Cisco Prime LAN Management Solution 4.1

Deployment Guide

September, 2011

Contents

Cisco Prime LMS 4.1

Introduction

Cisco Prime™ LAN Management Solution (LMS) is an integrated suite of management functions that simplify the configuration, administration, monitoring, and troubleshooting of Cisco® networks. Built on the latest web 2.0 Internet-based standards, Cisco Prime LMS allows network operators to manage a borderless network through a browser-based interface that can be accessed anytime from anywhere within the network. Cisco Prime LMS 4.1 improves the overall user experience and continues to provide new workflows built on functional partitioning that aligns the product with the way network operators do their jobs. Once installed, prepackaged monitoring and troubleshooting dashboards provide actionable information to quickly isolate and fix network problems before they affect services.

Configuring and deploying updates to the network has never been easier with the Template Center, which now incorporates Cisco Smart Business Architecture (SBA) templates that are based upon Cisco Validated Designs, simplifying platform and technology rollout and reducing the chance for errors. Work Centers provide a single area where guided workflows give step-by-step instructions to help operators quickly provision, monitor, and manage new Cisco value-added technologies and solutions, such as medianet, EnergyWise, TrustSec/Identity, Auto Smartports, and Smart Install.

For detailed product information related to LMS, refer to the product portal at http://www.cisco.com/en/US/prod/netmgtsw/prime.html.

About the Deployment Guide

This deployment guide considers scenarios where all applications reside on a single server and provides tips and suggestions on configuring the server and getting the basic functions of applications running. Discussions related to multiserver deployment can be found in the LMS 4.0 Large Scale Deployment Guide, available at http://www.cisco.com/en/US/products/ps11200/prod_white_papers_list.html.

Tip: In short, the decision on whether to use single or multiple LMS servers to manage the network depends on:

- How many devices are managed by the LMS server. In LMS 4.1, one single server can manage up to 5000 devices.
- How the LMS applications are used. For example, fault management is used extensively to poll the devices.

Useful Web Resources

Product Bulletin: http://www.cisco.com/en/US/products/ps11200/index.html

Supported Device List (check out the Generic Device Support section in Chapter 7, Resource Manager Essentials[RME]):
http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/device_support/table/lms41sdt.html

Evaluation Copy (valid for 100 devices and 90 days; copies of both Windows and Solaris are available):
http://www.cisco.com/go/nmsevals

Release Notes: http://www.cisco.com/en/US/products/ps11200/prod_release_notes_list.html

LMS Work Flow

The steps below summarize LMS setup workflow, which covers the whole lifecycle of LMS server from initial setup to ongoing operations. The following section illustrates in detail each of the steps mentioned in this workflow.

- The first step in the workflow is to turn on Cisco Discovery Protocol, Simple Network Management Protocol (SNMP), and other credentials such as Telnet username/password on the devices so that the devices can be discovered and managed by Cisco Prime LMS.

  Tools used: Command-line interface (CLI) tools such as console connection, Telnet, Secure Shell (SSH) Protocol, and so on.
- Once LMS server is installed, LMS 4.1 guides you to do the initial setup through the **Getting Started** workflow from the **Admin** menu. See Figure 1. This includes configuring basic server settings, automatically discovering the devices, or manually adding devices.

Figure 1. Getting Started with LMS

Setting Up Devices on the Network

Cisco Prime LMS 4.1 helps in managing Cisco devices on the network. Before LMS 4.1 can function properly, the network devices that LMS interfaces with must be set up correctly in order to communicate with the Cisco Prime LMS server. For example, the SNMP community strings must match between the device and the Cisco Prime LMS server. The information provided in this chapter is a general description of the means and procedures recommended to make sure that the network devices are set up properly.

Note: This chapter provides a great deal of information on the device configuration procedures required to manage devices using Cisco Prime LMS. Keep in mind that this document is not intended to be a comprehensive configuration guide for LMS 4.1. For additional LMS configuration details, please contact a Cisco certified network engineer (if possible) and refer to pertinent documents that are posted on Cisco.com.

Prior to LMS deployment, in the case of Cisco IOS® Software and Catalyst® Operating System devices, all configuration changes must be saved to nonvolatile memory (NVRAM) using the following command:

```
write memory
```

This command saves any pre-LMS deployment configuration changes. After LMS is deployed, configuration changes will be saved automatically where appropriate and no user intervention is required.

Also note that newer versions of Catalyst OS devices have separate running and startup configurations.

Device Configuration

This section describes the generic elements in the device configuration.

System Name

Each Cisco IOS device in the network must have a unique system name (sysname) in order to be managed. The system name is also populated in the Cisco Discovery Protocol table. If there are duplicate system names, LMS will discover only one device by that name on the network. On Cisco IOS devices, the domain name also affects the system name.

You can set up the system name using the following commands.

For Cisco IOS devices:

```
hostname<name>
```

For Cisco Catalyst OS devices:

```
set system name <name>
```

Domain Name

You can set a domain name on a Cisco IOS or Catalyst OS device. To set up the domain name, use the following commands.

For Cisco IOS devices:

```
ip domain-name <name>
```

For Cisco Catalyst OS devices:

```
set system name <name with domain name>
```

Command-Line Prompts

To utilize the NetConfig capability to execute batch changes on devices, Cisco device command-line prompts should meet the requirements described in this section.

Note: Customized prompts should also fulfill these requirements.

For Cisco IOS devices:

- Login prompt should end with an angle bracket (>).

  For example: `Cisco>`
- Enable prompt should end with a pound sign (#).

  For example: `Cisco#`

For Cisco Catalyst OS devices:

- Enable prompt must end with `(enable)`.

  For example: `Cisco (enable)`

Configuring Communication Protocols

LMS uses various protocols to communicate with the devices. These protocols must be configured properly on both the LMS server and devices so that they can communicate to each other. See Table 1 for a list of device credentials for LMS applications.

Table 1. Applications and Device Credentials

Application	Telnet/SSH Password	Enable Password	SNMP Read Only	SNMP Read/Write
Common Services	Not required	Not required	Required	Required
Topology and Identity Services	Not required	Not required	Required	Required
Fault Monitoring	Not required	Not required	Required	Not required
IPSLA Monitoring	Not required	Not required	Required	Required
Performance Monitoring	Not required	Not required	Required	Not required
TrendWatch	Not required	Not Required	Required	Not Required
Inventory	Not required	Not required	Required	Not required
Configuration Management (Telnet)	Required	Required	Required	Not required
Configuration Management[1] (TFTP)[2]	Not required	Not required	Required	Required
NetConfig	Required	Required	Required	Required
Config Editor	Required	Required	Required	Required
NetShow	Required	Required	Required	Not required
Software Management	Required[3]	Required[3]	Required	Required
Port and Module Configuration	Required	Required	Required	Required
EnergyWise	Required	Required	Required	Required
Auto Smartports	Required	Required	Required	Required
Identity Services	Required	Required	Required	Required
Smart Install	Required	Required	Required	Required

SNMP Settings

LMS supports SNMPv1/v2c and SNMPv3 with both AuthNoPriv mode and AuthPriv. SNMPv3 AuthPriv is a new feature introduced since LMS 3.0.1.

SNMP settings include both the read-only community string and the rewritable (RW) community string. The read-only community string is used to perform “snmp get” operations on MIB objects to collect information such as inventory, interface utilization, and so on. The rewritable community string is used in various cases. For example, the RW string is used in LMS for:

- Configuration deployment
- Software image management

Cisco Prime LMS can collect device configurations by either SNMP-write, which triggers TFTP, or by grabbing output from a CLI “show running”command (requiring Telnet or SSH access to the device).

In image deployment the RW community string is used to trigger the TFTP connection and also for the system reboot after the image is downloaded. The RW string is also used in CiscoWorks Campus Manager for configuration changes such as fixing discrepancies.

[1] Configuration download also uses Trivial File Transport Protocol (TFTP). Hence, SNMP Read/Write credentials are required.
[2] The file vlan.dat can be fetched only if the Telnet password and Enable password are supplied.
[3] Required in the case of a few devices such as PIX® devices, Cisco 2950 Series Switches.

For information on SNMP settings, refer to http://www.cisco.com/en/US/customer/tech/tk648/tk362/technologies_tech_note09186a0080094aa4.shtml.

System Reload

After a software image distribution operation using LMS is completed, LMS will reload the device if specified in the image distribution job. LMS will be able to reload any device (Cisco IOS or Catalyst OS) only if an SNMP manager (in this case LMS) is allowed to reset the agent.

The following command is needed on Cisco IOS devices only:

```
snmp-server system-shutdown
```

Telnet/SSH

Telnet is one of the basic protocols that can be used by LMS for configuration management. You can enable Telnet using the following commands.

To enable Telnet on Cisco IOS devices and Catalyst OS devices, enter these commands:

```
line vty 0 4
password<password>
transport input telnet
```

Note: More than four vty lines can be selected for login.

Different authentication on different vty lines is not supported.

SSH provides for a secure communication with the device.

Cisco IOSSoftware

The following example configures SSH control parameters on a router running Cisco IOS Software:

```
Router> config terminal
Router (config)# hostname hostname <the name of the router>
Router (config)# ip domain-name domainname <a domain that the router services>
Router (config)# crypto key generate rsa
Router (config)# aaa new-model
Router (config)# username <username> password <password>
Router (config)# ip ssh time-out <seconds>
Router (config)# ip ssh authentication-retries <integer>
Router (config)# line vty 0 4
Router (config-line)# transport input SSH
```

Make sure to do this for all vty lines.

Catalyst OS

The following examples configure SSH in Catalyst OS:

```
(enable) set crypto key rsa 1024
(enable) set ip permit enable ssh
```

Remote Copy Protocol

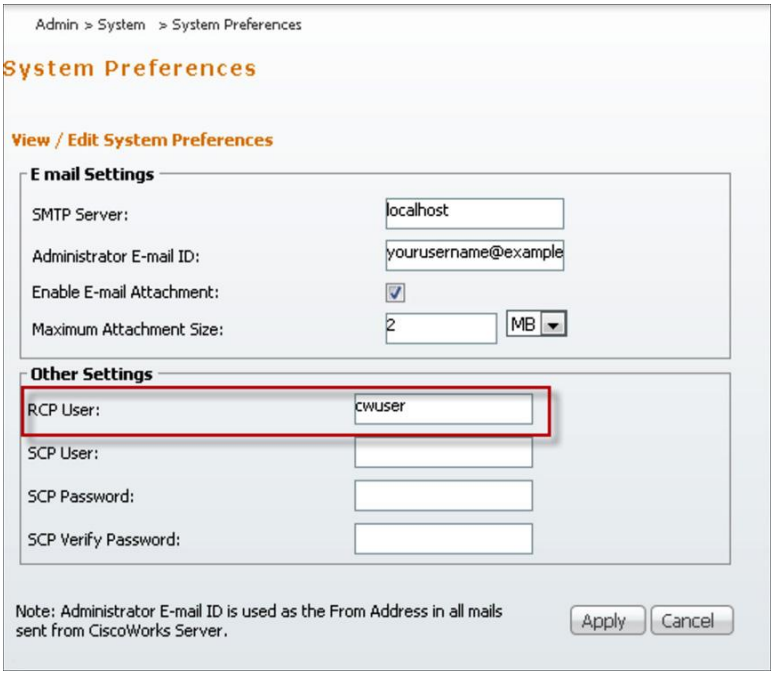
Remote Copy Protocol (RCP) is one of the protocols that can be used by LMS for configuration management and software image management. For LMS to be able to provide configuration and software management using RCP, it must be enabled on the devices.

RCP can be enabled only on devices running Cisco IOS Software using the following sample commands:

```
username cwuser password 7 000C1C0A05
ip rcmd rcp-enable
ip rcmd remote-host cwuser 172.17.246.221 cwuser enable
ip rcmd remote-username cwuser
```

Note: The value of `<remote-username>` and `<local-username>` entered in the device should match the RCPUser value provided in the LMS server. The default value is cwuser. This value can be reset by traversing through the following user interface links in LMS server: **Admin → System → System Preferences**. See Figure 2.

Figure 2. Setting the RCP User Value



Secure Copy Protocol

The Secure Copy Protocol (SCP) feature was introduced in Cisco IOS Software Release 12.2(2) T.

To enable and configure a Cisco router for SCP server-side functionality, perform the steps in Table 2.

Table 2. SCP Configuration

	Command	Purpose
Step 1	`Enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	`Router# configure terminal`	Enters global configuration mode.
Step 3	`Router (config)# aaa new-model`	Sets authentication, authorization, and accounting (AAA) at login.

	Command	Purpose
Step 4	`Router (config)# aaa authentication login default group tacacs+`	Enables the AAA access control system. Complete syntax: `aaa authentication login {default |list-name} method1 [method2...]`
Step 5	`Router (config)# aaa authorization exec default group tacacs+`	Sets parameters that restrict user access to a network. The exec keyword runs authorization to determine if the user is allowed to run an EXEC shell; therefore, you must use it when you configure SCP. Syntax: `aaa authorization {network | exec | commands level | reverse-access | configuration} {default | list-name} [method1 [method2...]]`
Step 6	`Router (config)# username superuser privilege 2 password 0 superpassword`	Establishes a username-based authentication system. You may skip this step if a network-based authentication mechanism - such as TACACS+ or RADIUS - has been configured. Syntax: `usernamename[privilegelevel]{passwordencryption-type encrypted-password}`
Step 7	`Router (config)# ip scp server enable`	Enables SCP server-side functionality.

HTTP and HTTPS

The Cisco IOS HTTP server provides authentication, but not encryption, for client connections. The data that the client and server transmit to each other is not encrypted. This leaves communication between clients and servers vulnerable to interception and attack.

Use the following command to enable HTTP mode:

```
ip http server
```

The Secure HTTP (HTTPS) feature provides the capability to connect to the Cisco IOS HTTPS server securely. It uses Secure Sockets Layer (SSL)[4] and Transport Layer Security (TLS) to provide device authentication and data encryption.

Configuring Other Protocols

Cisco Discovery Protocol

Cisco Common Services uses both Layer 2 (Cisco Discovery Protocol) and Layer 3 (Border Gateway Protocol [BGP], Open Shortest Path First [OSPF], Address Resolution Protocol [ARP], and routing tables) to discover devices. Cisco Discovery Protocol is the default protocol to discover Cisco devices on the network. Cisco Discovery Protocol is a Cisco proprietary Layer 2 protocol that is media and protocol independent and runs on all Cisco manufactured equipment. A Cisco device enabled with Cisco Discovery Protocol sends out periodic interface updates to a multicast address in order to make itself known to neighbors. Since it is a Layer 2 protocol, these packets (frames) are not routed.

