SolarWinds Orion

IP SLA Manager QuickStart Guide

solarwinds

IP SLA MANAGER

IP SLA Manager QuickStart Guide 09.25.2009 Version 3.0

About SolarWinds

SolarWinds, Inc develops and markets an array of network management, monitoring, and discovery tools to meet the diverse requirements of today's network management and consulting professionals. SolarWinds products continue to set benchmarks for quality and performance and have positioned the company as the leader in network management and discovery technology. The SolarWinds customer base includes over 45 percent of the Fortune 500 and customers from over 90 countries. Our global business partner distributor network exceeds 100 distributors and resellers.

Contacting SolarWinds

You can contact SolarWinds in a number of ways, including the following:

Team	Contact Information
Sales	1.866.530.8100 www.solarwinds.com
Technical Support	www.solarwinds.com/support
User Forums	www.thwack.com

Conventions

The documentation uses consistent conventions to help you identify items throughout the printed and online library.

Convention	Specifying
Bold	Window items, including buttons and fields.
Italics	Book and CD titles, variable names, new terms
`Fixed font`	File and directory names, commands and code examples, text typed by you
Straight brackets, as in [*value*]	Optional command parameters
Curly braces, as in {*value*}	Required command parameters
Logical OR, as in *value1*|*value2*	Exclusive command parameters where only one of the options can be specified

SolarWinds Orion IP SLA Manager Documentation Library

The following documents are included in the Orion IP SLA Manager documentation library:

Document	Purpose
Orion IP SLA Manager Administrator Guide	Provides detailed setup, configuration, and conceptual information.
Page Help	Provides help for every window in the Orion IP SLA Manager user interface
Release Notes	Provides late-breaking information, known issues, and updates. The latest Release Notes can be found at www.solarwinds.com.

The following documents supplement the Orion IP SLA Manager documentation library with information about Orion Network Performance Monitor:

Document	Purpose
Orion Network Performance Monitor Administrator Guide	Provides detailed setup, configuration, and conceptual information.
Page Help	Provides help for every window in the Orion Network Performance Monitor user interface
Release Notes	Provides late-breaking information, known issues, and updates. The latest Release Notes can be found at www.solarwinds.com.

Contents

About SolarWinds iii

Contacting SolarWinds iii

Conventions iii

SolarWinds Orion IP SLA Manager Documentation Library iv

Chapter 1

Introduction 1

Why Install Orion IP SLA Manager 1

What Orion IP SLA Manager Does 1

How Orion IP SLA Manager Works 3

Chapter 2

Getting Started with Orion IP SLA Manager 5

Installation Requirements 5

Orion IP SLA Manager Licensing 6

Installing Orion IP SLA Manager 6

Understanding Quality of Service and IP SLAs 7

Latency 10
Jitter 11
Packet Loss 12
Mean Opinion Score (MOS) 12

Monitoring Cisco CallManager Health 13

Using IP SLA Manager in the Orion Web Console 13

Adding Orion Nodes to IP SLA Manager 14

Configuring IP SLA Manager 14

Orion IP SLA Manager Settings 14
Configuring IP SLA Manager Settings 16
Adding or Deleting Cisco CallManager Devices 18
Adding VoIP Infrastructure 19
Adding Call Manager Devices from Other Manufacturers 19

Configuring Devices for IP SLA Operations 19

Designating Paths 20

Understanding the Impact IP SLA Operations Have on Your Network 20
Adding DNS IP SLA Operations to Your Devices 23
Adding FTP IP SLA Operations to Your Devices 25
Adding HTTP IP SLA Operations to Your Devices..... 26
Adding DHCP IP SLA Operations to Your Devices..... 27
Adding TCP Connect IP SLA Operations to Your Devices 28
Adding UDP Jitter IP SLA Operations to Your Devices..... 30
Adding VoIP UDP Jitter IP SLA Operations to Your Devices..... 31
Adding ICMP Echo IP SLA Operations to Your Devices..... 35
Adding UDP Echo IP SLA Operations to Your Devices 37

Chapter 3

Using IP SLA Manager 39

IP SLA Manager Views 39

Using Advanced Alerts and Actions..... 39

IP SLA Manager Alerts 40

Creating IP SLA Manager Reports 40

Using Predefined IP SLA Reports 41

Customizing Charts in IP SLA Manager 43

Chart Titles..... 43
Time Periods..... 43
Adjust Sample Interval..... 44
Chart Size 44
Data Tables 44
Font Size..... 44
Printing Options 44
Data Export Options 45
X-Axis Labels Orientation 45

Creating IP SLA Manager Maps 45

Appendix A

Software License Key 47

Maintaining Licenses with License Manager 47

Installing License Manager..... 48
Using License Manager..... 48

Chapter 1

Introduction

SolarWinds Orion IP Service Level Agreement (IP SLA) Manager offers an easy-to-use, scalable IP SLA network monitoring solution that integrates seamlessly into the Orion Network Performance Monitor Web Console.

Why Install Orion IP SLA Manager

Internet Protocol Service Level Agreement (IP SLA) technology offers a cost-effective and efficient response to the needs of enterprises of all sizes. As a network manager, you face more than the simple question of whether your network is up or down. You need to know specific quality of service measures for your network, and you need to know them both historically and in realtime. IP SLA Manager gives you the tools to quickly test the fitness of your current network and then determine and track quality of service on your network over time.

Orion IP SLA Manager leverages the proven functionality of Orion Network Performance Monitor (Orion NPM), adding a number of IP SLA-specific data collection and presentation tools that enable IP SLA network monitoring and realtime status reporting. Because it is a module of Orion NPM, IP SLA Manager maintains the function of Orion NPM while allowing you to narrow your network management and monitoring focus to the IP SLA capable devices of your wider network.

What Orion IP SLA Manager Does

IP SLA Manager provides a full-featured solution that gives you the ability to monitor and report both realtime and historical performance statistics for your IP SLA capable network. IP SLA Manager offers the following features to help you manage your entire network.

Quality of Service (QoS) Monitoring with Cisco IP SLA Operations

IP SLA Manager uses Cisco IP SLAs to measure network performance. Specifically, IP SLA operations provide immediate insight into network Quality of Service (QoS), including packet loss, latency, jitter, and mean opinion score (MOS) metrics. IP SLA Manager collects IP SLA data and then presents it in the easy-to-use Orion Web Console environment. With IP SLA Manager and IP SLA operations you know at a glance exactly how well your network is and has been performing. For more information about Cisco IP SLA operations, see www.cisco.com/go/ipsla.

Custom Charts and Gauges

IP SLA Manager provides a number of easy-to-read charts and gauges that you can customize to suit your monitoring requirements. Using custom IP SLA Manager gauges of key IP SLA metrics such as jitter, latency, packet loss, and mean opinion score (MOS), you can quickly determine the current status and performance of your network. With custom IP SLA Manager charts, you are able to easily track the historical performance of all the devices on your network, including routers, VoIP call managers, gateways, and VoIP phones.

Custom Alerts and Actions

Leveraging the Orion Advanced Alert Manager, IP SLA Manager allows you to create custom alerts for your network in the same way you create custom alerts and actions in Orion Network Performance Monitor. Specifically, IP SLA Manager allows you to configure IP SLA-related alerts with a variety of corresponding actions to notify you of events on your Orion-managed network. These IP SLA alerts are filtered from existing Orion alerts and presented separately, within IP SLA Manager. For more information about using Advanced Alerts in IP SLA Manager, see “Using Advanced Alerts and Actions” on page 39.

