OVERVIEW

CISCO IOS IP SERVICE LEVEL AGREEMENTS COMMAND LINE INTERFACE

As businesses increasingly use networking technology as a productivity tool, they are adding more applications and functions to their IP networks. With voice and other delay-sensitive data traveling on their networks, customers demand reliable network services and often turn to service-level agreements to help ensure network operating performance. Cisco IOS® IP Service Level Agreements (SLAs) is a capability embedded Cisco IOS Software, which allows Cisco customers to increase productivity, lower operational costs, and reduce the frequency of network outages.

IP and SLAs are converging, and extending IP performance monitoring to be application-aware is critical for new IP network applications such as voice over IP (VoIP), audio and video, enterprise resource planning (ERP), customer relationship management (CRM), material requirements planning (MRP), VPNs, and other business-critical applications. Cisco IOS IP SLAs can perform network assessments; verify quality of service (QoS), ease deployment of new services, and assist administrators with network troubleshooting. Cisco IOS IP SLAs use unique service-level assurance metrics and methodology to provide highly accurate, precise service-level assurance measurements.

This document details the new command-line interface (CLI) for Cisco IOS IP SLAs. IP SLAs take full advantage of past Cisco IOS Software service assurance functionality and added recent enhancements, including capabilities related to VoIP, Multiprotocol Label Switching (MPLS), and IP service monitoring. The new CLI eases the deployment of service monitoring and simplifies configuration of IP SLAs measurements and enhances command-line views for the service-level measurement data. This CLI will be introduced over three phases, with the first phase releasing in both Cisco IOS Software Releases 12.4 Mainline and 12.4T. The following list summarizes the CLI changes:

- The first phase includes the new “ip sla” Cisco IOS Software keyword and new show commands to increase usability of the data associated with IP SLAs measurements (by March 2005).
- The second phase includes ease-of-use improvements associated with measurements and the operation of measurement configuration and includes the deprecation of some show commands (by June 2005).
- The final phase of improvements will produce integration between IP SLAs and Modular QoS CLI (MQC), allowing automation and ease of use in the generation of IP SLAs measurements. The QoS integration allows the user to set up a class of service and then quickly and easily measure how the class of service is performing.

PHASE 1 CLI UPDATE: INTRODUCTION OF THE “IP SLA” KEYWORD

Phase 1 Cisco IOS Software Releases 12.4 Mainline and 12.4(1)T, by March 2005

Planned Releases 12.2SX and 12.2SB

The following list describes changes in phase 1:

- The “rtr” keyword has been changed to “ip sla monitor.” Therefore, all commands that use “rtr” are now replaced by the keywords “ip sla monitor.”
- The “show ip sla monitor statistics [details]” command is introduced, and this command replaces the “show rtr operational-state” command. The “show rtr operational-state” command is available in this release but will be removed in a later phase.
- The “show ip sla monitor statistics aggregated [details]” command is introduced, and this command replaces the “show rtr collection-history” command. This command is very similar to the “show ip sla monitor statistics” command but includes distribution statistics and an aggregated view of data.
- The previous CLI formats are accepted in configuration mode, but a “show run” or “show start” command will output the new CLI formats.

Table 1. A Summary of the New CLI Changes for IP SLAs in Phase 1

Description	Previous CLI Information	IP SLAs CLI
Keyword	rtr	**ip sla monitor**
	rtr responder	**ip sla monitor responder**
Show Commands		
	show rtr operation-state	***show ip sla monitor statistics** ***show ip sla monitor statistics detail**
	show rtr collection-statistics	show ip sla monitor collection-statistics
Release 12.4(1)T and above	show rtr collection-statistics	***show ip sla monitor statistics aggregated** ***show ip sla monitor statistics aggregated detail**
	show rtr application	show ip sla monitor application
	show rtr configuration	show ip sla monitor configuration
	show rtr distribution-statistics	show ip sla monitor distribution-statistics
Release 12.4(1)T and above	show rtr distribution-statistics	***show ip sla monitor statistics aggregated detail** ***show ip sla monitor statistics aggregated detail**
	show rtr enhanced-history	show ip sla monitor enhanced-history
	show rtr reaction-configuration	show ip sla monitor reaction- configuration
	show rtr reaction-trigger	show ip sla monitor reaction- trigger
	show rtr responder	show ip sla monitor responder
	show rtr total-statistics	show ip sla monitor total-statistics
	show rtr authentication	show ip sla monitor authentication
	show rtr apm	show ip sla monitor apm

* New show command.