Enabling Cisco Discovery Protocol on devices allows Common Services to learn information about neighboring devices and to send SNMP queries to those devices.

Enable/Disable Cisco Discovery Protocol on Cisco IOS devices:

Cisco Discovery Protocol is enabled on Cisco IOS devices by default. To manually enable the Cisco Discovery Protocol capability on Cisco IOS devices use the following commands:

- To enable Cisco Discovery Protocol globally:

  ```
  cdp run
  ```

[4] This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. For more details please visit http://www.openssl.org/.

- To enable Cisco Discovery Protocol on specific interfaces only:
  `cdp enable`

Use the `no` command to disable Cisco Discovery Protocol capability on Cisco IOS devices.

Enable/Disable Cisco Discovery Protocol on Cisco Catalyst OS devices:

Cisco Discovery Protocol is enabled on Cisco Catalyst OS devices by default. To enable Cisco Discovery Protocol capability manually on Catalyst OS devices use the following commands:

- To enable Cisco Discovery Protocol globally:
  `set cdp enable`
- To enable Cisco Discovery Protocol on specific ports only:
  `set cdp enable [mod/port]`

Use the `set cdp disable` command to disable Cisco Discovery Protocol on Catalyst OS devices.

Do not run Cisco Discovery Protocol on links that don't need to be discovered, for example, connection to the Internet and end host connection ports on access switches.

To protect from Cisco Discovery Protocol Denial of Service (DoS) attacks, do not enable Cisco Discovery Protocol on links that are connected to non-Cisco devices, and if the non-Cisco devices do not support Cisco Discovery Protocol, LMS 4.1 provides Link Layer Discovery Protocol (LLDP) as another protocol for discovery purposes. LLDP functions at Layer 2 and is supported by most other vendors. This release of LMS 4.1 will support only IPv4 for LLDP.

Note: Certain non-Cisco devices support Cisco Discovery Protocol. If you enable Cisco Discovery Protocol on the Cisco devices connected to non-Cisco devices, they will appear on the topology map and Cisco Discovery Protocol is a must for the topology map.

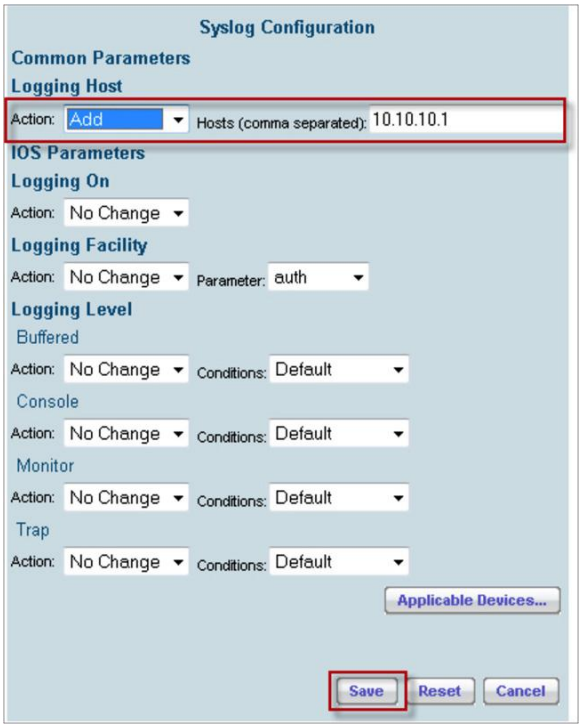
Syslog Messages

Syslog messages can be enabled on Cisco devices to use fully the capability of LMS. LMS has a built-in syslog receiver/analyzer, and it can invoke automated actions based on the content of the syslog message.

Please refer to
http://www.cisco.com/en/US/partner/products/sw/cscowork/ps2073/products_tech_note09186a00800a7275.shtml#topic1

Another way to turn on syslog devices is to use the LMS NetConfig functionality. With NetConfig, users can create a job to deploy syslog configuration commands to multiple devices at the same time. NetConfig will be discussed later in this document (please refer to "`Create a NetConfig Job to Enable Syslogs on Devices and Configure LMS Server as Receiver`" in the "Netconfig" section), but Figure 3 shows an example of syslog configuration:

Figure 3. An Example Syslog Configuration



Protocol Setup on LMS Server

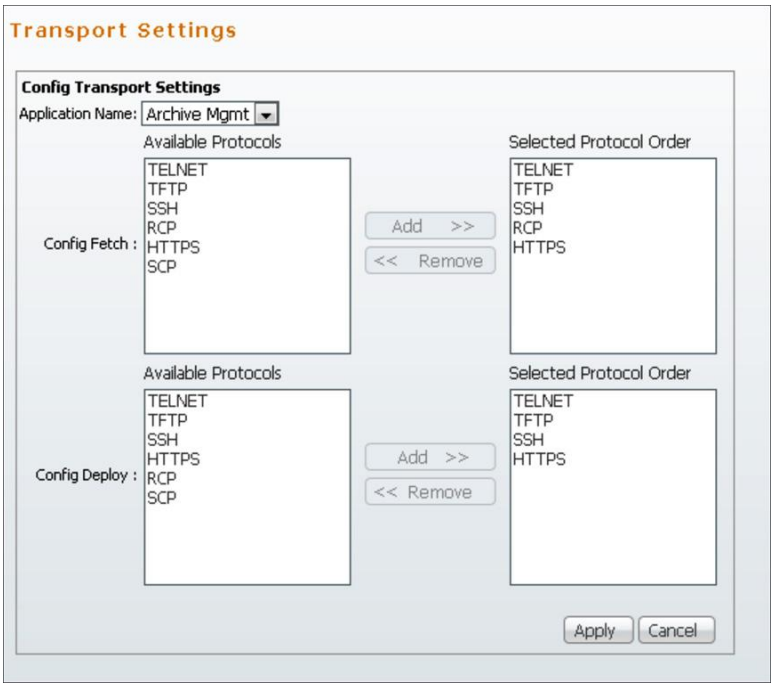
One of the most important areas of setup is LMS protocol setup. LMS uses various protocols for configuration and software management. Network administrators can assign the protocols to be used in LMS for configuration management and software management.

Configuration Management

You can set the protocols and order configuration management applications such as Archive Management, Config Editor, and NetConfig use to download configurations and to fetch configurations. The available protocols are Telnet, TFTP, RCP, SSH, SCP, and HTTPS.

To setup protocol ordering for configuration management, go to **Admin→Network→Config Collection Settings→Config Transport Settings.**

Figure 4. Configuring Transport Settings



As in Figure 4 for the Config Fetch task, LMS will first use Telnet, and if Telnet to the device fails, LMS will fallback to the next protocol in the order listed, in this case TFTP. LMS 4.1 also allows you to change this protocol order. It is recommended to use SSH as a secure protocol between the server and the device.

Device Secondary Credentials

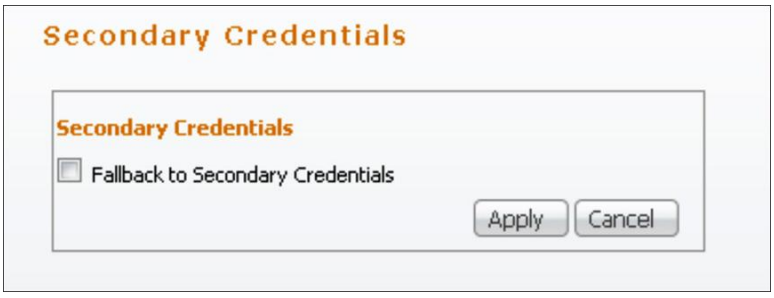
Once LMS discovers and adds all the network devices into its database, LMS uses the primary and secondary credentials to access these devices using the following protocols:

- Telnet
- SSH

The LMS server first uses the primary credentials to access the device. The primary credentials are tried out three times, and on failure the secondary credentials are tried out three times. Secondary credentials are used as a fallback mechanism for connecting to devices. See Figure 5.

For instance, if the AAA server is down, accessing devices using their primary credentials will lead to failure.

Figure 5. To specify fallback to the secondary credentials, select **Admin →Collection Settings→config→Secondary Credentials settings** (see Figure 5) Secondary Credentials

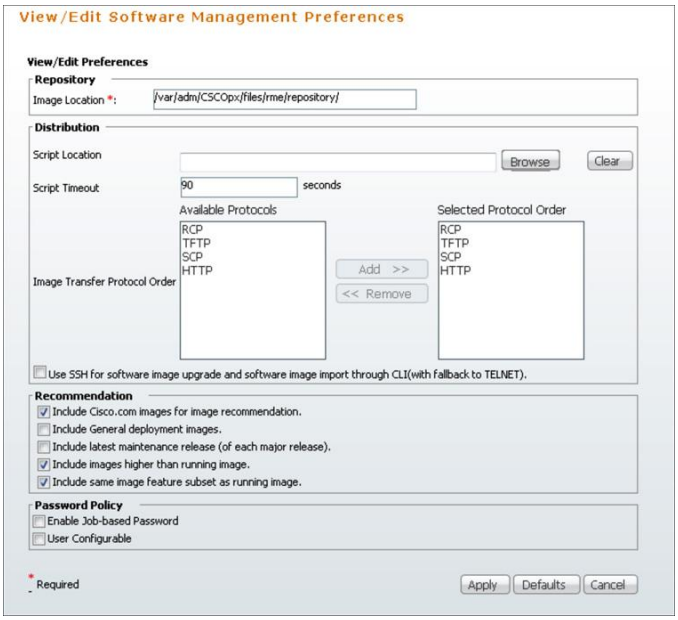


Software Image Management

Similarly, software management attempts downloading the software images based on the protocol order specified. While downloading the images, software management uses the first protocol in the list. If the first protocol in the list fails, these jobs use the second protocol and so on, until software management finds a transport protocol for downloading the images. The supported protocols are RCP, TFTP, SCP, and HTTP.

Using **Admin→Network→Software Image Management→View/Edit Preferences**, you can define the protocol order that software management has to use for software image downloads. Use the **Add** and **Remove** buttons for selecting the protocol order. See Figure 6.

Figure 6. Defining the Protocol Order for Software Image Downloads



Cisco Prime LMS Installation

Cisco Prime LMS 4.1 can be installedon the Windows or Solaris operating system or as a soft appliance. A soft appliance comes as an Open Virtual Archive (OVA) file, which is an open virtualized format to deploy the software package directly to your virtual machine (VM) systems. The OVA file comes with an embedded Red Hat Linux operating system with database and application.

Installation Checklist

Before you install LMS 4.1, make sure that:

- The server and client systems have the recommended hardware and software requirements. Please refer to the installation guide at http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/prereq.html#wp1109415
- You have closed all open or active programs. Do not run other programs during the installation process.
- You have disabled Terminal Services on the Windows operating system in the Application mode.If you have enabled Terminal Server in Application mode, disable the Terminal Server, reboot the system, and start the installation again. However, you can enable Terminal Services in the Administration mode.

- If you have configured Remote Syslog Collector (RSC) on a different server, you must upgrade RSC to RSC 5.1. See **Installing the Remote Syslog Collector** for further information.
- You have disabled the virus scanner on your system during installation.
- You have configured the recommended swap space. Refer to http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/prereq.html#wp1109415.

  For Windows and Solaris, after you uninstall earlier versions of LMS like LMS 3.2, you haveremoved the LMS logo manually if it is not removed during installation. For supported migration path, please refer to http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/instl.html#wp1581295.
- Make sure to set up the High Availability (HA) and Disaster Recovery (DR) environment before installing LMS By default, SSL is not enabled on the Cisco Prime server.
- While launching Cisco Prime, network inconsistencies might cause installation errors if you are installing from a remote mount point.
- You disable any popup blocker utility that is installed on your client system.
- LMS 4.1 is installed in the default directories:

  On Solaris and soft appliance: /opt/CSCOpx

  On Windows, 64 bit: **SystemDrive**:\Program Files<x86>\CSCOpx

  On Windows, 32 bit: **SystemDrive**:\Program Files\CSCOpx

  Where **SystemDrive** is the Windows operating system installed directory.
- If you selected another directory during installation, the application is installed in that directory.
- The destination folder does not contain the following special characters:

  On Solaris and soft appliance:

  ! @ # $ % ^ & * ( ) + | } { " : [ ]; ' ? <>, . ` = ~

  On Windows:

  ! @ # $ % ^ & * ( ) + | } { " [ ] ; ' / ? <>, . ` =
- If errors occured during installation, you have checked the installation log file:

  On Solaris and soft appliance, check the installation log file /var/tmp/Cisco_Prime_install_**YYYYMMDD**_**hhmmss**.log for LMS 4.1 installation

  Where **YYYYMMDD** denotes the year, month and date of installation and **hhmmss** denotes the hours, minutes and seconds of installation.

  For example:

  `/var/tmp/Cisco_Prime_install_20110721_182205.log`

  On Windows, check the installation log in the root directory on the drive where the operating system is installed. Each installation creates a new log file.

  For example, for LMS 4.1, the installation log file is:

  C:\Cisco_Prime_install_**YYYYMMDD**_**hhmmss**.log, where **YYYYMMDD** denotes the year, month and date of installation and **hhmmss** denotes the hours, minutes and seconds of installation.

For example:

```
C:\Cisco_Prime_install_20100721_182205.log
```

- You have disabled HP OpenView in order to run a faster installation. If HP OpenView is running on your system, installation will take more time.
- You have installed the latest Device Package updates to help ensure that you have the latest device support and bug fixes for LAN Management Solution.
- You have enabled Domain Name System (DNS) on the server so the device names can be resolved against IP addresses. If DNS is not present, create a local hosts file to help resolve the device names.
- You have registered the product and received a permanent license (recommended by Cisco).

You can press **Ctrl-C** (on Solaris, and not on soft appliance) or click **Cancel** (on Windows) at any time to end the installation. However, any changes to your system will not be undone.

For example, if any new files were installed or if they were any changes to the system files, you need to manually clean up the installation directories.

Note: We recommend that you do not terminate the installation while it is running.