Custom Reporting

With Orion Report Writer, IP SLA Manager provides realtime and historical statistics reporting for the IP SLA-specific network statistics. When you install IP SLA Manager, several predefined reports become available within Orion Report Writer. In addition, with the use of custom properties, you can also generate custom reports to specifically communicate the historical condition of your network. For more information about data reporting in IP SLA Manager, see “Creating IP SLA Manager Reports” on page 40.

Call Manager Monitoring

Call manager devices are scalable call processing solutions for managing IP-based telecommunications networks. These devices provide VoIP networks with the same features and functionality of more traditional telephony. IP SLA Manager uses the SNMP and ICMP monitoring technology at the core of Orion Network Performance Monitor to interact with call managers. As a result, you are able to persistently track call manager performance. With the addition of IP SLA Manager, you immediately know the status of your VoIP network and all of its components at any time.

Upon installation, IP SLA Manager allows you to monitor Cisco CallManager and CallManager Express devices. You can also define custom MIB pollers to monitor call managers from other manufacturers. For more information about custom MIB pollers, see “Creating Custom MIB Pollers” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*. For more information about Cisco CallManager and CallManager Express devices, search for “CallManager” at `www.cisco.com`. For more information about monitoring Cisco CallManager devices with IP SLA Manager, see “Adding or Deleting Cisco CallManager Devices” on page 18. For more information about monitoring other call manager devices with IP SLA Manager, see “Adding Call Manager Devices from Other Manufacturers” on page 19.

How Orion IP SLA Manager Works

Orion IP SLA Manager builds upon the proven technology of Orion Network Performance Monitor (Orion NPM) to give you monitoring, alerting, and reporting abilities for your network. After installation and initial configuration, IP SLA Manager deploys Cisco IP SLAs to generate various types of network traffic such as DNS requests, DHCP IP allocation, FTP and HTTP requests, TCP connect, ICMP and UDP Echo, and simulated VoIP traffic between devices on your network using the jitter codec you specify. Cisco IP SLAs provide realtime and historical performance statistics that IP SLA Manager presents in the readily customizable Orion Web Console.

IP SLA Manager only works with Cisco IOS devices that support the RTT MIB. For more information about the MIBs IP SLA Manager uses, see "MIBS Maintained by IP SLA Manager" in the *SolarWinds Orion IP SLA Manager Administrator Guide*.

Note: For VoIP statistics, IP SLA Manager uses simulated VoIP traffic, instead of real VoIP traffic, to ensure the continuous collection of performance statistics so you can know the state of your network at any time, regardless of whether the network is actually being used to complete a call.

Chapter 2

Getting Started with Orion IP SLA Manager

Orion IP SLA Manager uses the same intuitive installer and configuration wizard interfaces that Orion Network Performance Monitor employs. Though it is an enterprise-class monitoring solution, IP SLA Manager does not require any additional resources beyond those required for the underlying implementation of Orion Network Performance Monitor.

Installation Requirements

The server that you use to host IP SLA Manager must also support an installation of Orion Network Performance Monitor. The following requirements are based on a minimum installation of IP SLA Manager with SQL Server on a separate database server.

Note: To optimize database scalability, SolarWinds recommends that you maintain your SQL Server installation on its own server, separate from the server on which you are hosting Orion Network Performance Monitor and IP SLA Manager.

Hardware/Software	Requirements (for Orion server unless stated otherwise)
Environment	IP SLA Manager sites are limited to locations where there is an existing, Cisco IP SLA-compatible router to serve as a simulation node. For more information about IP SLA-capable routers and switches, see www.cisco.com/go/fn and select “IP SLAs – UDP Based VoIP Operation”.
CPU	Dual processor, 3GHz
RAM	3 GB
Hard Drive Space	20 GB
Operating System	Windows 2003 Server (32-bit or 64-bit) including R2, with IIS installed, running in 32 bit mode Windows 2008 Server (32-bit or 64-bit) with IIS installed, running in 32 bit mode
.Net Framework	Version 3.5 or later
Orion Network Performance Monitor	Version 9.5 SP4 or later
Database	SQL Server 2005 SP1 Express, Standard, or Enterprise SQL Server 2008 Express, Standard, or Enterprise
Web Browser	Internet Explorer version 6 or later Mozilla Firefox 3.0

For more information about system requirements for Orion Network Performance Monitor, see “Requirements” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

Orion IP SLA Manager Licensing

Orion IP SLA Manager is licensed based on the number of IP SLA source devices you want to monitor. Any device that has at least one monitored operation will count towards the license. In addition, IP SLA Manager also offers licenses both for additional IP SLA Manager pollers and for use with website-only Orion Network Performance Monitor installations. For more information about Orion Network Performance Monitor licensing, see “Licensing Orion Network Performance Monitor” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

The following list provides the different types of Orion IP SLA Manager licenses that are available:

- Up to 5 devices (IP SLA 5)
- Up to 25 devices (IP SLA 25)
- Up to 50 devices (IP SLA 50)
- Unlimited devices (IP SLA X)

Installing Orion IP SLA Manager

Orion IP SLA Manager employs an intuitive wizard to guide your installation. The following procedure will complete your installation of IP SLA Manager.

Notes:

- SolarWinds generally recommends that you back up your database before performing any upgrade.
- For most Orion IP SLA Manager installations, the Configuration Wizard automatically maintains the configuration settings that you entered for your initial Orion Network Performance Monitor installation.
- If you are installing a web-only version of Orion IP SLA Manager on a remote Orion Network Performance Monitor server, contact SolarWinds support at www.solarwinds.com for licensing instructions specific to your installation.
- If you are installing an additional IP SLA Manager poller, contact SolarWinds support at www.solarwinds.com for licensing instructions specific to your installation.

To install Orion IP SLA Manager:

1. Log on to the Orion Network Performance Monitor server you will use to monitor your VoIP network.

   Note: Orion IP SLA Manager requires Orion NPM version 9.5 SP4 or later.

2. ***If you downloaded the product from the SolarWinds website,*** navigate to your download location and launch the executable.
3. ***If you received physical media,*** browse to the executable file, and then launch the executable.
4. Read the SolarWinds welcome message, and then click **Next** to continue.
5. Select **I accept the terms of the license agreement**, and then click **Next**.
6. Click **Install**.
7. After the wizard completes installation, click **Finish**.
8. ***If this is a new installation of Orion IP SLA Manager,*** click **Enter Licensing Information**, and then complete the license registration process. For more information about Software License Keys, see “Software License Key” on page 47.
9. Click **Continue** when the license is successfully installed.
10. ***If the Configuration Wizard does not start automatically,*** click **Start > All Programs > SolarWinds Orion > Configuration Wizard**.
11. Review the configuration summary.
12. ***If the configuration settings are correct,*** click **Finish**.

Upgrading from VoIP Monitor to IP SLA Manager

Upgrading from VoIP Monitor to IP SLA Manager does not require you to uninstall your current installation. To upgrade IP SLA Manager, install IP SLA Manager normally. None of your historical data or customized settings will be lost in the process. For more information about installing IP SLA Manager, see "Installing Orion IP SLA Manager" on page 6.

Notes:

- Back up your Orion database before you install IP SLA Manager, to ensure that none of your data is lost during the upgrade.
- You must have VoIP Monitor 2.1 or later installed before upgrading to IP SLA Manager 3.0.
- If you have a large amount of VoIP and CallManager data, the upgrade may take more than 30 minutes to an hour to complete.

Understanding Quality of Service and IP SLAs

IP Service Level Agreements (IP SLAs) are a diagnostic method developed by Cisco that generates and analyzes traffic between Cisco IOS devices on your network. By using IP SLA Manager to implement IP SLA operations between your network devices, you can acquire realtime and historical statistics that give you accurate Quality of Service (QoS) measures for your network. IP SLA Manager builds on the proven monitoring capabilities of Orion Network Performance Monitor and presents performance metrics generated with Cisco IP SLA operations over designated paths on your network.

