



# Leveraging Cisco<sup>®</sup> IP SLA in Your Environment

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Cisco® IP Service Level Agreements, otherwise known as IP SLA, is a technology that is available by default on most Cisco routers and switches and can be used to measure end-to-end network performance. IP SLA reports on various metrics that gives visibility into network availability, network and IP application performance, and troubleshooting.

## What is IP SLA?

**IP SLA or IP Service Level Agreement is a solution from Cisco that assures IP service levels, proactively verifies network operation, and accurately measures network performance.**

IP SLA measures end-to-end service levels for performance metrics Round-Trip-Time, Latency, Jitter, Packet Loss, and Mean Opinion Score (MOS) by sending synthetic packets between two devices. This information can then be used to understand the cause of poor network performance and to optimize IP-based business applications. IP-based service level metrics help measure and verify network performance concerns associated with bandwidth requirements, network traffic identification, and service level agreements.

## Why IP SLA?

This is the age of converged networks. A single network now carries data, voice, and video. For business continuity and uptime, it is important to ensure that every network service meets its performance metric values. The uptime of delay-sensitive applications such as VoIP and real-time video is achieved through constant monitoring that enables proactive rather than reactive troubleshooting.

With Cisco IP SLA, users can:

- Verify service guarantees
- Validate network performance
- Proactively identify network issues

- Increase return on investment (ROI) by easing the deployment of new IP services

## IP SLA Metrics and Operations

The following are some of the metrics provided by Cisco IP SLA that aid in network performance monitoring and troubleshooting:

### Jitter

Jitter is the variance of inter-packet delay. When multiple packets are sent consecutively from source to destination and if there are delays in the network like queuing or arriving through alternate routes, the arrival delay between packets is the jitter value. For delay-sensitive applications like VoIP and real-time video streaming, a jitter value of 0 is ideal.

### Latency

Latency is the delay or the time it takes for a data packet to get from one designated point to another. The network administrator decides the latency value based on the requirements of the application and the network.

### Packet Loss

Packet loss occurs when data packets in a network are discarded at a given moment when a device is overloaded and unable to accept incoming data. You need to keep packet loss to the lowest value possible.

### Mean Opinion Score (MOS)

A common benchmark used to determine the quality of sound produced by specific codecs is MOS (Mean Opinion Score). The opinion scores are averaged to provide the mean for each sample. It is always preferable to have a MOS score of 4 or 5 for your VoIP calls.

Measuring these metrics provides actionable data that assists in network troubleshooting in case of issues or for bandwidth capacity planning and Quality of Service (QoS) implementation. Some of the uses and metrics for Cisco IP SLA are mentioned in the table below:

Use	Network Requirement	Metrics
<b>Network Performance Monitoring</b>	<ul style="list-style-type: none"> <li>Minimize packet delay, packet loss</li> <li>Verify QoS</li> </ul>	<ul style="list-style-type: none"> <li>Jitter</li> <li>Packet loss</li> <li>Latency</li> <li>Per QoS</li> </ul>
<b>Voice over IP (VoIP) Monitoring</b>	<ul style="list-style-type: none"> <li>To minimize packet delay, packet loss, Jitter</li> </ul>	<ul style="list-style-type: none"> <li>Jitter</li> <li>Packet loss</li> <li>Latency</li> <li>MOS Voice Quality Score</li> </ul>
<b>Service Level Agreement (SLA) Monitoring</b>	<ul style="list-style-type: none"> <li>To measure delay, packet loss, jitter</li> <li>One-way traffic</li> </ul>	<ul style="list-style-type: none"> <li>Jitter</li> <li>Packet loss</li> <li>Latency</li> <li>One-way</li> <li>NTP</li> </ul>
<b>Network Availability</b>	<ul style="list-style-type: none"> <li>To test connectivity</li> </ul>	<ul style="list-style-type: none"> <li>Connectivity tests to IP devices</li> </ul>