Licensing Process

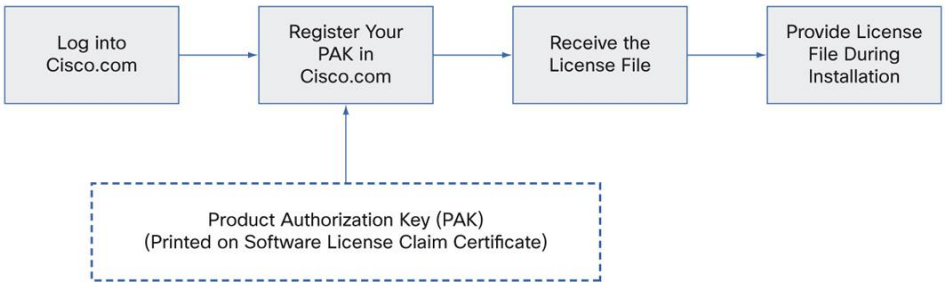
The Cisco Prime LMS product provides features such as software-based product registration and license key activation technologies. Product Authorization Key (PAK) ID refers to the identification key that you must enter while registering your product in Cisco.com to receive the product serial license key.The PAK is normally printed on the software claim certificate that is part of the product DVD kit.With the new ordering options introduced you can receive the digital PAK IDs through online delivery as well.

For additional information on licensing, please refer to http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/prep.html#wp1327286.

Steps to Follow for Licensing LMS

To license Cisco Prime LAN Management Solution, follow the steps below as shown in figure 7:

Figure 7. Steps in the licensing process



Step 1. Log onto Cisco.com to get your license file.If you are a registered user of Cisco.com, get your license from http://www.cisco.com/go/license.

If you are not a user of Cisco.com, get your Cisco.com user ID from http://tools.cisco.com/RPF/register/register.do. Once you get your Cisco.com user ID, log on to http://www.cisco.com/go/license to get your license file.

Step 2. Register the LMS product with Cisco.com using the PAK to get your license file.

Step 3. Install the license file:

If you have obtained the LMS license before installation:

a. Select the first LMS application you wish to install (ideally Common Services 3.1), and when prompted:
   - On Windows, select the first option button and click **Browse** and use the File browse window to locate the license file directory.
   - On Solaris, select **L** for License File after you accept the licensing agreement and continue installing the application.

b. Click **Next** to install the license file.

If you want to convert an evaluation copy to a licensed copy:

- After you install LMS 4.1, copy this license file to the Common Services server into a directory with read permissions for the user name **causer** in the user group **causers**.
- Select **Admin→System→License management.**

  The License Administration page appears.
- Click **Update.**

  A file browser appears.
- Enter the path to the new license file in the License File field and click **OK**.

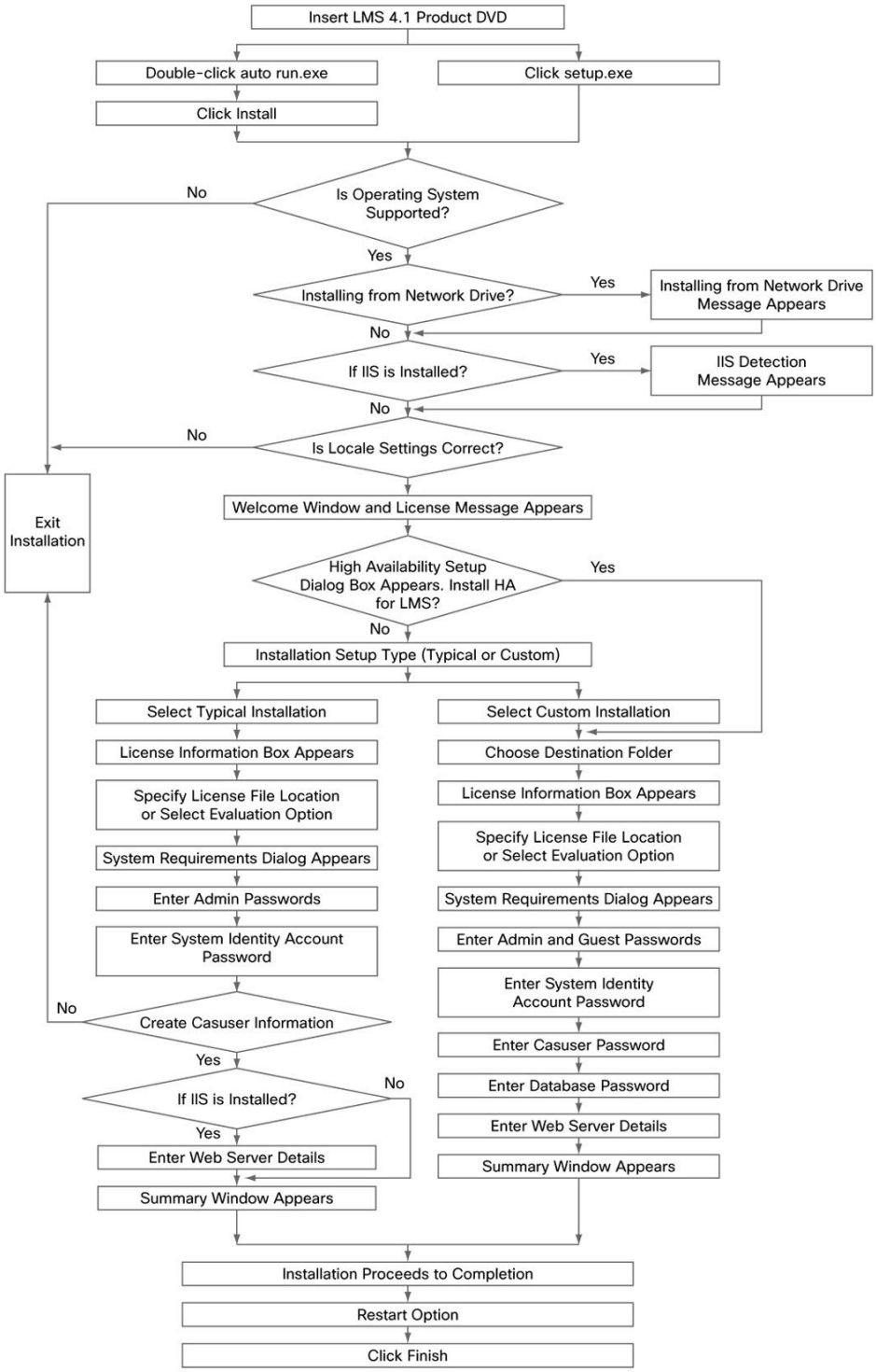
  The system verifies whether the license file is valid and updates the license.

Note: The license file obtained is platform independent and thus can be used in both Windows as well as Solaris operating systems.

New Installation of LMS 4.1 on Windows

Thanks to the single-package installation design, the LMS installation programs on both Windows and Solaris are user friendly and fail-proof. Figure 8 provides a flow diagram for Windows installation.

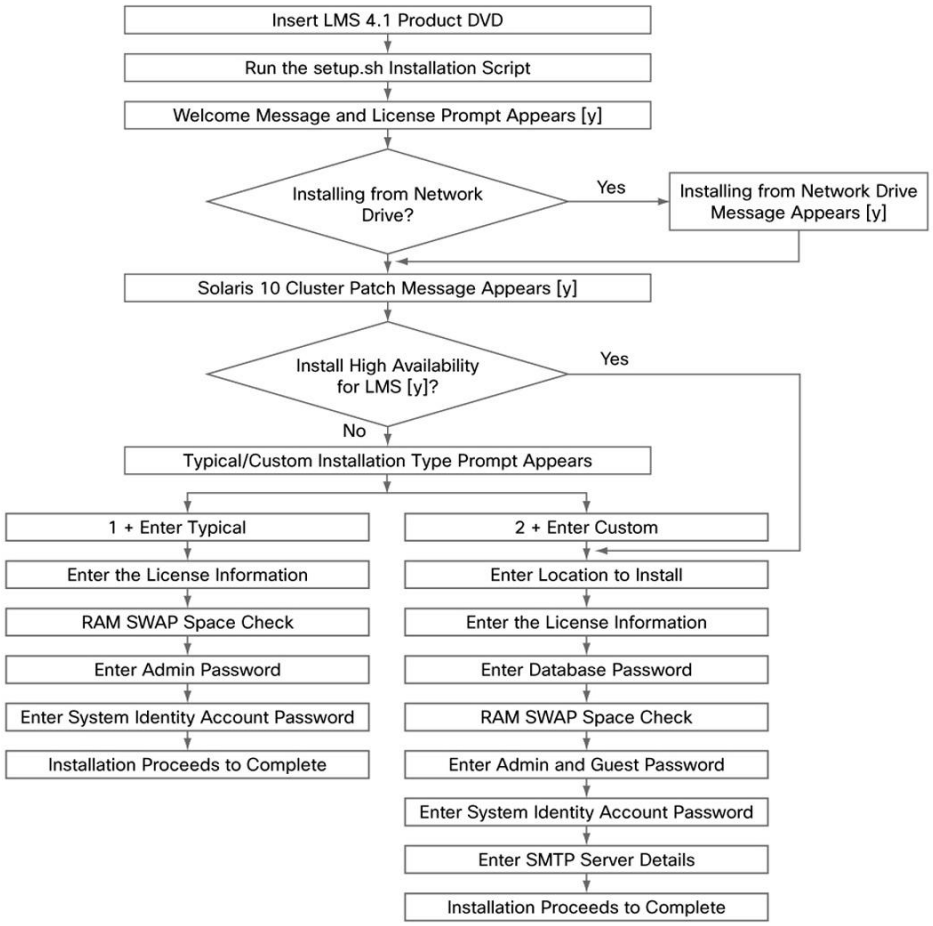
Figure 8. A Flow Diagram for Windows Installation of Cisco Prime LMS



New Installation of LMS 4.1 on Solaris.

Figure 9 provides a flow diagram for Solaris installation.

Figure 9. A Flow Diagram for Windows Installation of Cisco Prime LMS



New Installation of LMS 4.1 Using Soft Appliance

You can install the LMS soft appliance using the LMS 4.1 OVA image from the LMS 4.1 DVD.

- Make surethat your system meets the recommended hardware and software specifications specified inthe server requirements section for Solaris.
- It takes approximately 30 minutes (deployment in the local system) and 50 minutes (deployment in the network) to install the soft appliance on a virtualized environment.
- Soft appliance OVA software can be installed only in the VMware environment.

Note: You need not install any soft appliance image on the VM before installing LMS 4.1, as the LMS 4.1 OVA image has an embedded RedHat Enterprise soft appliance.

Follow the steps below to install the LMS 4.1 soft appliance image (OVA):

Step 1. Invoke the VMware vSphere client.

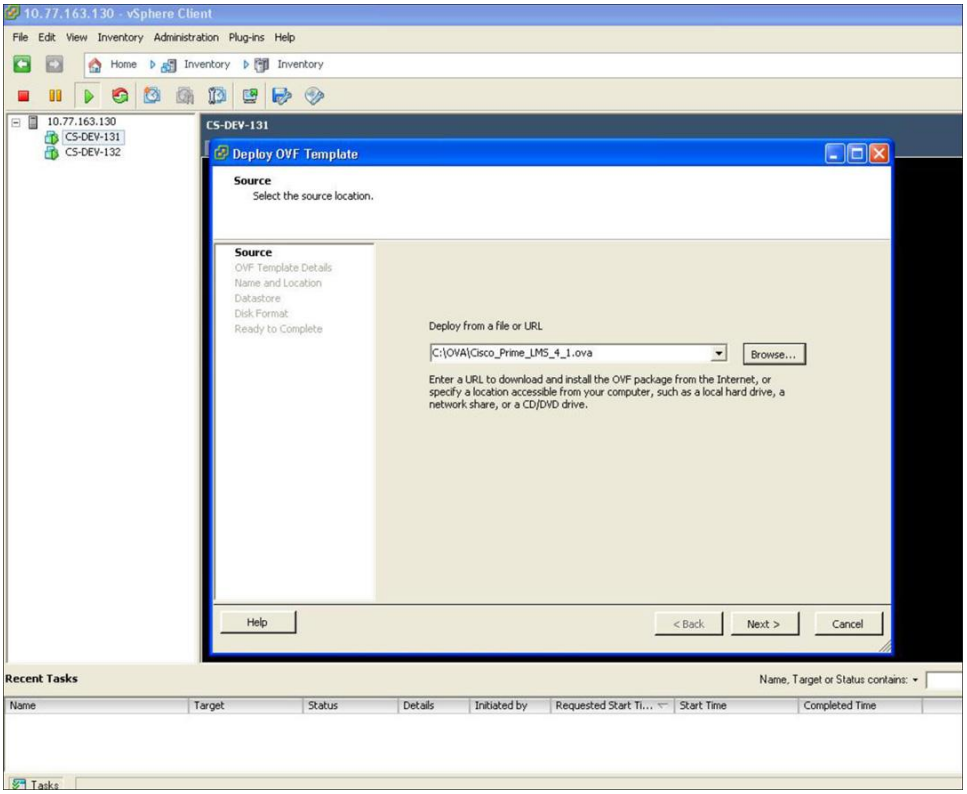
Step 2. Enter the IP address or name of the host that needs to be directly managed. To manage multiple hosts, enter the IP address or name of a vCenter server.

Step 3. Enter the username and password of the VMware server.

Step 4. Click **Login**.

Step 5. Select **File → Deploy OVF Template**. See Figure 10.