IP SLA operations use a source device and target device to measure various network metrics.

Source

A device that creates and inserts IP SLA packets into the network. The source is where all IP SLA operation tests are initiated.

Target

The ultimate destination of the packets created and sent by the source.

Operation

The type of test being performed on the network.

The following operations are supported by IP SLA Manager.

DHCP

Dynamic Host Configuration Protocol (DHCP) IP SLA operations measure the response time taken to discover a DHCP server and then obtain a leased IP address from it.

DNS

Domain Name Server (DNS) IP SLA operations measure the difference in time from when a DNS request is sent and when the reply is received.

FTP

File Transfer Protocol (FTP) IP SLA operations measure the response time between a Cisco device and an FTP server to retrieve a file.

HTTP

Hypertext Transfer Protocol (HTTP) IP SLA operations measure distributed web services response times.

ICMP Echo

Internet Control Message Protocol (ICMP) Echo IP SLA operations measure round trip time between nodes on your network.

TCP Connect

Transmission Control Protocol (TCP) Connect IP SLA operations measure WAN quality by testing connection times between two devices using a specific port.

UDP Echo

User Datagram Protocol (UDP) Echo IP SLA operations measure round trip time between nodes on your network.

UDP Jitter

UDP Jitter IP SLA operations measure WAN quality by testing connection times between two devices using a specific port number.

VoIP UDP Jitter

Voice over Internet Protocol (VoIP) UDP Jitter IP SLA operations measure call path metrics on your VoIP network.

Latency

Latency, also known as delay or lag, is a measure of the time it takes to complete a transfer of information, either roundtrip or one-way, between two network devices. With respect to VoIP, latency is a measure of the difference in time between when one caller speaks and when the other caller hears what the first has said. Excessive network latency can cause both noticeable gaps and a loss of synchronization in transmitted conversations, particularly when VoIP is used with other types of data, as in a videoconference. If these gaps become large enough, callers may find that they will inadvertently interrupt each other while conversing.

IP SLA operations measure latency by sequentially applying four different timestamps to a single test packet, as follows.

1. Timestamp **T1** is applied to a test packet as it leaves the source router.
2. Timestamp **T2** is applied as the test packet arrives at the target router.
3. Timestamp **T3** is applied as the test packet leaves the target router to return to the source.
4. Timestamp **T4** is applied when the test packet returns to the source.

IP SLA operations then provide four separate measures of latency by computing differences among the four timestamps, as follows.

Latency Measure	Calculation
Round Trip Time	T4 – T1
Source-to-Target Latency	T2 – T1
Target Processing Latency	T3 – T2
Target-to-Source Latency	T4 – T3

Note: Latency is computed for both Source-to-Target and Target-to-Source directions to account for asynchronous network behavior, providing a more detailed picture of overall network latency.

Jitter

Jitter is a measure of the variation in network latency that results in a loss of synchronization over time. In VoIP phone calls, users experience jitter as distracting noise, clicks, and pops. To ensure acceptable quality of service, network jitter should be located, isolated, and addressed. IP SLA Manager allows you to identify areas of your network that may be experiencing synchronization difficulties, enabling you to take the necessary action to ensure maximum QoS on your VoIP network.

IP SLA Manager requires you to select a jitter codec to properly configure IP SLAs for your VoIP network. Codecs compute jitter by specifying that IP SLA operations send a number of packets (*n*), each with a specific size (*s*), at a set interval (*i*) between packets, at a determined frequency (*f*), as shown in the following table.

Codec	IP SLA Operation Frequency (*f*)	Default Number of Packets (*n*)	Default Packet Size (*s*)	Default Interval between Packets (*i*)
G.711a	Set on each operation as the **Network test interval**	1000	160 + 12 RTP bytes	20 ms
G.711u		1000	160 + 12 RTP bytes	20 ms
G.729a		1000	20 + 12 RTP bytes	20 ms

Note: Based on the Cisco IP SLA operations used by IP SLA Manager, jitter codecs G.711a and G.711u can achieve peak MOS of 4.34. On the same basis, jitter codec G.729a can achieve a peak MOS of 4.06.

Packet Loss

Packet Loss is a quantitative measure of information loss over a given network connection. Though packet loss is inevitable in any network environment, the goal is always to identify where packets are lost in transmission so you can act to minimize information loss and maintain high QoS for your services.

Mean Opinion Score (MOS)

MOS is an industry standard measure of call quality expressed on a scale of increasing perceived quality, from 1 to 5. IP SLA Manager reports MOS as computed by a standard International Telecommunications Union (ITU) algorithm involving the codec for your VoIP network and values of latency, jitter, packet loss, and MOS advantage factor. Jitter, latency, and packet loss are variable quantities that are measured by IP SLA Manager in realtime. Generally, MOS reflects call quality as shown in the following table.

Call Quality	MOS
Very Satisfied	4.3-5.0
Satisfied	4.0-4.3
Some Users Satisfied	3.6-4.0
Many Users Dissatisfied	3.1-3.6
Nearly All Users Dissatisfied	2.6-3.1
Not Recommended	1.0-2.6

Both the MOS advantage factor and the codec algorithm are selected for your specific network on the IP SLA Manager Settings page. The following table provides some guidance as to how the advantage factor is determined for your application.

Communication System Type Examples	Maximum Advantage Factor Value
Conventional wired network	0
Wireless network within a building	5
Outdoor wireless network (cellular phones)	10
Remote communications by satellite	20

For more information about MOS calculations, see ITU-T Recommendation G.107. For more information about codec algorithms, see “Jitter” on page 11. For more information about IP SLA Manager Settings, see “Orion IP SLA Manager Settings” on page 14.

Monitoring Cisco CallManager Health

IP SLA Manager references the Cisco Management Information Base (MIB) CISCO-CCM-MIB to provide out-of-the-box monitoring capability for Cisco CallManager and CallManager Express devices. With the use of custom MIB pollers, IP SLA Manager can also track the performance of call managers from other manufacturers. For more information about custom MIB pollers, see “Creating Custom MIB Pollers” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*. Once a call manager device has been added to the Orion database for management by Orion Network Performance Monitor, you can use the intuitive interface of IP SLA Manager to track and report call-processing performance statistics for your VoIP network.

Only Cisco CallManager and CallManager Express devices may be added to IP SLA Manager as CallManager nodes. Call management devices from other manufacturers may be added, and monitored, as VoIP devices on the IP SLA Manager Infrastructure page in the IP SLA Manager Settings menu. For more information, see “Adding or Deleting Cisco CallManager Devices” on page 18. For more information about adding non-Cisco call management devices, see “Adding Call Manager Devices from Other Manufacturers” on page 19.

Using IP SLA Manager in the Orion Web Console

IP SLA Manager is a fully integrated module of the Orion Network Performance Monitor Web Console. Once IP SLA Manager is installed, click **IP SLA Manager** in the Orion Web Console Modules toolbar to open the IP SLA Manager Summary View. For more information about installing IP SLA Manager, see “Installing Orion IP SLA Manager” on page 6. For more information about the IP SLA Summary View, see “IP SLA Manager Views” on page 39.

All network devices and relevant interfaces that you want to monitor with IP SLA Manager must first be managed by Orion Network Performance Monitor. For more information, see “Using Orion System Manager” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*. After adding IP SLA devices to the Orion database, you can then submit them to IP SLA Manager for monitoring.