Example 1

The following example shows a configuration of the User Datagram Protocol (UDP) jitter operation to demonstrate the phase 1 CLI changes.

Previous CLI:

```
rtr 1
 type jitter dest-ipaddr 172.29.139.134 dest-port 5000 num-packets 20
 frequency 30
  rtr schedule 1 life 300 start-time after 00:05:00
```

New CLI:

```
ip sla monitor 1
 type jitter dest-ipaddr 172.29.139.134 dest-port 5000 num-packets 20
ip sla monitor schedule 1 life 300 start-time after 00:05:00
```

Example 2

The following example shows how the “rtr” keyword has been replaced by “ip sla monitor.”

Previous CLI:

```
router(config)#rtr ?
  <1-2147483647>            Entry number
  group                     Group configuration or group scheduling
  key-chain                 Use MD5 authentication for RTR control message
  logging                   Enable logging
  low-memory                Configure low-water memory mark
  reaction-configuration    RTR reaction configuration
  reaction-trigger          RTR trigger assignment
  reset                     RTR reset
  responder                 Enable RTR responder
  restart                   Restart an active entry
  schedule                  RTR entry scheduling
  slm                       Service-level management
```

New CLI:

```
router(config)#ip sla monitor ?
  <1-2147483647>            Entry number
  apm                       IP SLAs monitor APM configuration
  group                     Group configuration or group scheduling
  key-chain                 Use MD5 authentication for IP SLAs monitor control message
  logging                   Enable logging
  low-memory                Configure low-water memory mark
  reaction-configuration    IP SLAs monitor reaction configuration
  reaction-trigger          IP SLAs monitor trigger assignment
```

```
  reset                    IP SLAs monitor reset
  responder                Enable IP SLAs monitor responder
  restart                  Restart an active entry
  schedule                 IP SLAs monitor entry scheduling
  slm                      Service-level management
```

Example 3: The "ip sla monitor statistics" show Command

A new show command, "show ip sla monitor statistics," and its variant "show ip sla monitor statistics detail" have been introduced. This command improves the legibility of IP SLAs measurement data. This new show command replaces the previous "show rtr operational-state" command. The previous show commands are still available in the phase 1 CLI, but the new keyword "ip sla monitor" can be used to access the previous formatted output of these commands—for example, "show ip sla monitor operational-state":

```
router#show ip sla monitor statistics 1
Round trip time (RTT)   Index 1
        Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: *16:21:32.539 PST Fri Dec 10 2004
Latest operation return code: No connection
RTT Values
        Number Of RTT: 0
        RTT Min/Avg/Max: 0/0/0 ms
Latency one-way time milliseconds
        Number of one-way Samples: 0
        Source to Destination one way Min/Avg/Max: 0/0/0 ms
        Destination to Source one way Min/Avg/Max: 0/0/0 ms
Jitter time milliseconds
        Number of Jitter Samples: 0
        Source to Destination Jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source Jitter Min/Avg/Max: 0/0/0 ms
Packet Loss Values
        Loss Source to Destination: 0  Loss Destination to Source: 0
        Out Of Sequence: 0      Tail Drop: 0    Packet Late Arrival: 0
Voice Score Values
        Calculated Planning Impairment Factor (ICPIF): 0
        Mean Opinion Score (MOS): 0
Number of successes: 0
Number of failures: 2
Operation time to live: 3496 sec
```