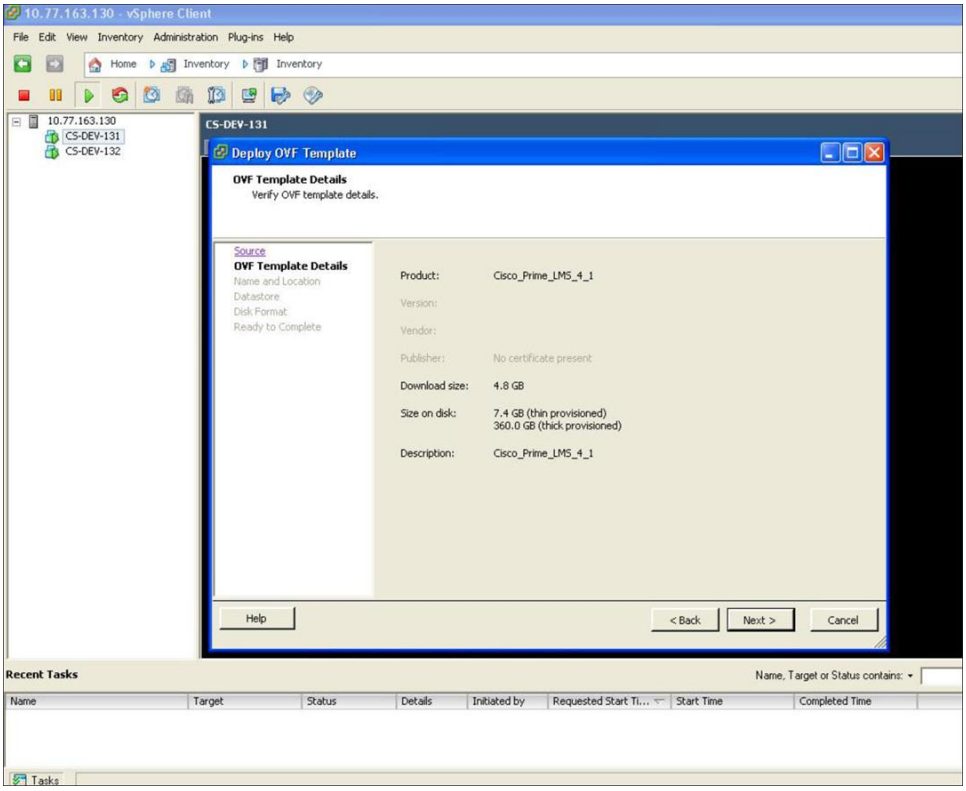
Figure 10. The Deploy OVF Template Window



Step 6. Click **Browse** to select the source Open Virtualization Format (OVF) template from your local file system or enter a URL to download the OVF package from the Internet.

Step 7. Click **Next**. The Deploy OVF Template - OVF Template Details window appears (Figure 11). You can verify the OVF template details.

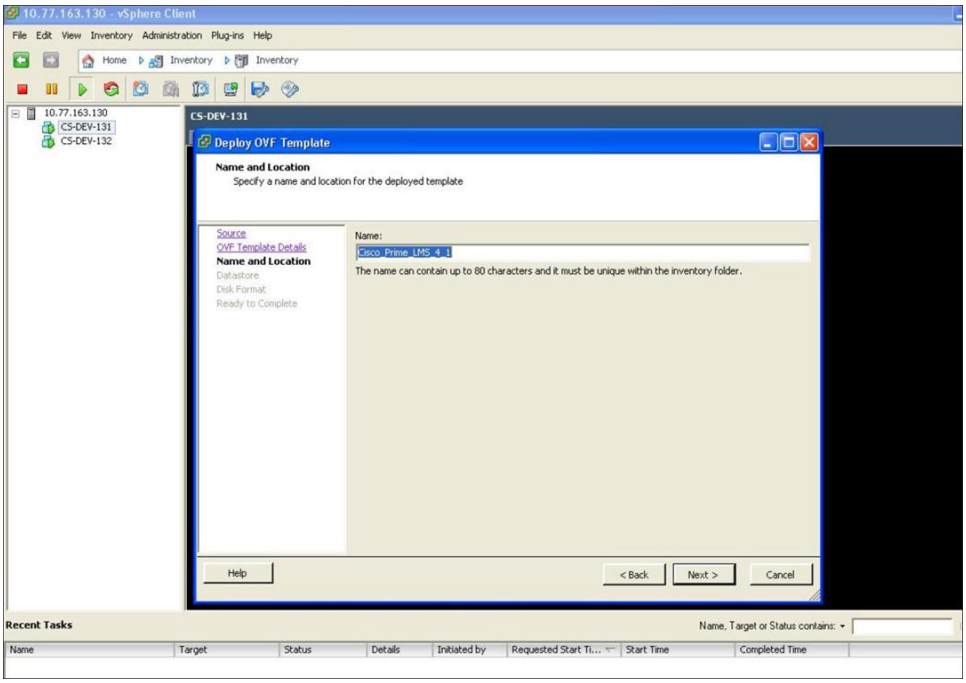
Figure 11. The Deploy OVF Template - OVF Template Details Window



Step 8. Click **Next**.

The Deploy OVF Template -Name and Location window appears (Figure 12).

Figure 12. The Deploy OVF Template - Name and Location Window



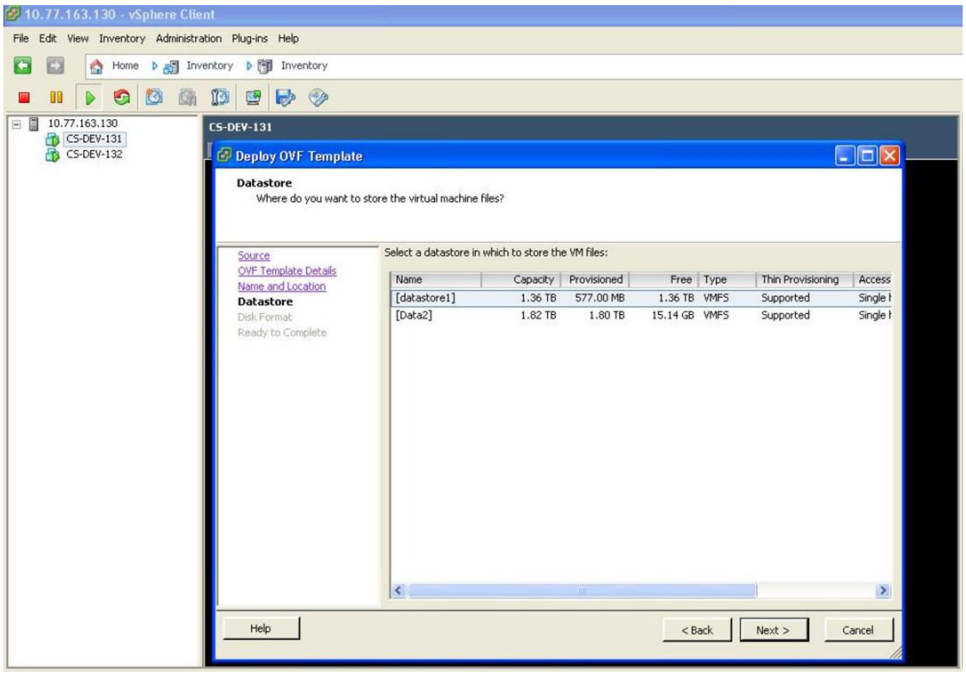
Step 9. Enter the name of the deployed template.

Note: Ensure that you provide a unique template name that does not exceed 80 characters. The unique template name refers to the virtual host deployed in the ESX/ESXi server.

Step 10. Click **Next**.

The Deploy OVF Template -Datastore window appears (Figure 13).

Figure 13. The Deploy OVF Template - Datastore Window

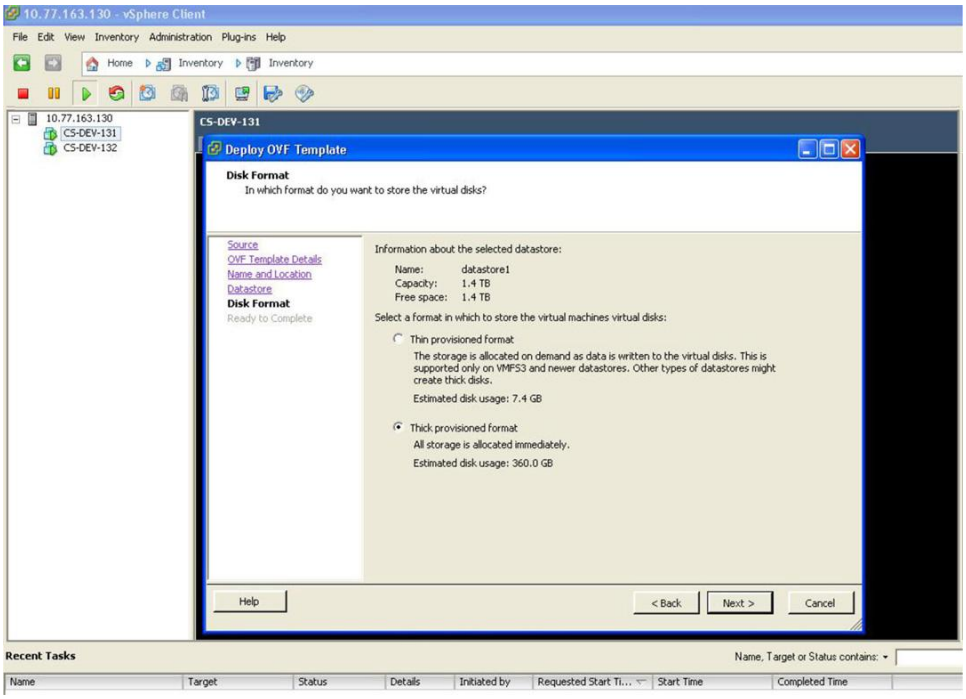


Step 11. Select a datastore where you want to store the virtual machine files.

Step 12. Click **Next**.

The Deploy OVF Template -Disk Format window appears (Figure 14).

Figure 14. The Deploy OVF Template - Disk Format Window



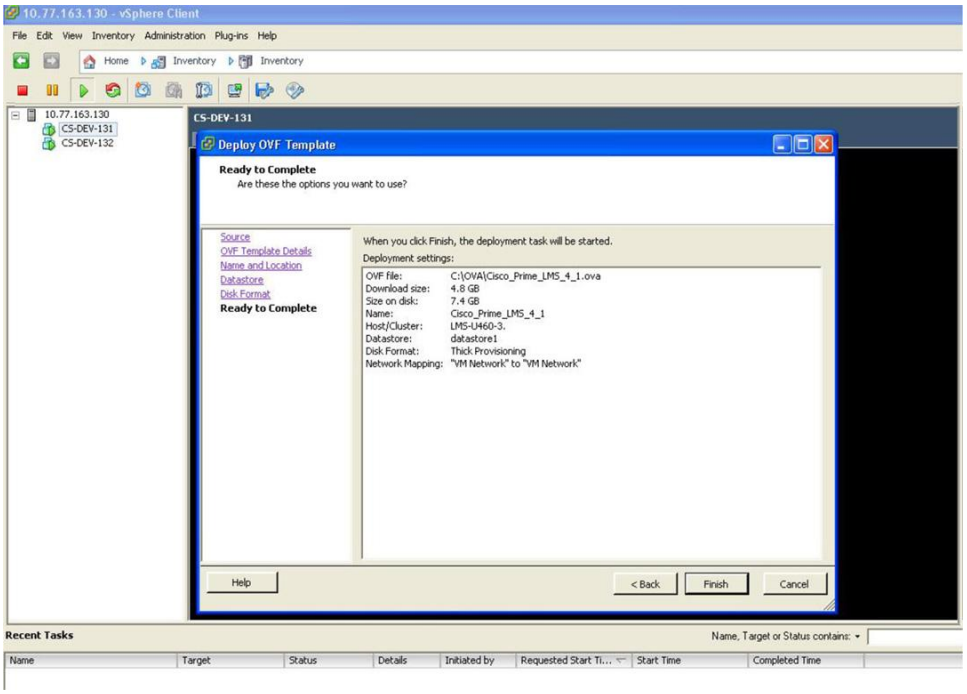
Step 13. You can select either **Thin provisioned format** or **Thick provisioned format**.

Note: We recommendthat you choose Thick provisioned format. If you use Thick provisioned format, you must make sure that your system meets the recommended hardware and software requirement specified in the server requirements section for Solaris.

Step 14. Click **Next**.

The Deploy OVF Template -Ready to Complete window appears (Figure 15). This window displays the deployment setting details.

Figure 15. The Deploy OVF Template - Ready to Complete Window



Step 15. Click **Finish** to start the deployment task.

Note: The deployment task takes approximately 50 minutes to complete.

Step 16. Select a server thathas the deployed template name specified in Step 9 from the servers listed on the left pane of the vSphere client window.Right-click the selected server and select **Power → Power On** to start the server.

Step 17. Select the Console tab.

The Welcome screen appears.

Step 18. Press **Enter** in the console window to continue with the next step.

Step 19. Enter the following configuration details of the server:

- Hostname (should not exceed 19 characters)
- IP Address
- IP Netmask

- Default Gateway
- DNS Domain Name
- Primary Name Server
- Secondary Name Server (optional)
- Primary NTP Server
- Secondary NTP Server (optional)
- System Time Zone

  Type **h** to see the list of supported time zones, and enter the time zone value. For example, Brazil/DeNoronha. You can check **Supported Server Time Zones and Offset Settings** for the list of values supported.
- Username

  Enter the username to access the LMS appliance console. This user will have the privilege to enable the shell access. The default username is sysadmin. You cannot use root as the username as it is a reserved username. You can use only alphanumeric characters for the username.
- Password

  Enter the sysadmin password. By default, this password will be set as the shell password.
- Confirm Password

  Enter the sysadmin password for confirmation.
- Admin Password

  Enter the password for the admin account to log into LMS using the browser. This password must contain a minimum of five characters and will also be used for the System Identity account.
- Confirm Password

  You can enter the admin password for confirmation.

Step 20. The following message appears:

For security reasons, passwords are not displayed. Do you want to view all the passwords? (Y/N) [N]:

Step 21. If you enter **Y**, the following passwords will be displayed.

- Admin user account password
- System identity user account password
- System-generated database password

The default option is N.

Step 22. It will take 15 to 20 minutes to process the databaseengine.

Step 23. The server is automatically rebooted.

Note: If you want to power off the VM server from the ESX server, you must do so only after stopping the daemons. You must not power off the VM while the daemons are running.

This completes the soft appliance installation. If you would like to change any server settings, please refer to http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/instl.html#wp1639616.

Verifying the LMS 4.1 Installation

After you install Cisco Prime LMS 4.1 on Windows, you must verify the installation. To do this:

- **Launch Cisco Prime LMS: http://server_name:1741**

  where server_name is the name of the Cisco Prime LMS server and 1741 is the TCP port used by the server.