Adding Orion Nodes to IP SLA Manager

Before you can start creating and monitoring IP SLA operations, you must add your IP SLA capable routers to IP SLA Manager. Nodes must first be added to the Orion database before you can add them to IP SLA Manager. For more information on adding nodes to Orion, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

To add Orion nodes to IP SLA Manager:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add Orion nodes to IP SLA**.
4. Select the nodes you want to add to IP SLA Manager, and then click **Add Nodes**.

Configuring IP SLA Manager

After establishing your basic IP SLA Manager configuration with the Configuration Wizard and adding IP SLA operations, you can change your settings at any time to further customize IP SLA Manager for your network. Modifications include the addition of IP SLA devices, the designation of paths, and the configuration of polling options. IP SLA Manager uses a wizard-based application to guide you through the process of configuring IP SLA Manager for your IP SLA network.

The following sections provide detailed instructions for configuring the various aspects of IP SLA Manager for your network.

Orion IP SLA Manager Settings

The IP SLA Manager Settings page gives an overview of the configuration pages within IP SLA Manager. The following aspects of IP SLA Manager may be configured from this page.

Manage IP SLA Operations

This page provides an intuitive interface for adding and IP SLA operations, on your network. Each IP SLA operation on your network is associated with a designated simulation node. You can easily create new IP SLA operations and edit or delete existing operations from the Manage IP SLA Operations page. You must first add IP SLA-capable nodes to your Orion database with System Manager before they are available for monitoring by IP SLA Manager. For more information about adding, editing, or deleting IP SLA operations, see “Configuring Devices for IP SLA Operations” on page 19.

Note: IP SLA operations are limited to locations where there is an existing, Cisco IP SLA-compatible router or switch to serve as a simulation node. For more information about Cisco IP SLA-capable routers and switches, see www.cisco.com/go/fn and select “IP SLAs – UDP Based VoIP Operation”.

Manage IP SLA Nodes

This page provides and interface that allows you to add and remove IP SLA devices to IP SLA Manager. For more information, see "Adding Orion Nodes to IP SLA Manager" on page 14.

Manage CallManager Nodes

The Manage CallManager Nodes page allows you to specify the devices on your VoIP network that are Cisco CallManager and CallManager Express devices. The IP SLA Manager CallManagers resource that is available on IP SLA Manager views is specifically tailored for Cisco CallManager devices. You must first add CallManager nodes to your Orion database with System Manager before they are available for monitoring by IP SLA Manager. For more information about adding Cisco CallManager devices, see “Adding or Deleting Cisco CallManager Devices” on page 18.

Select VoIP Infrastructure

The Select VoIP Infrastructure page allows you to select VoIP-related nodes and interfaces from your Orion database and then conveniently display them in the VoIP Infrastructure resource.

IP SLA Manager can monitor any node that is relevant to your VoIP network, provided you have first added the node with System Manager. By expanding the given node trees, you can choose to monitor VoIP traffic down to the interface level. IP SLA Manager provides a number of default alerts, reports, and resources that allow you to constantly monitor all of your VoIP devices. For more information about adding devices and interfaces, see "Adding Orion Nodes to IP SLA Manager" on page 14. For more information about alerts and reports in IP SLA Manager, see “Using IP SLA Manager” on page 39.

IP SLA Settings

This page presents general options regarding your configuration of IP SLA Manager. From the IP SLA Manager Settings page you can configure the following aspects of your IP SLA Manager installation:

- The port through which IP SLA Manager sends simulated traffic
- The jitter codec that IP SLA Manager simulates on your network
- The interval on which IP SLA Manager collects test data about your network
- The length of time that collected data is retained in the Orion database
- The MOS advantage factor that appropriately characterizes your VoIP network for the purpose of determining the Mean Opinion Score (MOS)
- The Type of Service (ToS) octet allows you to set precedence levels for VoIP traffic and IP SLA operations
- If you have multiple VoIP pollers installed, you can configure the interval on which IP SLA Manager checks the status of these additional VoIP pollers

Database Details

The IP SLA Manager Database Details page provides installation and memory sizing information for your Orion database. From this view you can read statistics concerning individual tables within your database. Select a table from the list to see a count of rows and the amount of memory used by data and indexes, respectively.

Configuring IP SLA Manager Settings

The following steps guide you through the process of configuring IP SLA Manager on the IP SLA Manager Settings page.

Note: IP SLA Manager maintains default values for these settings. If, at any time, you want to use the default settings, click **Restore Defaults**.

To configure IP SLA Manager settings:

1. ***If you want to use a port other than the default for simulated VoIP traffic,*** type your preferred port in the **VoIP UDP Port** field.
2. Select the **VoIP Jitter Codec** you are using for your VoIP network. For more information about jitter codecs, see “Jitter” on page 11.

3. Type a **Polling Interval**, in minutes.

   Note: IP SLA Manager measures the performance of your network by periodically sending test packets over defined call paths. IP SLA Manager measures the performance of your VoIP network in transmitting these test packets. The period between measurements is referred to as the Polling Interval. As network sizes and VoIP server performance vary, you may have to try a number of different intervals to achieve the desired balance between server processing load and data resolution.

4. Type the period of time, in days, to retain VoIP data in the **Call Path Data Retention** field.

   Note: IP SLA Manager stores statistics regarding the performance of your VoIP network in your Orion database. The length of time this data is retained is configurable, allowing you to balance database maintenance with IP SLA requirements. As network sizes and VoIP server performance vary, you may have to try different retention periods to achieve the desired balance between database memory allocation and data retention.

5. Type a value for the **MOS Advantage Factor**.

   Note: The advantage factor is a measure, on a scale of 0 to 20, of the willingness of your VoIP network users to trade call quality for convenience. For example, a cellular telephone is more convenient than a wired telephone, so some loss of call quality due to compression over a cellular phone network, as compared to call quality over a wired phone network, is acceptable to most users. This distinction is reflected in a higher advantage factor for a cellular phone network than for a wired phone network. For more information, see “Mean Opinion Score (MOS)” on page 12.

6. Provide a value for the **Type of Service** (ToS) octet to set the precedence of VoIP traffic on your network.

   Note: The ToS octet is a decimal value (0-255) that sets the precedence for VoIP traffic monitored with Cisco IP SLA operations. The default ToS value used by IP SLA Manager is 184, corresponding to Expedited Forwarding (EF) per hop behavior (PHB) and a Differentiated Service Code Point (DSCP) value of 46.

7. In the **Multiple Poller Check Interval** field, provide an interval, in minutes, to establish the frequency with which IP SLA Manager checks for other configured VoIP pollers.

   Note: Set this number relatively high to optimize resource allocation unless you intend to add or remove additional VoIP pollers soon.

8. Click **OK** after you have completed your IP SLA Manager settings configuration.

Adding or Deleting Cisco CallManager Devices

Cisco CallManager and CallManager Express devices are added and deleted on the Manage CallManager Nodes section found in IP SLA Manager Settings page. The following sections give procedures for adding or deleting CallManager devices.

Note: Call managers from manufacturers other than Cisco can be monitored with IP SLA Manager if you use a custom management information base (MIB) poller specifically configured for your non-Cisco call manager. For more information, see “Adding Call Manager Devices from Other Manufacturers” on page 19.

Adding CallManager Devices to IP SLA Manager

The following procedure adds a Cisco CallManager device to IP SLA Manager.

To add a CallManager device to IP SLA Manager:

1. ***If you have not already added your CallManager devices to the Orion database,*** use Orion System Manager to add your CallManager devices before continuing. For more information on adding devices, see “Using Orion System Manager” in the *SolarWinds Orion NPM Administrator Guide*.
2. Click **Add new CallManager nodes**.
3. Expand the device lists to review available CallManager-hosting devices.