An IP SLA's Operation performs synthetic tests or network measurements from the source to a destination device using specific protocols such as UDP, ICMP, and TCP. Some examples of IP SLA operations are:

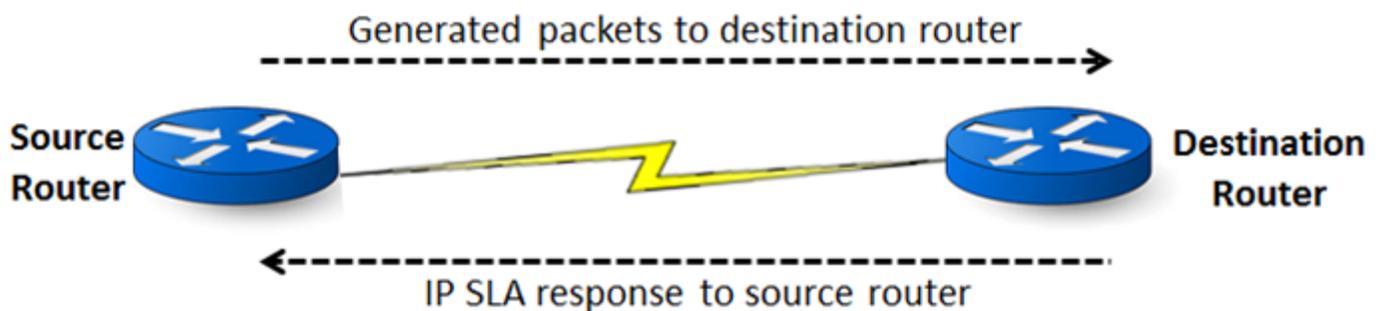
- DHCP – Measures the round-trip time to retrieve an IP address
- DNS – Measures the DNS look-up time (time to request and receive a reply)

- FTP – Measures the round-trip time to transfer a file
- HTTP – Measures the round-trip time to access a Web page
- ICMP Echo – Measures round-trip delay
- TCP Connect – Measures connection time, which is useful for application and server monitoring
- UDP Echo – Measures response times between IP SLA nodes using IP
- UDP Jitter – Measures round-trip delay, one-way delay, one-way jitter, and one-way packet loss
- VoIP UDP Jitter – Measures VoIP call path metrics

Configure your source router to initiate IP SLA operations based on your requirements and the destination router to respond, and then you can pull back information and reports on the same.

### Use Case: Measuring Performance across an MPLS Link

To determine the quality of an MPLS link, IP SLA operations are performed by sending synthetic packets between the routers at the source and destination locations. These tests can be done either before or after deploying [MPLS](#). The tests communicate back-and-forth between the two routers to report on link latency, round-trip-time, and packet loss. This indicates if the link is performing according to expectations.



To check the quality of a VoIP application on your MPLS connection, measuring the MOS value provides information on the quality of communication between the two routers or locations. The ideal MOS value for a VoIP communication is between 4 and 5.

IP SLA is capable of providing you with statistics on required metrics over time. This helps you determine the actual performance of an application and precipitate the investigation with other network technologies like [NetFlow](#). It also helps you isolate the actual cause of the performance issue and resolve the problem.

## Challenges of IOS IP SLA Monitoring

The challenge around IP SLA is that configuration and maintenance of IP SLA operations have traditionally required the use of CLIs (command line interfaces). To [configure IP SLA](#) manually, you would need to either telnet or SSH to each device and then begin configuring each operation for each path individually. This can be a time-consuming and painful process, especially when you have multiple routing devices. Additionally, native IP SLA results are hard to understand and use, particularly because you need to log in to multiple source devices to see the corresponding IPSLA results. Therefore, you need:

- A single platform that can help configure and manage IP SLA operations across multiple devices
- A single reporting unit that can extract and report on data from multiple devices across the network

## Summary

Cisco IP SLA is a feature that is available by default on most Cisco devices (depending on your IOS). Ensure that you leverage this free IOS feature to measure network performance and troubleshoot issues.