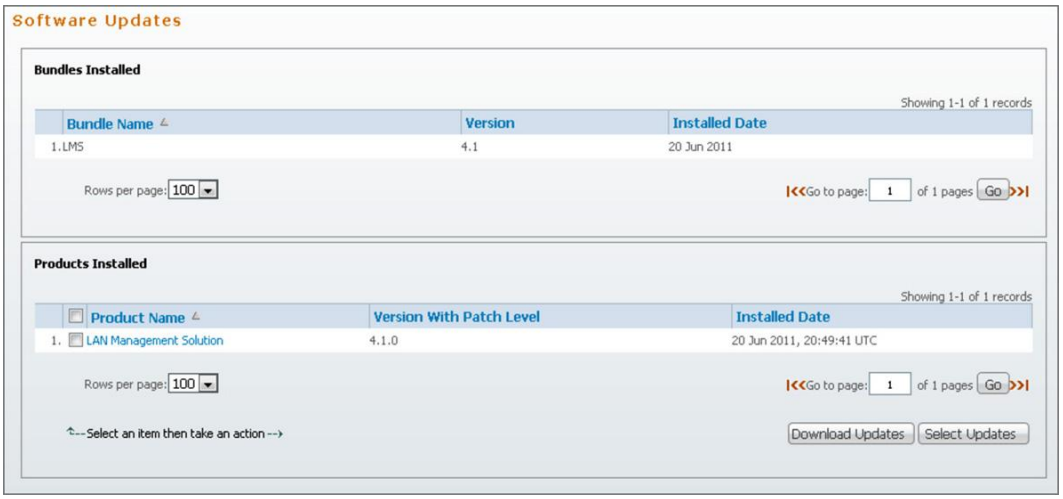
  In normal mode (HTTP), the default TCP port for Cisco Prime LMS is 1741. When SSL (HHTPS) is enabled, the default TCP portis 443.

  You can change the HTTPS port number of the Cisco Prime LMS server during the installation.

- Select **Admin→System→Software Center→Software Update**.

  The Software Updates window (Figure 16) appears.

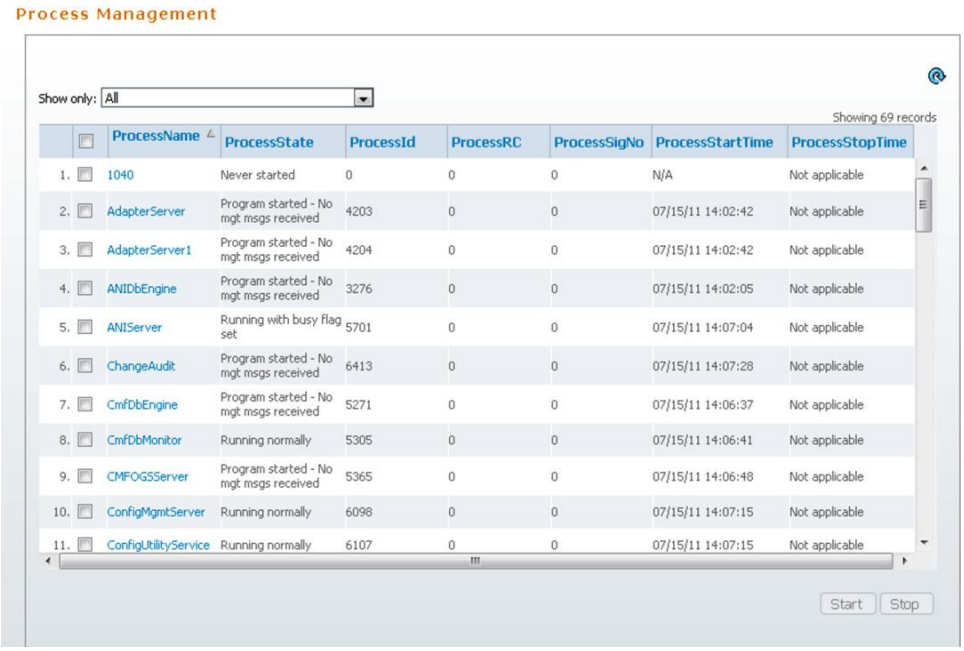
Figure 16. The Software Updates window



or

- Select **Admin→System→Server Monitoring→Processes** to see various process statuses (Figure 17).

Figure 17. The Status of Various Processes



Ports Used by LMS Applications

Make sure the ports listed in Table 3 are open on the Cisco Prime LMS server, or are not used by other applications.

Table 3. LMS Application Port Usage

Protocol	Port Number	Service Name	Applications	Direction (of Establishment) of Connection
TCP	49	TACACS+ and Access Control Server (ACS)	Common Services, Configuration and Software Image Management, Topology and Identity Services, Fault Management, IPSLA Monitoring	Server to ACS
TCP	25	Simple Mail Transfer Protocol (SMTP)	CiscoWorks Common Services (PSU), Inventory, Configuration and Image Management	Server to SMTP server
TCP	22	SSH	Common Services, Topology and Identity Services, Inventory, Configuration and Image Management	Server to device
TCP	23	Telnet	Common Services, Topology and Identity Services, Inventory, Configuration and Image Management	Server to device
User Datagram Protocol (UDP)	69	TFTP	Common Services, Inventory, Configuration and Image Management	Server to device Device to server
UDP	161	SNMP	Common Services, CiscoView, Inventory, Configuration and Image Management, Topology and Identity Services, Fault Management, IPSLA Performance Management, and Device Performance Management	Server to device Device to server
TCP	514	Remote Copy Protocol	Common Services	Server to device

Protocol	Port Number	Service Name	Applications	Direction (of Establishment) of Connection
UDP	162	SNMP traps (standard port)	Topology and Identity Services and Fault Management	Device to server
UDP	514	Syslog	Common Services, Inventory, Configuration and Image Management	Device to server
UDP	1431	Trap listener to MAC notification traps	Topology and Identity Services	Device to server
UDP	9000	Trap receiving (if port 162 is occupied)	Fault Management	Device to Server
UDP	16236	UT host acquisition	Topology and Identity Services	End host to Server
TCP	443	CiscoWorks HTTP server in SSL mode	CiscoWorks Common Services	Client to server Server internal
TCP	1741	CiscoWorks HTTP Protocol	CiscoWorks Common Services, CiscoView, Topology and Identity Services, Inventory, Configuration and Image Management, Fault Management, and Internetwork Performance Monitor (IPM	Client to server
UDP	42342	OSAGENT	Common Services	Client to server (for ANIServer)
TCP	42352	ESS HTTP (alternate port is 44352/tcp)	Common Services	Client to server
TCP	8898	Log server	Fault Management	Server internal
TCP	9002	DynamID authentication (Device Fault Manager [DFM] broker)	Fault Management	Server internal
TCP	9007	Tomcat shutdown	Common Services	Server internal
TCP	9009	Ajp13 connector used by Tomcat	Common Services	Server internal
UDP	9020	Trap receiving	Fault Management	Server internal
UDP	14004	Lock port for ANIServer singlet on check	Topology and Identity Services	Server internal
TCP	15000	Log server	Fault Management	Server internal
TCP	40050-40070	CSTM ports used by CS applications, such as OGS, DCR	Common Services	Server internal
TCP	40401	LicenseServer	Common Services	Server internal
TCP	43242	ANIServer	Topology and Identity Services	Server internal
TCP	42340	CiscoWorks Daemon Manager - Tool for Server Processes	Common Services	Server internal
TCP	42344	ANI HTTP server	Common Services	Server internal
UDP	42350	Event Services Software (ESS) (alternate port is 44350/udp)	Common Services	Server internal
TCP	42351	Event Services Software (ESS) listening (alternate port is 44351/tcp)	Common Services	Server internal
TCP	42353	ESS routing (alternate port is 44352/tcp)	Common Services	Server internal
TCP	43441	Common Services database	Common Services	Server internal
TCP	43455	Inventory, Configuration and Image Management Database	Inventory, Configuration and Image Management	Server internal
TCP	43443	ANIDbEngine	Topology and Identity Services	Server internal
TCP	43445	Fault history database	Fault Management	Server internal
TCP	43446	Inventory service database	Fault Management	Server internal

Protocol	Port Number	Service Name	Applications	Direction (of Establishment) of Connection
TCP	43447	Event Promulgation Module database	Fault Management	Server internal
TCP	44400-44420	CSTM ports	Fault Management, Device Performance Management	Server internal
TCP	47000-47040	CSTM ports	Inventory, Configuration and Image Management	Server internal
TCP	49154	UPMDbEngine	Device Performance Management	Server internal
TCP	49155	OpsxmlDbEngine, JDBC/ODBC	CiscoWorks Assistant	Server internal
TCP	49157	IPSLA Performance Management Database	IPSLA Management	Server internal
TCP	50001	SOAPMonitor	Inventory, Configuration and Image Management	Server internal
TCP	55000-55020	CSTM ports for Topology and Identity Services	Topology and Identity Services	Server internal

Getting Started with Cisco Prime LMS 4.1

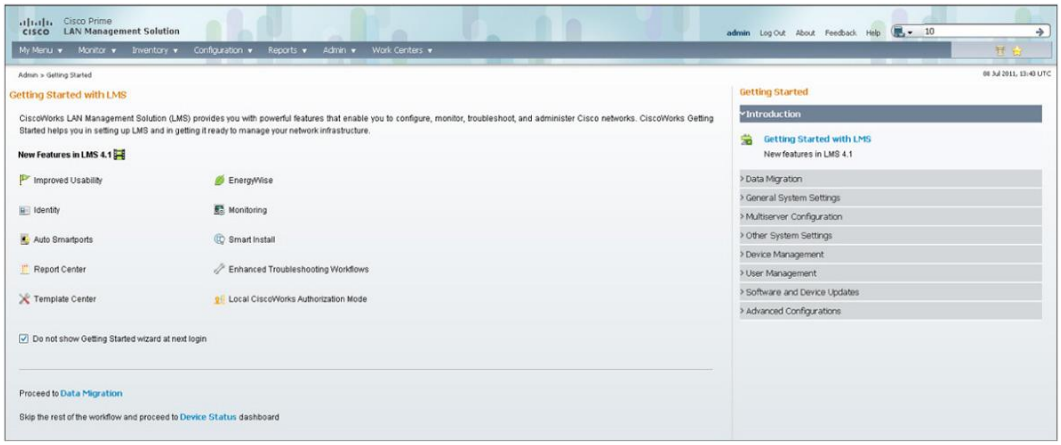
The LMS Getting Started workflow assists you in performing the tasks required to get your Cisco Prime LMS ready and to manage your Cisco networks.

When you login to Cisco Prime LMS server for the first time, the Introduction page of the Getting Started workflow appears. The Introduction page lists the new features added in Cisco Prime LMS 4.1. You can do the following tasks using the Getting Started workflow:

- Configuring email, cisco.com, and proxy settings
- Updating software and device packages
- Migrating data
- Configuring RCP and SCP credentials, security, backup, and authentication settings
- Managing devices and credentials
- Managing user roles and users
- Linking to advanced functionalities and settings

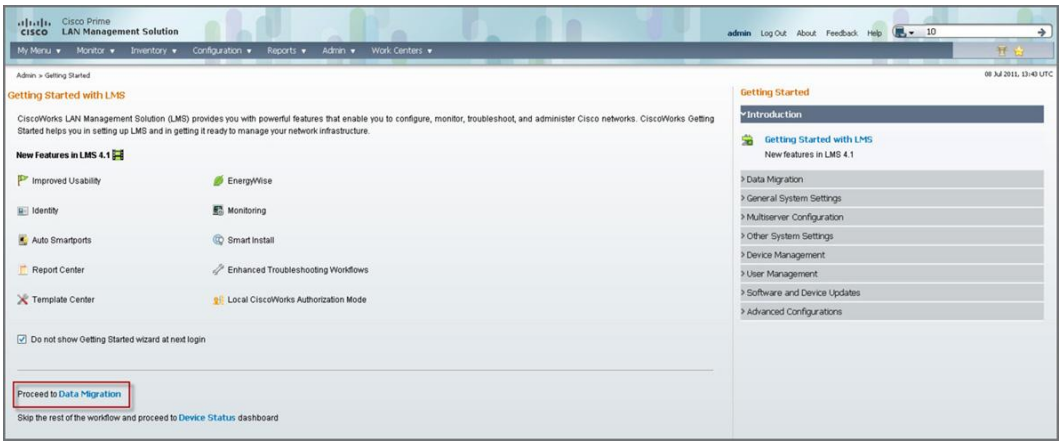
You can configure these tasks stepbystep using the Getting Started workflow. You can also execute these tasks independently by selecting the task from the Getting Started assistant pane (Figure 18).

Figure 18. Getting Started Wizard



You can follow the workflow by clicking theProceed to Data Migration linkor, if you know the next step, you can click any of the steps on the right side under the Getting Started wizard.

Figure 19. Getting Started - Data Migration



Data Migration

This section describes how you can perform data migration from the previous version of LMS to LMS 4.1.It is assumed that you have backed up your current LMS installation.

Important: You have to freshly install LMS 4.1on a new server and then perform data migration from the previous version of LMS thatwas backed up. The migration path is available for the following versions of LMS for Solaris and Windows

- LMS 4.0.1
- LMS 4.0
- LMS 3.2
- LMS 3.1
- LMS 3.0 December 2007 update
- LMS 2.6

For more information on data migration, please refer to http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/instl.html#wp1581295.

To start data migration:

1. Store the backup archive on the server to which you want to migrate the data.
2. Go to the command prompt and stop the daemons using the following command:
   - For Windows:
     `net stop crmdmgtd`
   - For Solaris:
     `/etc/init.d/dmgtd stop`
3. Run the command:
   - For Windows:
     `NMSROOT\bin\perl NMSROOT\bin\restorebackup.pl -d backup_directory`
   - For Solaris:
     `/opt/CSCOpx`**`/bin/perl`** `/opt/CSCOpx`**`/bin/restorebackup.pl`** `-d backup_directory`

     where `NMSROOT` is the Cisco Prime installation directory and `backup_directory` is the directory in which the backup archive is located.
4. Once the migration is complete, start the daemons using the following command:
   - For Windows:
     `net start crmdmgtd`
   - For Solaris:
     `/etc/init.d/dmgtd start`

LMS 4.1 also supports data migration from Solaris to soft appliance if the customer has installed LMS 4.1 soft appliance in his network. The migration path is available from the following previous version of LMS (assuming LMS 4.1 soft appliance is already deployed into another VM):

- LMS 4.0.1
- LMS 4.0
- LMS 3.2

To start data migration:

1. Store the backup archive on the server to which you want to migrate the data.
2. Stop the daemon manager by entering:
   - /etc/init.d/dmgtd stop
3. Restore the backed up data by entering:
   - **NMSROOT/bin/perl** NMSROOT/**bin/restorebackup.pl** -d **BKP** [-t **temporary_directory**]

     where BKP is the backup directory.