   Note: If you do not see an expected CallManager device, use Orion System Manager to add it. For more information on adding devices, see “Using Orion System Manager” in the *SolarWinds Orion NPM Administrator Guide*.
4. Check the devices hosting CallManagers you want to monitor, and then click **Add New CallManagers**.

Deleting Cisco CallManager Devices from IP SLA Manager

The following procedure provides the steps required to delete a Cisco CallManager device from IP SLA Manager.

To delete a CallManager device from IP SLA Manager:

1. Click **Remove CallManager nodes**.
2. Select the CallManager-hosting devices you want to delete, and then click **Remove CallManagers**.
3. ***If you are sure that you want to stop monitoring the selected node for CallManager data,*** click **OK** in the dialog.

Adding VoIP Infrastructure

The Select VoIP Infrastructure page provides an intuitive interface that allows you to select the Orion-managed devices that are part of your VoIP network. The following procedure shows how to add VoIP devices to IP SLA Manager.

Note: If a VoIP device that you want to monitor with IP SLA Manager is not listed on this page, you must add the device to the Orion database using Orion System manager. For more information, see “Using Orion System Manager” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

To add a VoIP device to IP SLA Manager:

1. Click **Select VoIP Nodes**.
2. Navigate the available devices and interfaces, and then check the appropriate objects for your VoIP network.
3. ***If you do not see an expected VoIP-related device or interface in the list,*** use System Manager to add the device to the Orion database. For more information, see “Using Orion System Manager” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

   Note: If you are adding a VoIP Simulation node and you want IP SLA Manager to automatically discover its IP SLA operation configuration, you must provide an SNMP read/write community string when you add the device. For more information about IP SLA operations, see “Configuring Devices for IP SLA Operations” on page 19.

Adding Call Manager Devices from Other Manufacturers

Call managers from manufacturers other than Cisco can be monitored with IP SLA Manager if you use a custom management information base (MIB) poller specifically configured for your non-Cisco call manager. IP SLA Manager treats non-Cisco call managers in the same way as any other VoIP device, so non-Cisco call managers are added to IP SLA Manager in the same that any other VoIP device is added. For more information about creating custom MIB pollers, see “Creating Custom MIB Pollers” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*. For more information about adding devices to IP SLA Manager, see “Adding VoIP Infrastructure” on page 19.

Note: IP SLA Manager presents a non-Cisco call manager in the same way that it presents any other VoIP network node. Non-Cisco call managers are not displayed with Cisco devices in the CallManagers resource.

Configuring Devices for IP SLA Operations

Cisco IP Service Level Agreements (IP SLAs) are the primary means by which IP SLA Manager acquires information about the performance of your network. The

process of configuring a device for IP SLA can be quite intricate, as it can involve numerous command line operations on each router. To ease the process of device configuration, IP SLA Manager can automatically add IP SLA operations to your network devices and start monitoring those operations immediately.

Designating Paths

For some of the SLA operations utilized by IP SLA Manager, performance statistics are collected by sending traffic over paths between sites that you define. Because large networks can quickly become complicated, IP SLA Manager provides an easy-to-use interface for selecting paths for monitoring. When configuring IP SLA operations, IP SLA Manager offers the following three options for establishing monitoring:

Fully Meshed

A Fully Meshed path configuration connects every node you define over distinct call paths to every other node selected.

Hub and Spoke

A Hub and Spoke call path configuration allows you to designate specific nodes as hubs. Each hub is then connected to all other nodes, with paths representing spokes.

Custom

The Custom call path configuration option allows you to define your own paths. All defined nodes are listed under this option, and expanding each node displays a list of all other nodes. Checkboxes allow you to define paths to best suit your monitoring requirements.

Understanding the Impact IP SLA Operations Have on Your Network

When configured properly, IP SLA operations have a minimal impact on your overall network health. Problems can arise when configurations force operations to be tested too frequently, or when too many overlapping operations are being performed across similar paths.

Most problems are created when using IP SLA operations on a fully meshed network. For example, in a fully meshed network with seven devices, a simple ICMP Echo operation would require 42 operations to test each link in each direction. The number of links is found using the following calculation.

Hub-and-Spoke Links = *N* -1

Full Mesh Links = *N*(*N*-1)/2

Where *N* is the number of devices on the network. Therefore, the number of links in a seven device fully meshed network would be 7(7-1)/2, or 7(6)/2, or 21.

To test each link bi-directionally, twice as many operations are needed. The number of bi-directional links is found using the following calculation:

Hub-and-Spoke Links = (*N* -1)2

Full Mesh Links = *N*(*N*-1)

Therefore the total number of operations for the seven site hub-and-spoke and seven site full mesh are as follows:

Hub-and-Spoke Operations = (7-1)2 = 12

Full Mesh Operations = 7(7-1) = 42

Adding three additional operations to that network would increase the operations from 36 to 144 (36*4). 144 operations will not have a significant impact on this small network.

When looking at a typical mid-sized network with 30 devices, the number of operations begins to quickly increase, according to the following calculation:

Links = 30*29/2 = 435

Total Operations = 435*2*4 = 3480

As you can see, the number of operations starts to grow at an exponential rate. Here is the same arithmetic for a 180 device network:

Links = 180*179/2 = 16,110

Total Operations = 16,110*2*4 = 128,800

By continuing to add operations and devices to any network, especially in a fully meshed environment, overall network performance will start to degrade. In addition to burdening the network with test packets, a large number of IP SLA operations can cause the following effects:

- Several thousand test results stored every five minutes can create a large database affecting others services on the Orion database.
- Chances are that most of the historical results will never be examined due to the large number of results to filter.
- Adding thousands of IP SLA operations could add a significant burden to the SNMP poller.

Because IP SLA operations can be dangerous when improperly implemented, you can use the following strategies to help avoid these issues.

Keep Local Tests Local

Not all test types are used to test WAN services (DHCP is one example). A large network may have several distributed DHCP servers. If each site has a local DHCP server, users at that site would receive IP addresses from the local server if it is available. For 40 sites you could accomplish DHCP testing by deploying an operation from each site's local switch or router to the site's local DHCP server. This creates only 40 tests with 40 results to poll and store every five minutes. You might also add tests for some secondary DHCP servers and have 50 or so total tests. If you added all DHCP testing to all sites to all servers you would have approximately 40^2, or 1600 tests. Most of these tests are for DHCP requests to remote sites, which will never actually be what the users request when obtaining an IP address.

Test Paths Only for Supported Traffic

For this example, UDP jitter, a common IP SLA test, will be used. On an MPLS 40-site network, the UDP jitter operation is implemented between the 5 sites that use UDP to deliver video conferencing. Because video conferencing is sensitive to network jitter and delay, implementing jitter operations between these sites is recommended. Using the formula for a full mesh network such as an MPLS network, we need to set up 10 operations. However, if full mesh is deployed to test the links between all sites, there would be 40*39/2=780 tests, and only 1.3% of the tests would be for valid video paths. Therefore, a custom deployment of the operations is the recommended option for this scenario.

Consider Decreasing the Test Frequency When Possible

Decreasing or increasing the test frequency has a significant impact on the network load. For example, decreasing the test frequency from 300 seconds to 360 seconds will lessen the test impact on the source device and network by ten percent. Increasing the frequency to 150 seconds will increase the load by one hundred percent.

Avoid Overlapping Tests

It is possible to deploy a DNS test to an internal DNS server, an HTTP test to an intranet page, a ping test to the HTTP server, and a TCP connect to the HTTP server from a local switch. While there are four individual operations testing four services, there are now three redundant tests overlapping each other. The HTTP operation performs the following.

1. Resolves the URL to an IP address using the DNS server.
2. Performs a TCP port 80 request to the HTTP server.
3. Requests the HTTP and detects a successful page load.
4. Records the DNS resolve time, TCP open time, and page load time.