SolarWinds VoIP & Network Quality Manager (VNQM) is designed to make it easier for you to deploy and use Cisco IP SLA technology. It automates the configuration and management of the IP SLA operations and pulls IP SLA data from multiple devices into an easy-to-use web interface. Network teams can then use this for performance analysis, alerting, and even within topology maps to display site-to-site network performance.

## References:

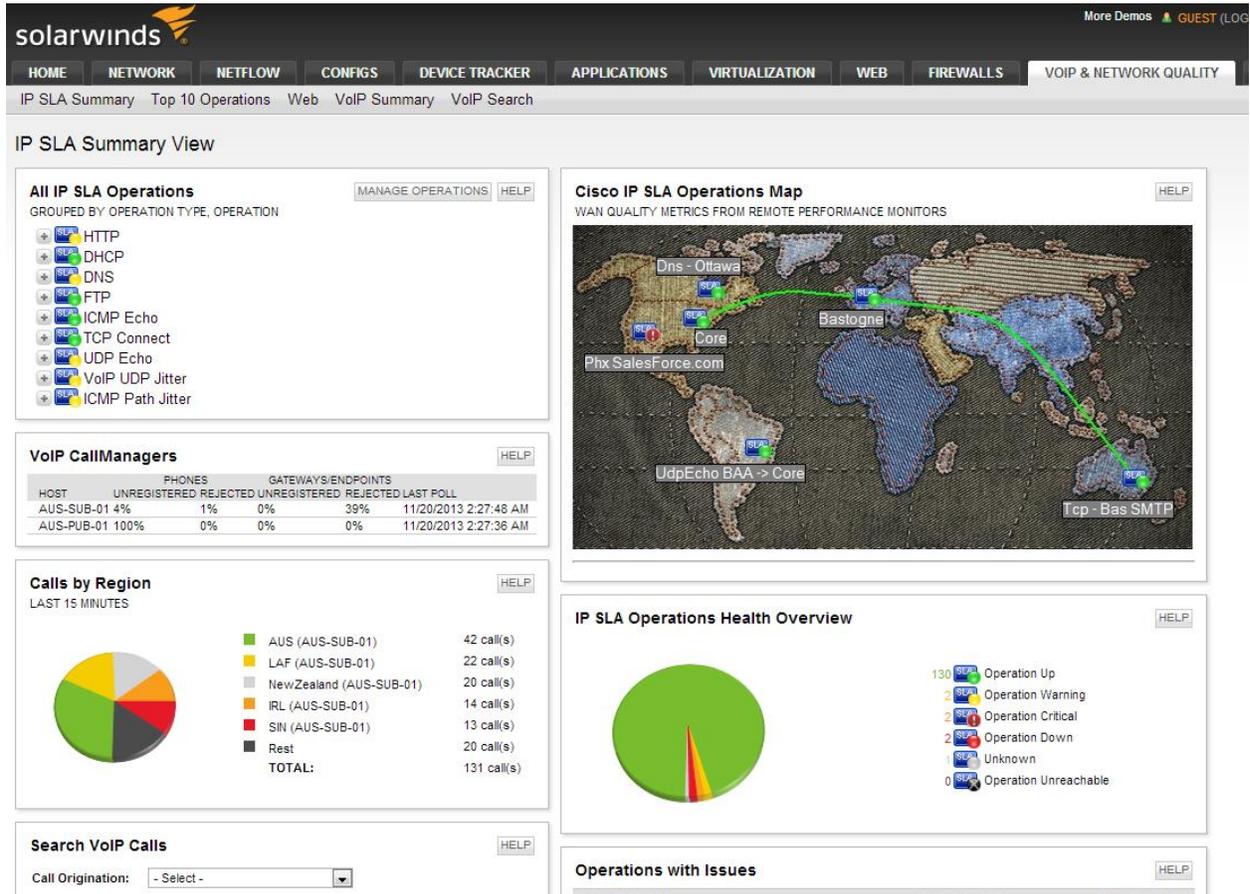
- Cisco® IP SLA - [http://www.cisco.com/en/US/tech/tk920/tsd\\_technology\\_support\\_sub-protocol\\_home.html](http://www.cisco.com/en/US/tech/tk920/tsd_technology_support_sub-protocol_home.html)
- IP SLA Configuration Guide - <http://www.cisco.com/en/US/docs/ios-ml/ios/ipsla/configuration/15-mt/sla-15-mt-book.html>