     You must enter the absolute path for **BKP**. For example, if **BKP** is under /opt, give the path as **NMSROOT/bin/perl NMSROOT/bin/restorebackup.pl** -d **/opt/BKP**.

4. Start the daemon manager by entering:

   - /etc/init.d/dmgtd start

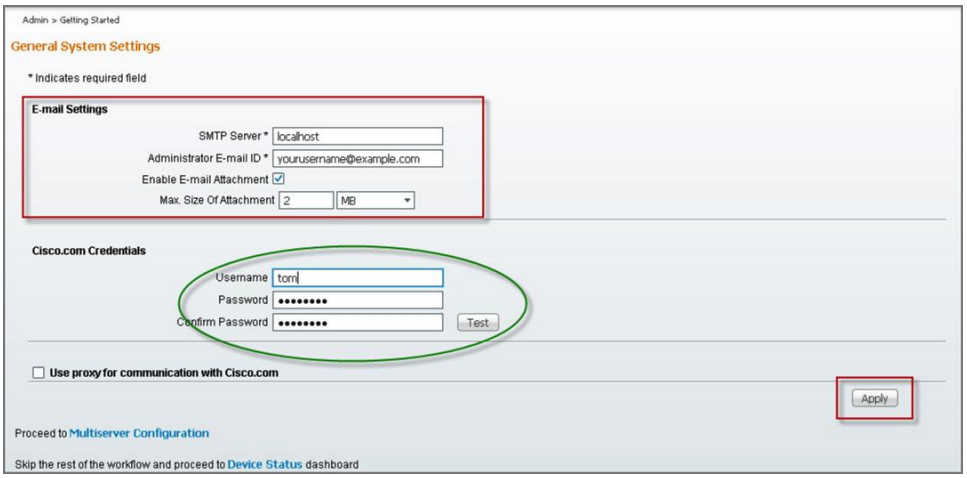
For more information on data migration, please refer:
http://www.cisco.com/en/US/docs/net_mgmt/ciscoworks_lan_management_solution/4.1/install/guide/dmg.html#wp1214701

Click the Proceed to **General System Settings** link for the next steps.

General System Settings

General system settings (Figure 19) allow administrators to configure email for LMS to send notifications in case of alerts and Cisco.com credentials to run end-of-sale, end-of-life, and Product Security Incident Response Team (PSIRT) reports as well as for the software image distribution feature.

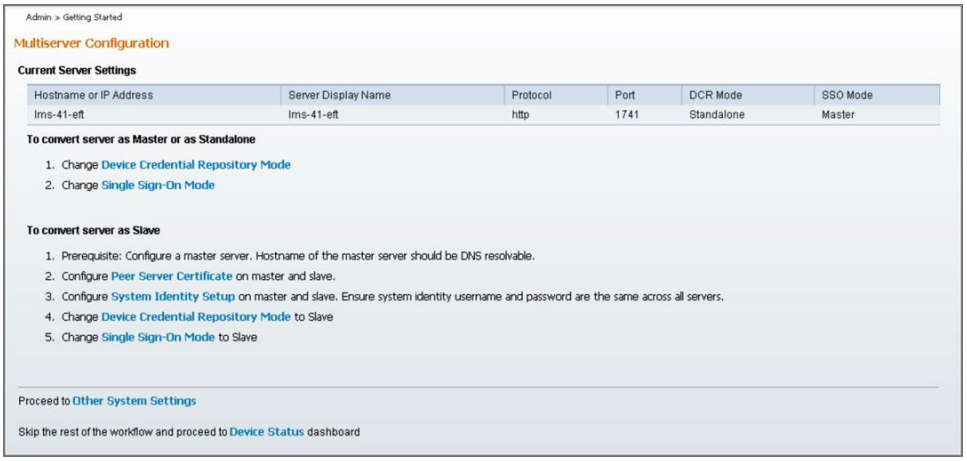
Figure 20. The General System Settings Window



Multiserver Configuration

Multiserver configuration can be accomplished by selecting **Getting Started → Multiserver Configuration** (see Figure 20).

Figure 21. The Multiserver Configuration Window



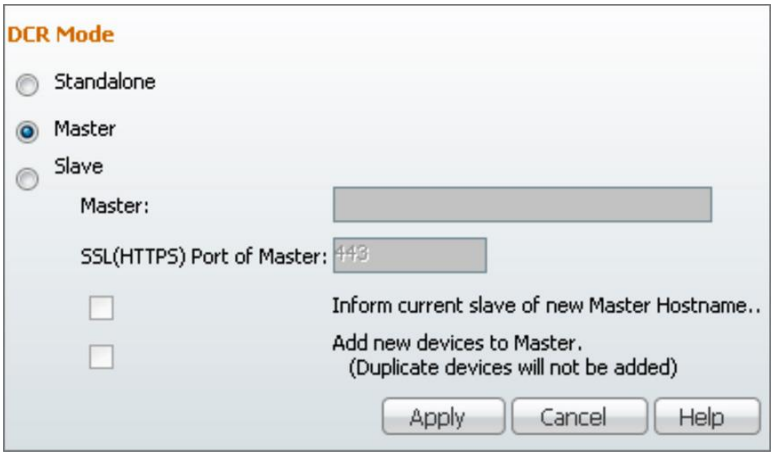
The most common installations are stand-alone singleserver. If you are doing a multiserver deployment, then you can skip this section and click **Proceed to Other System Settings**.

Designate This Server as Master

- Change the Device Credential Repository (DCR) mode to Master.

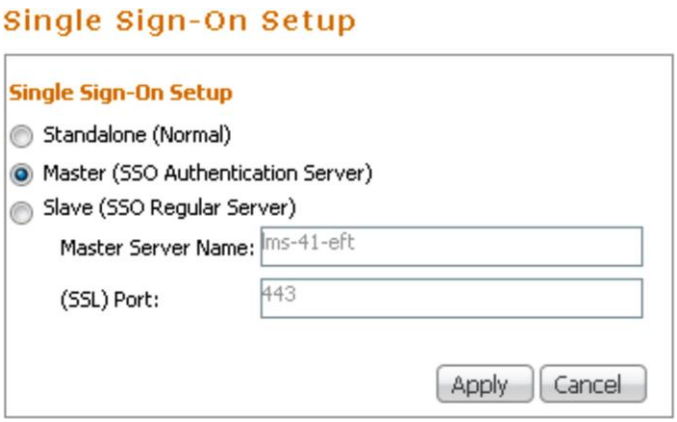
By doing this, you are designating this server as master and informing LMS that the DCR is going to be updated and maintained on this master server.Choose **Master** as the DCR mode and click **Apply** (Figure 21).

Figure 22. Changing the DCR Mode to Master



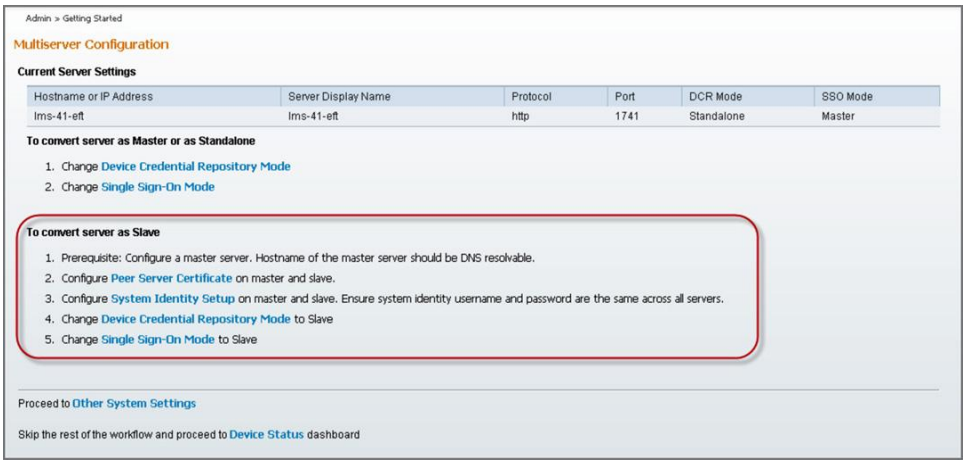
- Change the SingleSign-On mode (Figure 22)
- Choose **Master** and click **Apply**

Figure 23. Change the Single Sign-On Setup



Similarly, you can use the steps highlighted in Figure 23to designate a server or servers as slave instead of master.

Figure 24. Multiserver Configuration Options



Click the Proceed to **Other System Settings** link to continue.

Other System Settings

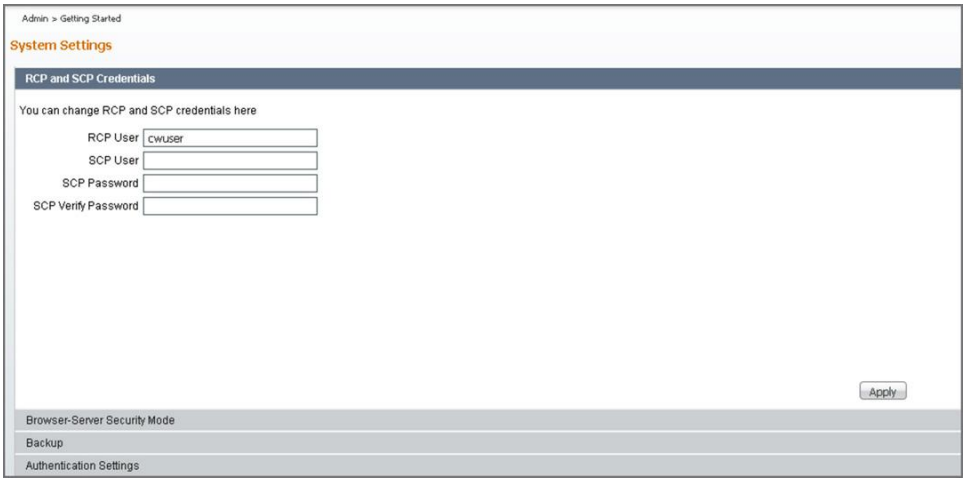
In this section you can set up the following:

- RCP and SCP credentials for the LMS server when LMS uses these protocols
- Browser-server security mode
- Backup - LMS backup directory location and schedule
- Authentication settings - You can choose from a number of authentication modes.

RCP and SCP Credentials

Use the System Settings window (Figure 24) to change the RCP and SCP credentials.

Figure 25. The System Settings Window



RCP User: Name used by a network device when it connects to Cisco Prime LMS server to run RCP. The user account must exist on UNIX systems and should also be configured on devices as local user in the IP rcmd configuration command. The default RCP username is cwuser.

SCP User: Name used by a network device when it connects to the Cisco Prime LMS server to run SCP. The username you have entered here is used for authorization while transferring software images using SCP. You must specify a username that has SSH authorization on a Solaris system. SCP uses this authorization for transferring software images.

SCP Password: Enter the password for the SCP user in this field. The password you have entered here is used for authentication while transferring software images using SCP. You must specify a username that has SSH authentication on a Solaris system. SCP uses this authentication for transferring software images.

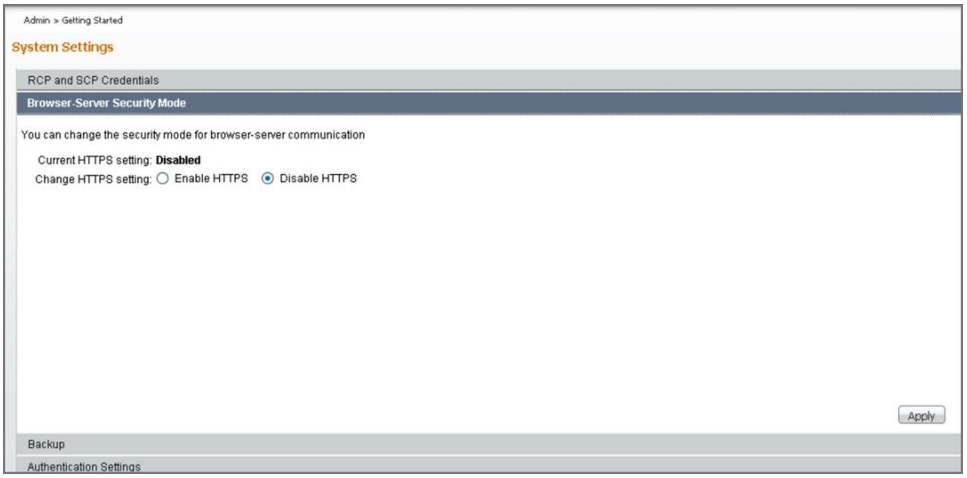
SCP Verify Password: Reenter the SCP password in this field.

Click **Apply**.

Browser-Server Security Mode

Choose the HTTPS setting, either to enable or disable HTTPS (Figure 25).

Figure 26. Enable or Disable HTTPS in the System Settings Window

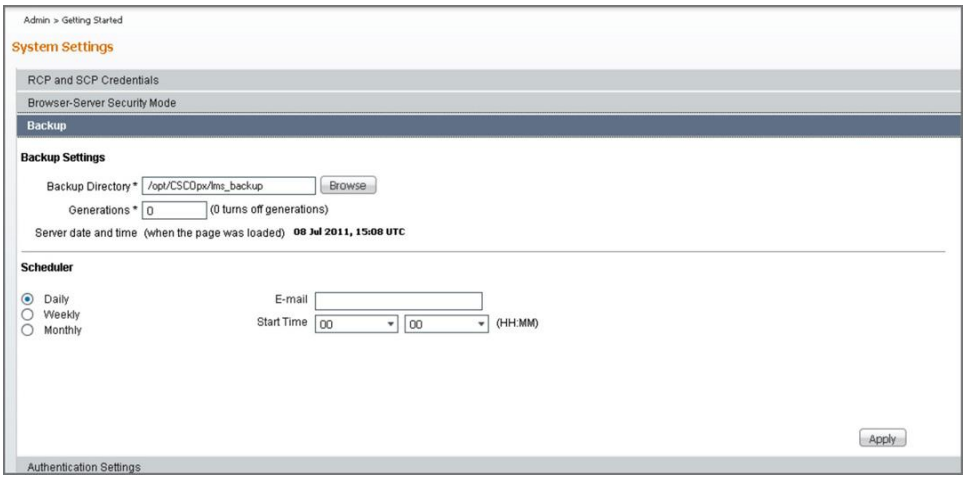


Backup

Specify the location of the backup directory in the Backup Directory field and the maximum number of backups to be stored in the Generations field.