Using the HTTP test, the other three tests can be eliminated because they yield the same results.

Because it is so easy to bring down your network with too many IP SLA operations, IP SLA Manager limits the number of operations that can be created at one time to 306, or 18 nodes in a fully meshed environment.

For more detailed information on IP SLA operation configurations and deployment strategies, see the *New to Networking Volume 2: The Basics of Cisco IP SLA* technical reference at www.thwack.com.

Adding DNS IP SLA Operations to Your Devices

Domain Name Server (DNS) IP SLA operations measure the difference in time from when a DNS request is sent and when the reply is received. These operations ensure that your DNS servers are operational as well as performing as expected.

To add DNS IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.

4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select **DNS**, and then click **Next**.
7. Select the nodes you want add to your new DNS operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see "Adding Devices for Monitoring in the Web Console" in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
8. Type the IP Address of the DNS server and the hostname or IP address to resolve, and then click **Next**.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Define your warning and critical threshold values in the associated fields.
11. ***If you want to assign a Virtual Routing and Forwarding (VRF) name for this path,*** expand Advanced, and then type the VRF name.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
12. Click **Next**.
13. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
14. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
15. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding FTP IP SLA Operations to Your Devices

File Transfer Protocol (FTP) IP SLA operations measure the response time between a Cisco device and an FTP server to retrieve a file. These operations ensure that your FTP servers are operational as well as performing as expected.

To add FTP IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **FTP**, and then click **Next**.
7. Select the nodes you want add to your new FTP operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see "Adding Devices for Monitoring in the Web Console" in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
8. Type the URL of the FTP server to be tested, and then click **Next**.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Define your warning and critical threshold values in the associated fields.
11. ***If you want to assign a type of service or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the type of service number and VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
12. Click **Next**.
13. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.

14. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.

15. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding HTTP IP SLA Operations to Your Devices

Hypertext Transfer Protocol (HTTP) IP SLA operations measure distributed web services response times. These operations ensure that your HTTP servers are operational as well as performing as expected.

To add HTTP IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **HTTP**, and then click **Next**.
7. Select the nodes you want add to your new HTTP operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
8. Type the URL of the HTTP server to be tested, and then click **Next**.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Define your warning and critical threshold values in the associated fields.

11. ***If you want to assign a type of service or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the type of service number and VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.

12. Click **Next**.

13. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.

14. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.

15. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding DHCP IP SLA Operations to Your Devices

Dynamic Host Configuration Protocol (DHCP) IP SLA operations measure the response time taken to discover a DHCP server and then obtain a leased IP address from it. These operations ensure that your DHCP servers are operational as well as performing as expected.

To add DHCP IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **DHCP**, and then click **Next**.
7. Select the nodes you want add to your new DHCP operations, and then click **Next**.

Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see "Adding Devices for Monitoring in the Web Console" in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

8. Type the IP address of the DHCP server to be tested, and then click **Next**.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Define your warning and critical threshold values in the associated fields.
11. ***If you want to assign a Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
12. Click **Next**.
13. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
14. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
15. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding TCP Connect IP SLA Operations to Your Devices

Transmission Control Protocol (TCP) Connect IP SLA operations measure WAN quality by testing connection times between two devices using a specific port. These operations ensure that your WAN is operational as well as performing as expected.

To add TCP Connect IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.

4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **TCP Connect**, and then click **Next**.
7. Select the type of path your network is configured to use. For more information, see "Designating Paths" on page 20.
8. Select the nodes you want add to your new TCP Connect operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Type the port number to be used in the test in the **Port Number** field.
11. Define your warning and critical threshold values in the associated fields.
12. ***If you want to assign a type of service or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the type of service number and VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
13. Click **Next**.
14. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
15. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
16. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding UDP Jitter IP SLA Operations to Your Devices

User Datagram Protocol (UDP) Jitter IP SLA operations measure WAN quality by testing connection times between two devices using a specific port number. These operations ensure that your WAN is operational as well as performing as expected.

To add UDP Jitter IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **UDP Jitter**, and then click **Next**.
7. Select the type of path your network is configured to use. For more information, see "Designating Paths" on page 20.
8. Select the nodes you want add to your new UDP Jitter operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Type the port number to be used in the test in the **Port Number** field.
11. Define your warning and critical threshold values in the associated fields.
12. ***If you want to assign a type of service or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the type of service number and VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
13. Click **Next**.

14. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
15. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
16. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding VoIP UDP Jitter IP SLA Operations to Your Devices

Voice over Internet Protocol (VoIP) UDP Jitter IP SLA operations measure call path metrics on your VoIP network. These operations ensure that your VoIP network is operational as well as performing as expected.

To add VoIP UDP Jitter IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **VoIP UDP Jitter**, and then click **Next**.
7. Select the type of path your network is configured to use. For more information, see "Designating Paths" on page 20.
8. Select the nodes you want add to your new VoIP UDP Jitter operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Type the port number to be used in the test in the **Port Number** field.

11. Define your warning and critical threshold values in the associated fields.

12. ***If you want to assign a codec, type of service, or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then select the codec, and then type the type of service number and VRF name in the appropriate fields. For more information about codec algorithms, see “IP SLA operations use a source device and target device to measure various network metrics.

Source

A device that creates and inserts IP SLA packets into the network. The source is where all IP SLA operation tests are initiated.

Target

The ultimate destination of the packets created and sent by the source.

Operation

The type of test being performed on the network.

The following operations are supported by IP SLA Manager.

DHCP

Dynamic Host Configuration Protocol (DHCP) IP SLA operations measure the response time taken to discover a DHCP server and then obtain a leased IP address from it.

DNS

Domain Name Server (DNS) IP SLA operations measure the difference in time from when a DNS request is sent and when the reply is received.

FTP

File Transfer Protocol (FTP) IP SLA operations measure the response time between a Cisco device and an FTP server to retrieve a file.

HTTP

Hypertext Transfer Protocol (HTTP) IP SLA operations measure distributed web services response times.

ICMP Echo

Internet Control Message Protocol (ICMP) Echo IP SLA operations measure round trip time between nodes on your network.

TCP Connect

Transmission Control Protocol (TCP) Connect IP SLA operations measure WAN quality by testing connection times between two devices using a specific port.

UDP Echo

User Datagram Protocol (UDP) Echo IP SLA operations measure round trip time between nodes on your network.

UDP Jitter

UDP Jitter IP SLA operations measure WAN quality by testing connection times between two devices using a specific port number.

VoIP UDP Jitter

Voice over Internet Protocol (VoIP) UDP Jitter IP SLA operations measure call path metrics on your VoIP network.

Latency

Latency, also known as delay or lag, is a measure of the time it takes to complete a transfer of information, either roundtrip or one-way, between two network devices. With respect to VoIP, latency is a measure of the difference in time between when one caller speaks and when the other caller hears what the first has said. Excessive network latency can cause both noticeable gaps and a loss of synchronization in transmitted conversations, particularly when VoIP is used with other types of data, as in a videoconference. If these gaps become large enough, callers may find that they will inadvertently interrupt each other while conversing.

IP SLA operations measure latency by sequentially applying four different timestamps to a single test packet, as follows.

1. Timestamp **T1** is applied to a test packet as it leaves the source router.
2. Timestamp **T2** is applied as the test packet arrives at the target router.
3. Timestamp **T3** is applied as the test packet leaves the target router to return to the source.
4. Timestamp **T4** is applied when the test packet returns to the source.

IP SLA operations then provide four separate measures of latency by computing differences among the four timestamps, as follows.