Example 4: The “ip sla monitor statistics detail” show command

```
router#show ip sla mon statistics 1 detail
Round trip time (RTT)   Index 1
        Latest RTT: NoConnection/Busy/Timeout
Latest operation start time: *16:23:32.559 PST Fri Dec 10 2004
Latest operation return code: No connection
Over thresholds occurred: FALSE
RTT Values
        Number Of RTT: 0
        RTT Min/Avg/Max: 0/0/0 ms
Latency one-way time milliseconds
        Number of one-way Samples: 0
        Source to Destination one way Min/Avg/Max: 0/0/0 ms
        Destination to Source one way Min/Avg/Max: 0/0/0 ms
        Source to Destination one way Sum/Sum2: 0/0
        Destination to Source one way Sum/Sum2: 0/0
Jitter time milliseconds
        Number of Jitter Samples: 0
        Source to Destination Jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source Jitter Min/Avg/Max: 0/0/0 ms
        Source to destination positive jitter Min/Avg/Max: 0/0/0 ms
        Source to destination positive jitter Number/Sum/Sum2:  0/0/0
        Source to destination negative jitter Min/Avg/Max: 0/0/0 ms
        Source to destination negative jitter Number/Sum/Sum2: 0/0/0
        Destination to Source positive jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source positive jitter Number/Sum/Sum2:  0/0/0
        Destination to Source negative jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source negative jitter Number/Sum/Sum2: 0/0/0
        Interarrival jitterout: 0       Interarrival jitterin: 0
Packet Loss Values
        Loss Source to Destination: 0  Loss Destination to Source: 0
        Out Of Sequence: 0      Tail Drop: 0    Packet Late Arrival: 0
Voice Score Values
        Calculated Planning Impairment Factor (ICPIF): 0
        Mean Opinion Score (MOS): 0
Number of successes: 0
Number of failures: 4
Operation time to live: 3355 sec
Operational state of entry: Active
Last time this entry was reset: Never
```

Example 5: The “ip sla monitor statistics aggregated detail” show Command

```
router#show ip sla monitor statistics aggregated 10 detail
Round trip time (RTT)   Index 10
Start Time Index: *08:27:07.920 PST Mon Dec 13 2004
Type of operation: jitter
Voice Scores:
MinOfICPIF: 0   MaxOfICPIF: 0   MinOfMOS: 0     MaxOfMOS: 0
RTT Values
        Number Of RTT: 0
        RTT Min/Avg/Max: 0/0/0 ms
Latency one-way time milliseconds
        Number of Latency one-way Samples: 0
        Source to Destination Latency one way Min/Avg/Max: 0/0/0 ms
        Destination to Source Latency one way Min/Avg/Max: 0/0/0 ms
        Source to Destination Latency one way Sum/Sum2: 0/0
        Destination to Source Latency one way Sum/Sum2: 0/0
Jitter time milliseconds
        Number of Jitter Samples: 0
        Source to Destination Jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source Jitter Min/Avg/Max: 0/0/0 ms
        Source to destination positive jitter Min/Avg/Max: 0/0/0 ms
        Source to destination positive jitter Number/Sum/Sum2: 0/0/0
        Source to destination negative jitter Min/Avg/Max: 0/0/0 ms
        Source to destination negative jitter Number/Sum/Sum2: 0/0/0
        Destination to Source positive jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source positive jitter Number/Sum/Sum2: 0/0/0
        Destination to Source negative jitter Min/Avg/Max: 0/0/0 ms
        Destination to Source negative jitter Number/Sum/Sum2: 0/0/0
        Interarrival jitterout: 0       Interarrival jitterin: 0
Packet Loss Values
        Loss Source to Destination: 0  Loss Destination to Source: 0
        Out Of Sequence: 0      Tail Drop: 0    Packet Late Arrival: 0
Number of successes: 0
Number of failures: 1
Failed Operations due to over threshold: 0
Failed Operations due to Disconnect/TimeOut/Busy/No Connection: 0/0/0/1
Failed Operations due to Internal/Sequence/Verify Error: 0/0/0

Distribution Statistics:
Bucket Range: 0-19 ms
Avg. Latency: 0 ms
Percent of Total Completions for this Range: 0 %
```

```
Number of Completions/Sum of Latency: 0/0
Sum of RTT squared low 32 Bits/Sum of RTT squared high 32 Bits: 0/0
Operations completed over thresholds: 0
```

PHASE 2 CLI UPDATE: UPDATE OF MEASUREMENT OPERATION SYNTAX

In phase 2 the individual operation syntax will be updated to enhance ease of use, the details are shown below.