In the Scheduler section, you can set the frequency of the backups by choosing Daily, Weekly, and so on. See Figure 27.

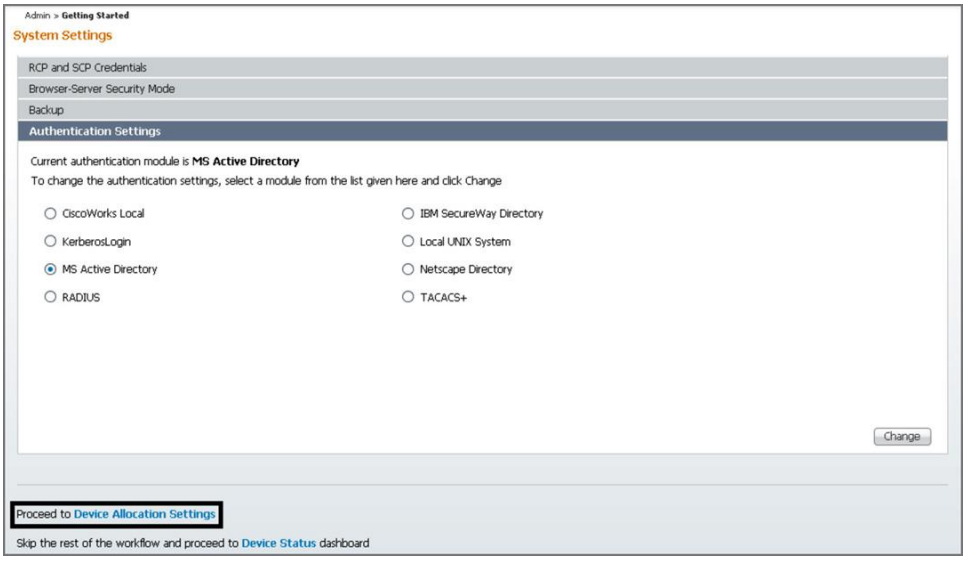
Figure 27. Specify the Backup Directory and Schedule Backups in the System Settings Backup Window



Authentication Settings

Cisco Prime LMS provides various ways to authenticate a user. Administrator can choose from the optionsshown in Figure 27.

Figure 28. Options for Authenticating Users



Device Management

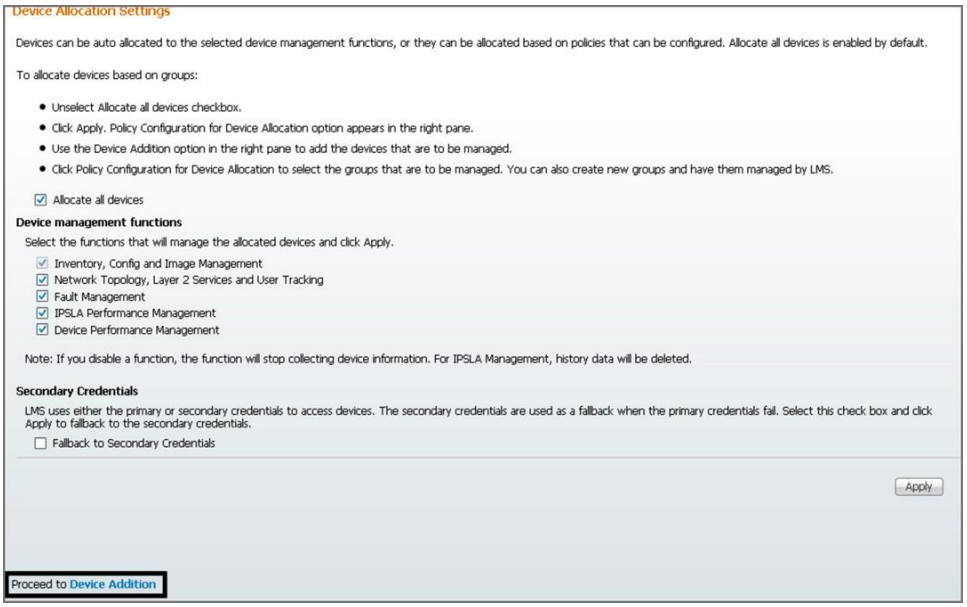
In this section there are two primary tasks:device management functions and device addition into LMS.

Device Management Functions

The check boxes determine which of the functions will be performed by LMS on the added devices. By default all the functions are checked. Unchecking any function will result in the lack of chosen functionality for the added devices. This is done to save LMS resources, but it is common to choose all the available functions.

Click the Proceed to **Device Allocation Settings and then click on Device Addition** link.

Figure 29. Device Addition



Device Addition

There are multiple ways to add devices into LMS database as described below:

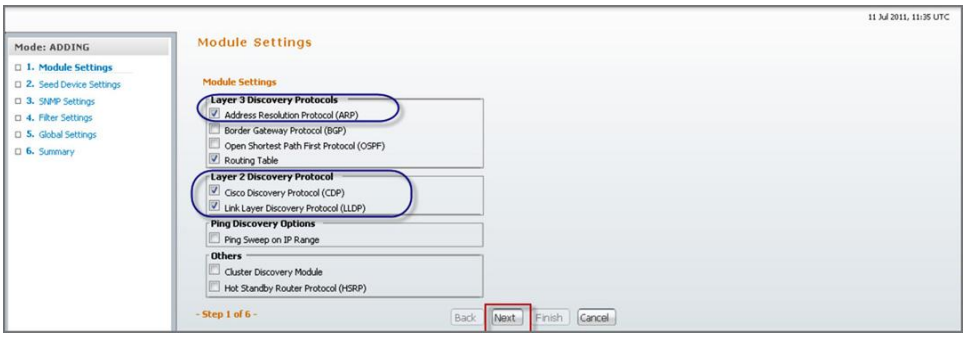
- Device autodiscovery
- Manually adding devices
- Importing devices

For the purpose of this document, device autodiscovery is shown in Figure 30. For device autodiscovery, select **Admin → Network → Discovery settings**.

Figure 30. Options for Device Autodiscovery

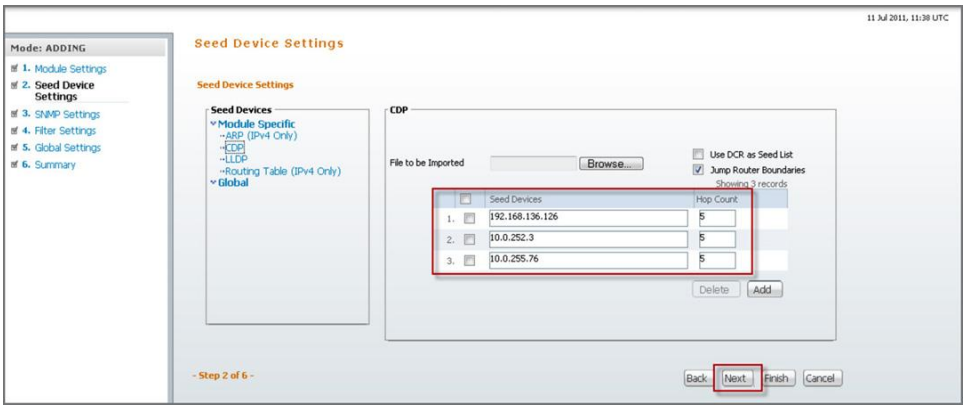
Select the discovery protocol that you would like to use based on your network design. You can select one or multiple discovery protocols (Figure 29).

Figure 31. Selecting Discovery Protocols



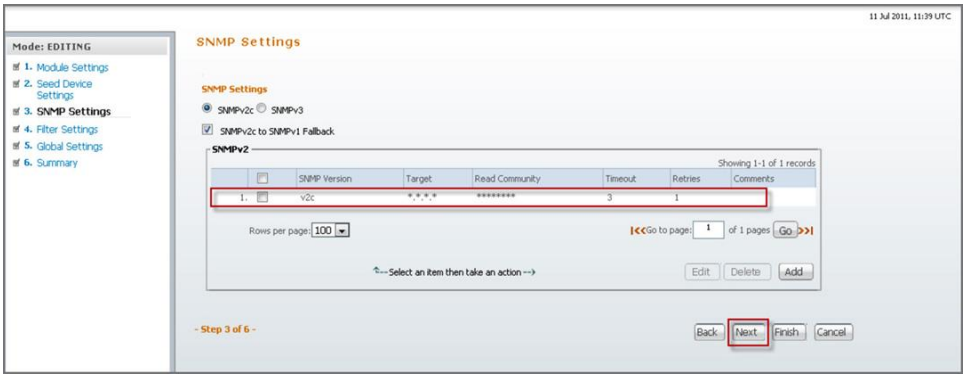
Click **Next** to configure seed device settings (Figure 30). You can add one or multiple seed devices.

Figure 32. Adding Seed Devices



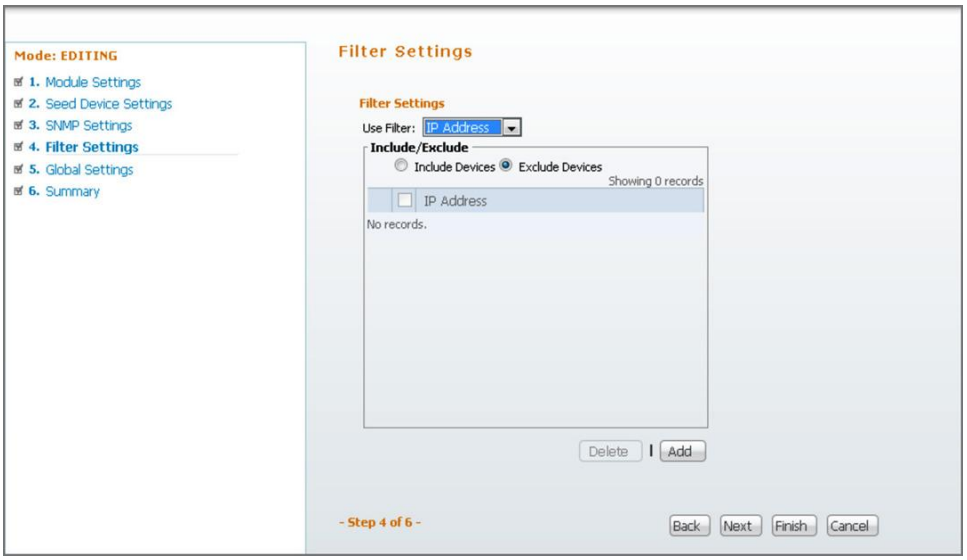
Click **Next** to add SNMP settings (Figure 31).

Figure 33. Adding SNMP Settings



Click **Next** to go to Filter Settings (Figure 32), which is an optional step and can be used if you would like include or exclude specific IP addresses, DNS domains, system objectIDs, or system locations from your discovery process.

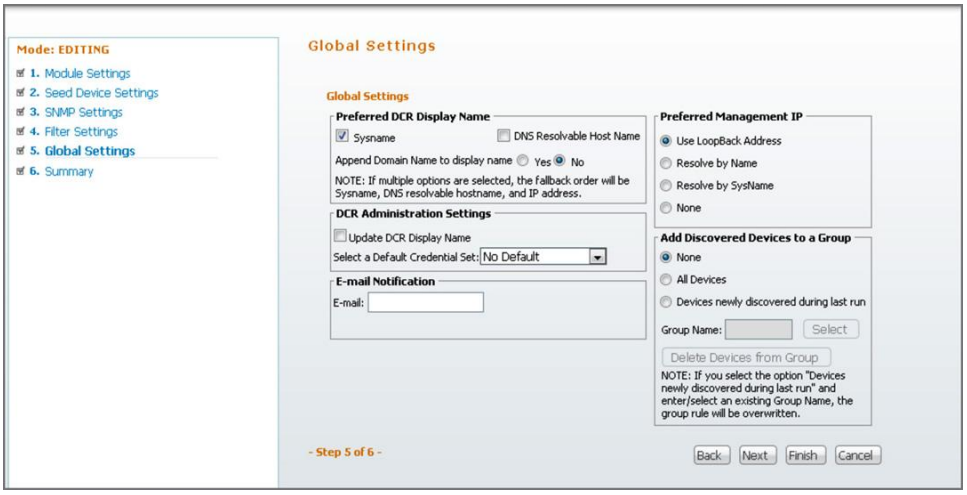
Figure 34. Filter Settings



Click **Next** and the Global Settings page will appear (Figure 35). This step is optional; however, if you skip this step, you will lose the opportunity of choosing the preferred display name, which is Sysname or DNS name, and a few other options.

Sysname (system name of the devices) is introduced in Cisco Prime LMS 4.1 as another option for displaying discovered devices, using sysname in cases where DNS is not available to resolve host names.

Figure 35. Global Settings



Note: If multiple options are selected, the fallback order will be Sysname, DNS resolvable hostname and IP address.

Click **Next** for the final step of this discovery process, which is a summary page (Figure 34) that provides a summary of selections from step 30 to step 35.

Figure 36. Discovery Settings Summary

Click **Start Discovery** to start the network device discovery. Cisco Prime LMS will run the discovery based on the discovery protocols that you chose in the previous step and will display all the discovered devices.