Latency Measure	Calculation
Round Trip Time	T4 – T1
Source-to-Target Latency	T2 – T1
Target Processing Latency	T3 – T2
Target-to-Source Latency	T4 – T3

Note: Latency is computed for both Source-to-Target and Target-to-Source directions to account for asynchronous network behavior, providing a more detailed picture of overall network latency.

” on page 9.

Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.

13. Click **Next**.
14. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
15. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
16. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding ICMP Echo IP SLA Operations to Your Devices

Internet Control Message Protocol (ICMP) Echo IP SLA operations measure round trip time between nodes on your network. These operations ensure that your network devices are operational as well as performing as expected.

To add ICMP Echo IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.

3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **ICMP Echo**, and then click **Next**.
7. Select the type of path your network is configured to use. For more information, see "Designating Paths" on page 20.
8. Select the nodes you want add to your new ICMP Echo operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Define your warning and critical threshold values in the associated fields.
11. ***If you want to assign a type of service or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the type of service number and VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
12. Click **Next**.
13. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
14. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
15. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Adding UDP Echo IP SLA Operations to Your Devices

UDP Echo IP SLA operations measure round trip time between nodes on your network. These operations ensure that your network devices are operational as well as performing as expected

To add UDP Echo IP SLA operations to your network devices:

1. Log on to your Orion IP SLA Manager server using an account with administrator privileges.
2. Click **IP SLA Manager** in the Modules menu bar, and then click **IP SLA Manager Settings** at the top right of the view.
3. Click **Add new operations**.
4. ***If you do not have existing IP SLA operations created on your routers,*** select **Create new operations**, and then click **Next**.
5. ***If you have already created IP SLA operations on your routers,*** select **Monitor existing operations**, and then click **Next**.
6. Select the **UDP Echo**, and then click **Next**.
7. Select the type of path your network is configured to use. For more information, see "Designating Paths" on page 20.
8. Select the nodes you want add to your new UDP Echo operations, and then click **Next**.

   Note: If you do not see your IP SLA routers in the list, you will need to add the devices to Orion before you can continue. For more information, see “Adding Devices for Monitoring in the Web Console” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.
9. Type the frequency for the operation to be performed in the **Frequency** field.
10. Type the port number to be used in the test in the **Port Number** field.
11. Define your warning and critical threshold values in the associated fields.
12. ***If you want to assign a type of service or Virtual Routing and Forwarding (VRF) name for this path,*** expand **Advanced**, and then type the type of service number and VRF name in the appropriate fields.

    Note: VRFs only exist on provider edge routers (PE). A VRF is a routing and forwarding table instance, and you can have more than one VRF per PE. The VRF includes routes that are available to a certain set of sites. A VRF is named based on the VPNs it services and on the role of the CE in the topology.
13. Click **Next**.

14. ***If you have already created IP SLA operations on your routers,*** type the operation number associated with the IP SLA operation you are adding, and then click **Next**.
15. Review the operations you want to create, and then click **Create Operations**.

    Note: Depending on the amount of operations that are being created, this process may take several minutes to complete.
16. Click **Go to IP SLA Home** to finish the procedure and return to the IP SLA Manager home page.

Chapter 3

Using IP SLA Manager

Orion IP SLA Manager employs the same proven Web Console architecture used by Orion NPM, but IP SLA Manager focuses on the IP SLA operations of your Orion-managed network. IP SLA Summary View provides a customizable default page for IP SLA Manager. This default page gives you a complete overview of your entire network at a glance. After you have installed IP SLA Manager, you can start monitoring your network from the IP SLA Summary View.

To start IP SLA Manager:

1. Log on to your Orion IP SLA Manager server.
2. Click **Start > All Programs > SolarWinds Orion > IP SLA Manager > IP SLA Web Console**.

   Note: You can also open IP SLA Manager at any time from within the Orion Web Console by clicking **IP SLA Manager** in the toolbar.

IP SLA Manager Views

IP SLA Manager presents current metrics of network performance in easily reviewed tables, graphs, and charts. For more information about customizing IP SLA Manager views, see “Customizing Views” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*. The following views are provided with IP SLA Manager:

- IP SLA Summary View
- Top 10 Operation View
- Web Summary View
- VoIP Summary View

Using Advanced Alerts and Actions

VoIP Monitor provides a number of VoIP-specific alerts you can use with Orion Advanced Alert Manager to actively monitor and respond to detected issues. The Orion Advanced Alerts Manager also allows you to designate actions for VoIP Monitor alerts.

Note: Only advanced alerts may be used for VoIP-specific purposes. Basic alerts can not be configured to trigger on VoIP conditions or events.

IP SLA Manager Alerts

Your installation of IP SLA Manager supplements the alerting abilities of Orion Network Performance Monitor with a number of IP SLA-specific alerts.

Alert	Condition
Jitter	Triggered whenever a threshold value for latency variability is either met or sustained for a designated period of time.
Latency	Triggered whenever the measured delay on a designated call path reaches a threshold value, or it can be triggered if a defined delay is sustained for a designated period of time.
Mean Opinion Score (MOS)	Triggered whenever a connection either experiences a MOS below a specified level or maintains a specified MOS over a set period of time.
Packet Loss	Triggered whenever perceived packet loss either exceeds a threshold value or is sustained at a designated level for a specified period of time.
IP SLA Infrastructure Node Status	Triggered whenever a designated node changes status, Up or Down.
Rejected Gateways	Triggered whenever the number of rejected gateways on a Cisco CallManager device exceeds a defined percentage of the total number of gateways on the same CallManager device.
Rejected Phones	Triggered whenever the number of rejected phones on a Cisco CallManager device exceeds a defined percentage of the total number of phones on the same CallManager device.
Unregistered Gateways	Triggered whenever the number of unregistered gateways on a Cisco CallManager device exceeds a defined percentage of the total number of gateways on the same CallManager device.
Unregistered Phones	Triggered whenever the number of unregistered phones on a Cisco CallManager device exceeds a defined percentage of the total number of phones on the same CallManager device.

Other alerts can be configured following the procedures in the *SolarWinds Orion Network Performance Monitor Administrator Guide* and using variables available in Orion NPM and the Advanced Alert Manager. For more information about using Advanced Alerts within Orion Network Performance Monitor, see “Creating and Configuring Advanced Alerts” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

Creating IP SLA Manager Reports

SolarWinds provides Report Writer as a quick and easy way for you to extract data from your Orion database. Because IP SLA Manager is an integrated module of Orion Network Performance Monitor, information that you collect about your IP SLA capable network is easily presented in a variety of formats using Orion Report Writer.

A number of predefined IP SLA-specific reports are available with your installation of IP SLA Manager. Report Writer also enables custom IP SLA report creation, as necessary, using criteria and conditions you choose. When you have finished editing your reports, you can view them through the IP SLA Manager web interface and print them with the click of a button. For more information about predefined IP SLA Reports, see “Using Predefined IP SLA Reports” on page 41. For more information about using Report Writer, see “Creating Reports” in the *SolarWinds Orion Network Performance Monitor Administrator Guide*.

A report scheduling application is available to all customers with a current maintenance agreement. This tool schedules automatic email reports that can be sent to individual users or groups of users. Simply log in to the customer portal of www.solarwinds.com and download the Report Scheduler from the Additional Components for Orion area.

Report Writer capabilities are further enhanced when they are used with the Custom Property Editor. Custom properties are available for report sorting and filtering.

Using Predefined IP SLA Reports

The following historical IP SLA reports are provided with IP SLA Manager installation. Access these reports either by clicking **Reports** in the Views toolbar or by opening Orion Report Writer, where they may be modified, as necessary, to suit your IP SLA network performance reporting requirements. For more information, see “Creating Reports” in the *SolarWinds Orion NPM Administrator Guide*.