## Top 5 reasons to Download SolarWinds VoIP & Network Quality Manager (VNQM)

1. Automatically determine and deploy IP SLA on devices
2. Be notified when key VoIP metrics such as jitter, latency, packet loss, or MOS exceeds thresholds
3. Monitor and troubleshoot VoIP call performance
4. Gain detailed visibility into performance of Cisco & Avaya VoIP gateway and PRI trunk utilization
5. Model real-world VoIP traffic with synthetic VoIP traffic generators to create and monitor performance baselines.

# Get a global snapshot of your IP SLA operations with SolarWinds VNQM!

 **DOWNLOAD FREE TRIAL**



The screenshot shows the SolarWinds VNQM interface for IP SLA operations. The top navigation bar includes: HOME, NETWORK, NETFLOW, CONFIGS, DEVICE TRACKER, APPLICATIONS, VIRTUALIZATION, WEB, FIREWALLS, and VOIP & NETWORK QUALITY. The main content area is titled "IP SLA Summary View" and contains several widgets:

- All IP SLA Operations:** A list of operation types including HTTP, DHCP, DNS, FTP, ICMP Echo, TCP Connect, UDP Echo, VoIP UDP Jitter, and ICMP Path Jitter.
- VoIP CallManagers:** A table showing performance metrics for different hosts.
- Calls by Region:** A pie chart showing the distribution of calls across various regions.
- Search VoIP Calls:** A search filter for call origination.
- Cisco IP SLA Operations Map:** A world map showing WAN quality metrics and specific operations like "Dns - Ottawa", "Core", "Bastogne", "Phx Salesforce.com", "UdpEcho BAA -> Core", and "Tcp - Bas SMTP".
- IP SLA Operations Health Overview:** A gauge chart and a list of operation statuses.
- Operations with Issues:** A section for identifying problematic operations.

HOST	PHONES		GATEWAYS/ENDPOINTS		REJECTED LAST POLL
	UNREGISTERED	REJECTED	UNREGISTERED	REJECTED	
AUS-SUB-01	4%	1%	0%	39%	11/20/2013 2:27:48 AM
AUS-PUB-01	100%	0%	0%	0%	11/20/2013 2:27:36 AM

Region	Call Count
AUS (AUS-SUB-01)	42 call(s)
LAF (AUS-SUB-01)	22 call(s)
NewZealand (AUS-SUB-01)	20 call(s)
IRL (AUS-SUB-01)	14 call(s)
SIN (AUS-SUB-01)	13 call(s)
Rest	20 call(s)
<b>TOTAL:</b>	<b>131 call(s)</b>

Status	Count
Operation Up	130
Operation Warning	2
Operation Critical	2
Operation Down	2
Unknown	1
Operation Unreachable	0

## About SolarWinds

[SolarWinds](#) (NYSE: SWI) provides powerful and affordable IT management software to customers worldwide from Fortune 500 enterprises to small businesses. In all of our market areas, our approach is consistent. We focus exclusively on IT Pros and strive to eliminate the complexity that they have been forced to accept from traditional enterprise software vendors. SolarWinds delivers on this commitment with unexpected simplicity through products that are easy to find, buy, use and maintain while providing the power to address any IT management problem on any scale. Our solutions are rooted in our deep connection to our user base, which interacts in our online community, [thwack](#), to solve problems, share technology and best practices, and directly participate in our product development process. Learn more today at <http://www.solarwinds.com>.

