Optional) Specifies the number of seconds the IP SLAs operations will actively collect information. The default is 3600 seconds (one hour).
start-time	(Optional) Indicates the time at which the group of IP SLAs operations will 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**.
*hh***:***mm*[**:***ss*]	(Optional) Specifies an 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.*
month	(Optional) Specifies the name of the month in which to start the multioperation schedule. If 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.
day	(Optional) Specifies the 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 *hh***:***mm***:***ss*	(Optional) Indicates that the multioperation schedule should start *hh* hours, *mm* minutes, and *ss* seconds after this command was entered.

Defaults

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

Command History

Release	Modification
12.4(4)T	This command was introduced. This command replaces the **ip sla monitor group schedule** command.
12.4(6)T	The following arguments and keywords were added: • **add** *operation-ids* • **delete** *operation-ids* • **reschedule**
12.0(32)SY	This command was integrated into Cisco IOS Release 12.0(32)SY.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB. This command replaces the **rtr group schedule** command.

Usage Guidelines

Though 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.

For example, consider a scenario where you are scheduling 1 to 780 operations at a schedule period of 60 seconds. The command would be as follows:

ip sla group schedule 2 1-780 schedule-period 60 start-time now

IP SLAs calculates how many operations it should start in each 1-second interval by dividing the number of operations by the schedule period (780 operations divided by 60 seconds, which is 13 operations per second). Operations 1 to 13 in multioperation group 2 start after 0 seconds, operations 14 to 26 start after 1 second, operations 27 to 40 start after 2 seconds, and the iteration continues until operations 768 to 780 start after 59 seconds. This high value of operations starting at every 1-second interval (especially for jitter operations) can load the CPU to very high values.

On a Cisco 2600 router, the maximum recommended value of operations per second is 6 or 7 (approximately 350 to 400 operations per minute). Exceeding this value of 6 or 7 operations per second could cause major performance (CPU) impact. Note that the maximum recommended value of operations per second varies from platform to platform.

Note No warning messages will be displayed if IP SLAs multiple operations scheduling leads to a high number of operations starting per second.

When you reboot the router, the IP SLAs multiple operations scheduling functionality schedules the operations in the same order as was done before the reboot. For example, assume the following operation had been scheduled:

ip sla group schedule 2 1-20 schedule-period 40 start-time now

Over a range of 40 seconds, 20 operations have to be started (that is, one operation every 2 seconds). After the system reboot, operation 1 will start at *t* seconds and operation 2 starts at *t*+2 seconds, operation 3 starts at *t*+4 seconds, and so on.

The IP SLAs multiple operations scheduling functionality schedules the maximum number of operations possible without aborting. However, this functionality skips those IP SLAs operations that are already running or those that are not configured and hence do not exist. The total number of operations will be calculated based on the number of operations specified in the command, irrespective of the number of operations that are missing or already running. The IP SLAs multiple operations scheduling functionality displays a message showing the number of active and missing operations. However, these messages are displayed only if you schedule operations that are not configured or are already running.

IP SLAs Random Scheduler

The IP SLAs random scheduler option provides the capability to schedule multiple IP SLAs operations to begin at random intervals over a specified duration of time. The random scheduler option is disabled by default. To enable the random scheduler option, you must configure the **frequency range** *random-frequency-range* keywords and argument. The operations within the multioperation schedule restart at uniformly distributed random frequencies within the specified frequency range. The following guidelines apply for setting the frequency range:

- The starting value of the frequency range should be greater than the timeout values of all the operations in the multioperation schedule.
- The starting value of the frequency range should be greater than the schedule period (amount of time for which the group of operations is scheduled). This guideline ensures that the same operation does not get scheduled more than once within the schedule period.

The following guidelines apply if the random scheduler option is enabled:

- The individual operations in a multioperation schedule will be uniformly distributed to begin at random intervals over the schedule period.
- The operations within the multioperation schedule restart at uniformly distributed random frequencies within the specified frequency range.
- The minimum time interval between the start of each operation in a multioperation schedule is 100 milliseconds (0.1 seconds). If the random scheduler option is disabled, the minimum time interval is 1 second.
- Only one operation can be scheduled to begin at any given time. If the random scheduler option is disabled, multiple operations can begin at the same time.
- The first operation will always begin at 0 milliseconds of the schedule period.
- The order in which each operation in a multioperation schedule begins is random.

Adding or Deleting IP SLAs Operations

The following guidelines apply when an IP SLAs operation is added to or deleted from an existing multioperation schedule:

- If an operation is added that already belongs to the multioperation schedule, no action is taken.
- If two or more operations are added after the multioperation schedule has started, then the start times of the newly added operations will be uniformly distributed based on a time interval that was calculated prior to the addition of the new operations. If two or more operations are added before the multioperation schedule has started, then the time interval is recalculated based on both the existing and newly added operations.
- If an operation is added to a multioperation schedule in which the random scheduler option is enabled, then the start time and frequency of the newly added operation will be randomly chosen within the specified parameters.
- If an operation is added to a multioperation schedule in which the existing operations have aged out or the lifetimes of the existing operations have ended, the newly added operation will start and remain active for the amount of time specified by the multioperation schedule.
- If an active operation is deleted, then the operation will stop collecting information and become inactive.
- If the **ip sla group schedule** *group-id* **reschedule** command is entered after an operation is added or deleted, the time interval between the start times of the operations is recalculated based on the new number of operations belonging to the multioperation schedule.

Examples

The following 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 schedule period of 20 seconds. The first operation (or set of operations) is scheduled to start immediately. Since the frequency is not specified, it is set to the value of the schedule period (20 seconds) by default.

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

The following 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 will restart will be chosen randomly within the range of 80 to 100 seconds.

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

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.

Feature Information for the IP SLAs Random Scheduler

Table 1 lists the release history for this feature.

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

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Note Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for the IP SLAs Random Scheduler

Feature Name	Releases	Feature Information
IP SLAs Random Scheduler	12.4(2)T, 12.2(33)SRB	The IP SLAs Random Scheduler feature is an enhancement to the existing IP SLAs Multiple Operation Scheduling feature. With the IP SLAs Random Scheduler feature, you can now schedule multiple IP SLAs operations to begin at random intervals uniformly distributed over a specified duration of time and to restart at uniformly distributed random frequencies within a specified frequency range. Random scheduling improves the statistical metrics for assessing network performance.