Phase 2 is included in Cisco IOS Software Releases 12.4(2)T by June 2005.

Planned in Releases 12.2SX and 12.2SB

The following list describes changes in phase 2:

- Removal of the “type” keyword allows the user to enter operations directly under the IP SLAs definition.
- The number of Cisco IOS Software sublevels has been reduced, so that individual operations are easy to configure. For example, the “protocol” keyword for Internet Control Message Protocol (ICMP) operations has been removed.
- Redundant and older show commands have been removed and have been replaced by new show commands—for example, “show rtr operational-state.” The show commands will be hidden in this release and later removed in a follow-on release.
- History features are grouped together under the “history” keyword.
- The “monitor” keyword has been removed. The “ip sla monitor” keywords are replaced by “ip sla” keywords. The “monitor” keyword in Cisco IOS Software Releases 12.4 Mainline and 12.4(1)T was verbose and the decision was made to remove it.

The following example shows the configuration without the “type” keyword and some new definitions used to define measurement operations.

Example 1: Removal of the type Keyword

Previous CLI:

```
router(config)#rtr  1
router (config-rtr)#?
SAA entry configuration commands:
  exit  Exit operation configuration
  type  Type of entry

rtr 1
 type jitter dest-ipaddr 1.1.1.1 dest-port 5000
```

New CLI:

```
router(config)#ip sla 1
router (config-ip-sla)#?
        dhcp               Dynamic Host Configuration Protocol (DHCP) operation
        dns                Domain Name System (DNS) query operation
        icmp-echo          ICMP echo operation
        frame-relay        Frame-relay operation
        ftp                FTP operation
        http               HTTP operation
```

```
          udp-jitter          UDP jitter operation
          path-echo           Path discovered ICMP echo operation
          path-jitter         Path discovered ICMP jitter operation
          slm                 SLM operation
          tcp-connect         TCP connect operation
          udp-echo            UDP echo operation
           voip               VoIP measurements

ip sla 1
  udp-jitter  1.1.1.1  5000
```

Example 2: Reducing the Number of Sublevels for Measurement Configuration

The following example shows the configuration to reduce the number of Cisco IOS Software sublevels used to configure operations in IP SLAs.

Previous CLI:

```
router(config)#rtr 1
router(config-rtr)#type echo ?
  protocol  Protocol to Use for Operations
router(config-rtr)#type echo protocol ?
  ipIcmpEcho  Use IP/ICMP

router (config-rtr)#type echo protocol ipIcmpEcho ?
  Hostname or A.B.C.D  IP address or hostname

rtr 1
 type echo protocol ipIcmpEcho 172.29.139.134
```

New CLI:

```
router(config)#ip sla 1
router(config-ip-sla)# icmp-echo ?
  Hostname or A.B.C.D     Destination IP address or hostname
  source-ip               Source address

ip sla 1
icmp-echo 172.29.139.134
```

Example 3: Removal of Legacy show Commands

The show commands listed in Table 2 are hidden in this release and are being replaced with new commands in Cisco IOS Software Release 12.4(2nd)T. The new commands will be used in this release and beyond.

Table 2. Deprecated show Commands for Cisco IOS Software Release 12.4(1)T

Deprecated show Commands	IP SLAs CLI
show rtr operation-state	**show ip sla statistics** **show ip sla statistics detail**
show ip sla monitor operation-state	**show ip sla statistics** **show ip sla statistics detail**
show rtr collection-statistics	**show ip sla statistics aggregated** **show ip sla statistics aggregated details**
show rtr distribution-statistics	**show ip sla statistics aggregated detail**
show rtr total-statistics	**show ip sla statistics aggregated detail**

Example 4: History Commands with One Keyword

The following example shows the configuration in which all the history commands are grouped under a single keyword.