Historical IP SLA Reports

The following reports are predefined for reporting on the IP SLA operations on your network.

- DHCP – Last 7 Days
- DHCP – Last Month
- DHCP – This Month
- DNS – Last 7 Days
- DNS – Last Month
- DNS – This Month
- FTP – Last 7 Days
- FTP – Last Month
- FTP – This Month
- HTTP – Last 7 Days
- HTTP – Last Month
- HTTP – This Month
- ICMP Echo – Last 7 Days
- ICMP Echo – Last Month
- ICMP Echo – This Month
- TCP Connect – Last 7 Days
- TCP Connect – Last Month
- TCP Connect – This Month
- UDP Echo – Last 7 Days
- UDP Echo – Last Month
- UDP Echo – This Month
- UDP Jitter – Last 7 Days
- UDP Jitter – Last Month
- UDP Jitter – This Month

Historical VoIP Reports

The following reports are predefined for reporting on the VoIP-enabled devices on your network.

- Jitter – Last 30 Days
- Latency – Last 30 Days
- MOS Score – Last 30 Days
- Packet Loss – Last 30 Days
- VoIP Nodes Availability – Last 30 Days

Customizing Charts in IP SLA Manager

Charts produced within the Orion Network Performance Monitor Web Console are easily customizable. The following sections describe options that are available on the Customize Chart page to modify the presentation of a selected chart.

Note: Click **Refresh** at any time while customizing a chart to review changes you have made.

Chart Titles

Chart Titles are displayed at the top center of a generated chart. The Chart Titles area allows you to modify the title and subtitles of your generated chart.

Note: Orion Network Performance Monitor may provide default chart titles and subtitles. If you edit any of the **Chart Titles** fields on the Custom Chart page, you can restore the default titles and subtitles by clearing the respective fields, and then clicking **Submit**.

Time Periods

You can designate a predefined or custom time period for your chart using either of the following methods:

- Select a predefined time period from the Adjust Time Period for Chart menu.
- Provide custom Beginning and Ending Dates/Times in the appropriate fields in the Enter Date / Time Period area.

Adjust Sample Interval

The sample interval dictates the precision of your generated chart. A single point or bar is plotted for each sample interval. If a sample interval spans multiple polls, polled data is automatically summarized and plotted as a single point or bar on the chart.

Note: Due to limits of memory allocation, some combinations of time periods and sample intervals may require too many system resources to display, due to the large number of polled data points. As a result, charts may not display if the time period is too long or if the sample interval is too small.

Chart Size

Chart size options configure the width and height, in pixels, of the chart. You can maintain the same width/height aspect ratio, or scale the chart in size, by entering a width in the Width field and then entering `0` for the Height.

Data Tables

The **Data Table Below Chart** option displays a table of the charted data points below the chart.

Note: You may not be able to read individual data points if you select a small sample interval. Select a larger sample interval to more easily read data points.

Font Size

Font sizes for generated charts are variable. The Font Size option allows you to select a Small, Medium, or Large size font for your chart labels and text.

Note: Font size selections are maintained in the printable version of your chart.

Printing Options

To print your customized chart, click **Printable Version**. A printable version of your customized chart displays in the browser.

Data Export Options

Exportable chart data is also available from selected charts in the Display Data from Chart area. Data may be exported as Microsoft Excel-compatible Raw Data or as HTML-formatted Chart Data, as shown in the following steps.

To export chart data:

1. ***If you want to view your chart data as Microsoft Excel-compatible Raw Data,*** click **Raw Data**, and then follow the prompts, if provided, to open or save the resulting raw data file.
2. ***If you want to view your chart as HTML-formatted data,*** click **Chart Data** and the data for your chart displays in a new browser window.

X-Axis Labels Orientation

The x-axis labels of selected charts may be configured as follows:

- To display an x-axis label horizontally, as read on a page, select **Horizontal** in the X-Axis Labels Orientation area of the Customize Chart page.
- To display an x-axis label vertically, facing left, corresponding to a 90° counterclockwise rotation of the label, select **VerticalLeftFacing** in the X-Axis Labels Orientation area of the Customize Chart page.
- To display an x-axis label vertically, facing right, corresponding to a 90° clockwise rotation of the label, select **VerticalRightFacing** in the X-Axis Labels Orientation area of the Customize Chart page.

Creating IP SLA Manager Maps

Maps produced within the Orion Network Performance Monitor Web Console are easily customizable. You can create new maps or modify any existing map to include IP SLA operations. The operation status is displayed on the map in the same fashion as nodes, interfaces, or volumes.

To add Orion IP SLA Manager operations to your map:

1. Locate the source node in the left pane containing the IP SLA operations you want to add.
2. Click **[+]** next to the node name.

3. Click **[+]** next to **IP SLA Operations**.
4. Drag the desired operations to the drawing area.

For more information on creating maps, see the ***Error! Unknown document property name.*** *Network Atlas Administrator Guide* at www.solarwinds.com.

Appendix A

Software License Key

After installing the program, the setup program displays the licensing window. Complete the following procedure to enable a software license key.

To enable a software license key:

1. Click **Enter Licensing Information**.
2. ***If the computer on which you installed IP SLA Manager is connected to the Internet,*** complete the following procedure.
   a. Click **I want to activate my license over the Internet**.
   b. Browse to http://support.solarwinds.com.
   c. Login to the customer portal using your CustomerID and password.
   d. Click **License Management**.
   e. Browse to SolarWinds Orion IP SLA Manager, and then locate the unregistered licenses list.
   f. Copy your unregistered IP SLA Manager activation key to the clipboard, and then paste it into the **Activation Key** field on the Activate Toolset window.
   g. ***If you use a proxy server to access the Internet,*** check the **Proxy Server** checkbox, and then type the proxy address and port number.
   h. Click **Next**.
3. ***If the computer on which you are installing IP SLA Manager is not connected to the Internet,*** complete the following procedure.
   a. Click **I want to activate my license through the Customer Portal**.
   b. Complete the procedure described on the Activate Toolset window to complete the registration.

Maintaining Licenses with License Manager

SolarWinds License Manager is an easily installed, free utility that gives you the ability to migrate IP SLA Manager licenses from one computer to another without contacting SolarWinds Customer Service. The following sections provide procedures for installing and using License Manager.

Installing License Manager

Install License Manager on the computer from which you are migrating currently licensed products.

Note: You must install License Manager on a computer with the correct time. If the time on the computer is off by as little as 5 minutes, in either direction, from Greenwich Mean Time (GMT), you will be unable to reset licenses without calling SolarWinds Customer Service. Time zone settings do not affect and do not cause this issue.

To install License Manager:

1. Click **Start > All Programs > SolarWinds > SolarWinds License Manager Setup**.
2. Click **I Accept** to accept the SolarWinds EULA.
3. ***If you are prompted to install the SolarWinds License Manager application,*** click **Install**.

Using License Manager

You must run License Manager on the computer where the currently licensed SolarWinds product is installed before you can migrate licenses to a new installation. The following procedure deactivates currently installed licenses that can then be transferred to a new installation.

To deactivate currently installed licenses:

1. Click **Start > All Programs > SolarWinds > SolarWinds License Manager**.
2. Check the products you want to deactivate on this computer, and then click **Deactivate**.
3. Specify your SolarWinds Customer ID and password when prompted, and then click **Deactivate**.

   Note: Deactivated licenses are now available to activate on a new computer.

When you have successfully deactivated your products, log on to the computer on which you want to install your products, and then begin installation. When asked to specify your licenses, provide the appropriate information. The license you deactivated earlier is then assigned to the new installation.