Previous CLI:

```
router(config-rtr)#type jitter  dest-ipaddr 1.1.1.1 dest-port 10010
routerconfig-rtr-jitter)#?
SAA jitter configuration commands:
  buckets-of-history-kept             Maximum number of history buckets to collect
  default                             Sets a command to its defaults
  dest-ipaddr                         Destination IP address
  dest-port                           Destination port
  distributions-of-statistics-kept    Maximum number of statistics distribution buckets to
                                      capture
  enhanced-history                    Enables enhanced history collection
  exit                                Exit probe configuration
  filter-for-history                  Adds operation to history when...
  frequency                           Frequency of an operation
  hours-of-statistics-kept            Maximum number of statistics hour groups to capture
  lives-of-history-kept               Maximum number of history lives to collect
  no                                  Negates a command or sets its defaults
  owner                               Owner of entry
  request-data-size                   Request data size
  statistics-distribution-interval    Statistics distribution interval size
  tag                                 User-defined tag
```

```
  threshold                          Operation threshold in milliseconds
  timeout                            Timeout of an operation
  tos                                Type of service
  verify-data                        Verifies data
  vrf                                Configures SAA for a VPN routing/forwarding instance
```

New CLI:

```
router(config-sla-monitor)#icmp-echo 1.1.1.1 source-ipaddr 3.3.3.3
router(config-sla-monitor-echo)#?
IP SLAs echo configuration commands:
  default                            Sets a command to its defaults
  exit                               Exit operation configuration
  frequency                          Frequency in milliseconds of an operation to active
  no                                 Negates a command or sets its defaults
  request-data-size                  Requests data size, not including protocol of IP header
  threshold                          Operation threshold in milliseconds
  timeout                            Timeout in milliseconds for an operation
  tos                                Type of service setting for QoS
  verify-data                        Verifies the integrity of data payload
  history                            IP SLAs history commands

router(config-sla-monitor)#icmp-echo 1.1.1.1 source-ipaddr 3.3.3.3 history
router(config-sla-monitor-echo)#?
IP SLAs echo configuration commands:
  buckets-kept                       Maximum number of history buckets to collect
  distributions-of-statistics-kept   Maximum number of statistics distribution buckets to
                                     capture
  enhanced                           Enable enhanced history collection
  filter                             Adds operation to history when...
  hours-of-statistics-kept           Maximum number of statistics hour groups to capture
  lives-kept                         Maximum number of history lives to collect
  statistics-distribution-interval   Statistics distribution interval size
```

Example 5: Removal of the “monitor” Keyword for Configuration

The following two examples show the removal of the monitor keyword that was introduced in Cisco IOS Software Release 12.4 Mainline. One example is a configuration command, and the other example is a show command. It is thought that the monitor keyword is verbose, and so it was removed.

Previous CLI:

```
ip sla monitor 1
 type jitter dest-ipaddr 172.29.139.134 dest-port 5000 num-packets 20
 frequency 30
ip sla monitor schedule 1 life 300 start-time after 00:05:00
ip sla monitor reaction-configuration 1 timeout-enable action-type trapOnly
```

New CLI:

```
ip sla 1
  type jitter dest-ipaddr 172.29.139.134 dest-port 5000 num-packets 20
ip sla schedule rtr schedule 1 life 300 start-time after 00:05:00
ip sla reaction-configuration 1 timeout-enable action-type trapOnly
```

Monitor Keyword Removal for a show Command

Previous CLI:

```
router#show ip sla monitor statistics aggregated 10
```

New CLI:

```
router#show ip sla statistics aggregated 10
```

PHASE 3 CLI UPDATE: INTEGRATION OF IP SLAS WITH MODULAR QOS CLI (MQC)

The following list describes changes in phase 3:

- A macro capability will be used to generate and schedule IP SLAs operations, and these operations will be configured with a new CLI that will utilize QoS CLI.
- The capability will initially allow configuration and measurement of QoS performance.
- This capability will be outlined at a later date in this document.

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