User Management

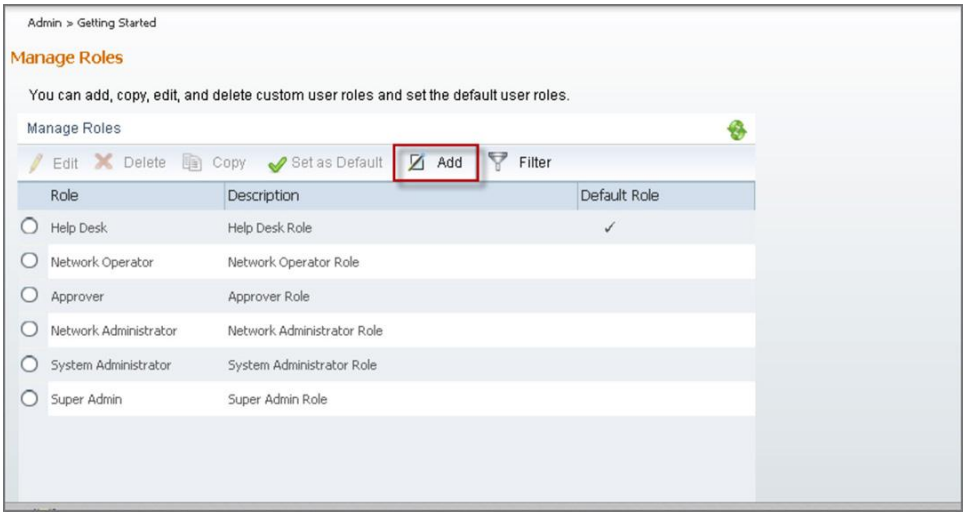
In this section, you can define user roles and, based on the user roles, you can define and add users.

User Roles

Cisco Prime LMS provides system predefined roles and a default role. But you can also create your own roles to fit your organizational needs as well as change the default role. This section shows how to create a customized role. If you don't need to define a custom role, please skip this subsection.

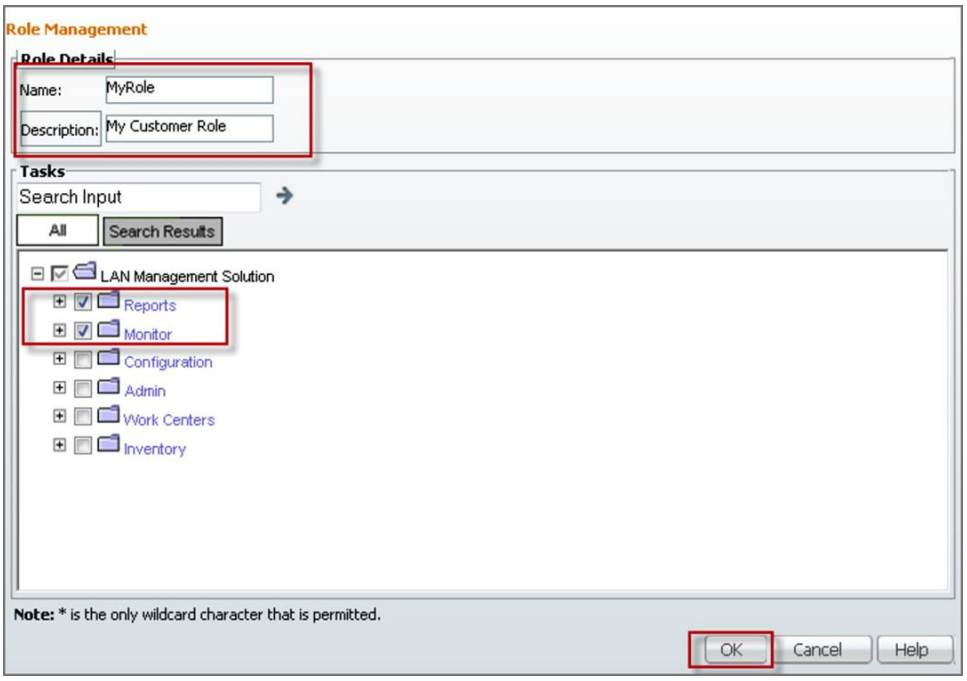
Go to **Admin → Getting Started → User Management → Manage Roles** and Click **Add**. See Figure 37

Figure 37. Managing Roles



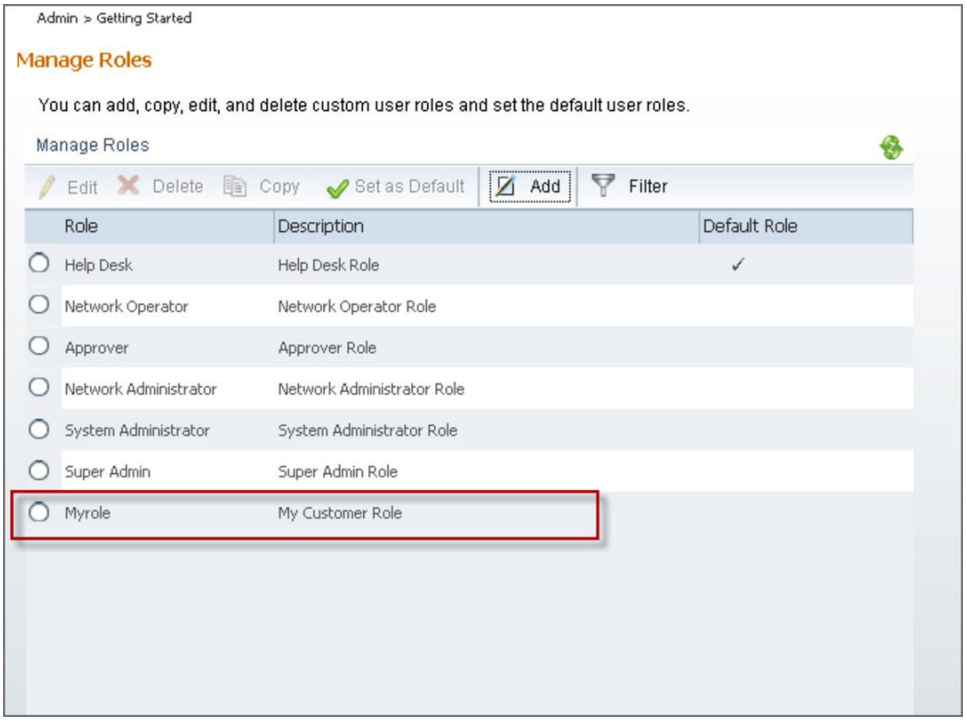
Enter the role name as Myrole, enter some description, and choose the tasks that this role can execute. See Figure 36. Here we are choosing **Reports** and **Monitor**. Through the role-based access control (RBAC) settings, Myrole can perform only the reporting and monitoring functionality of LMS.

Figure 38. Managing Roles



Click **OK**.

Figure 39. Completed Customized Role

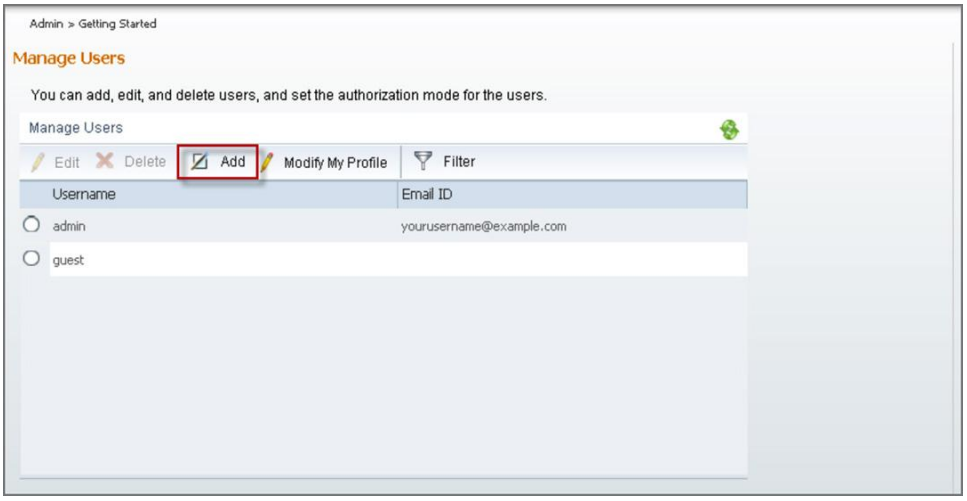


A customized role is now created that can perform only reporting and monitoring of the entire network.

Adding Users

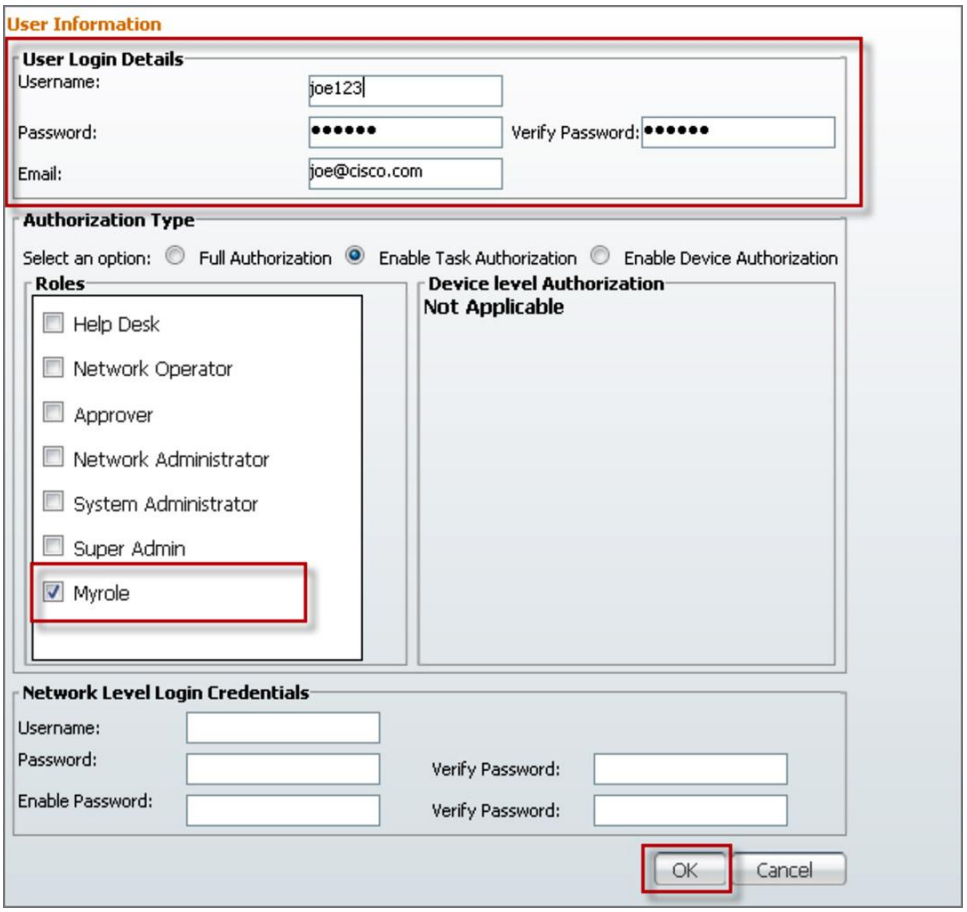
You can also add users to LMS. To add users, go to **Admin → Getting Started → User Management → Manage Users** and click **Add**. See Figure 40.

Figure 40. Adding Users



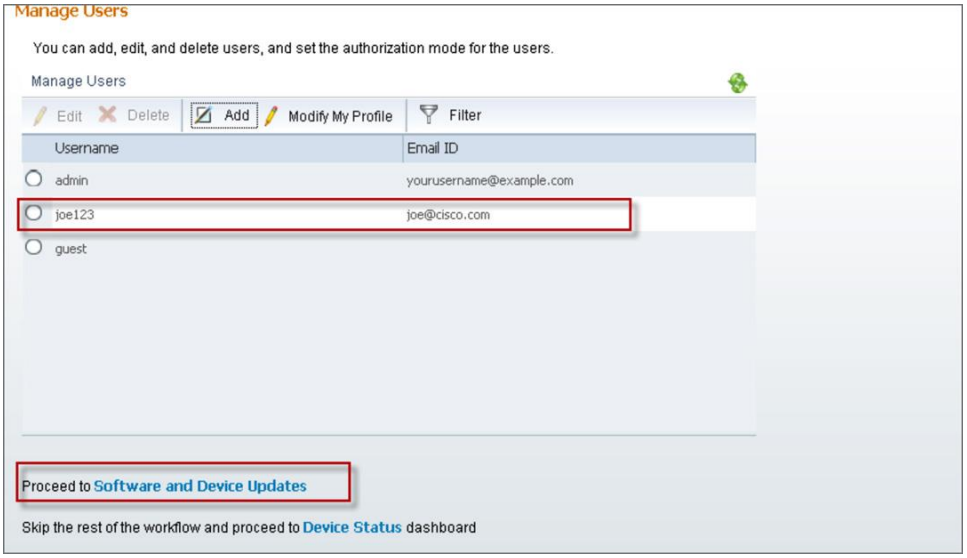
In this case, we are creating a user called joe123. See Figure 41.

Figure 41. Creating User joe123



Click **OK**. The Manage Users window (Figure 42) appears.

Figure 42. joe123 Has Been Added to the Users

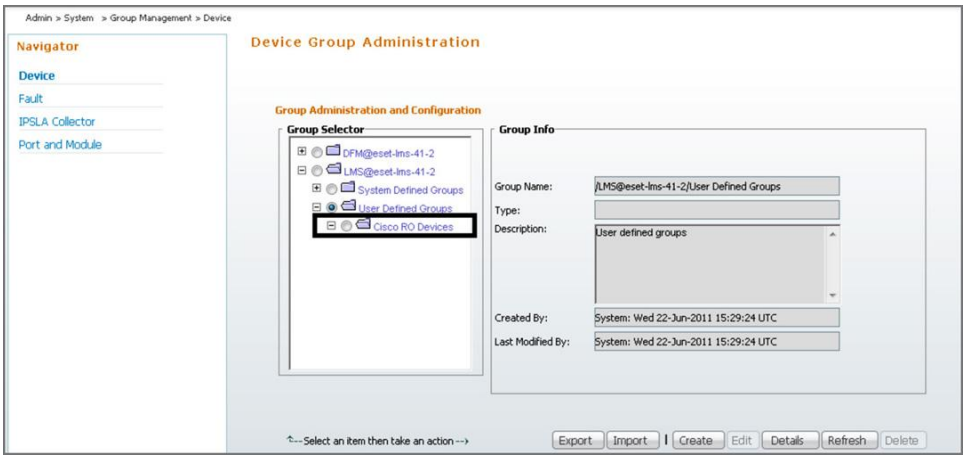


A new user joe123 has been added with MyRole privileges.

RBAC is also very useful for user-defined groups into which you can group your devices into a group and then assign roles for user, allowing joe123, for example, to manage only that specific user-defined group.

To add a user-defined group, click **Admin → System → Group Management→ Device** and click **Create**. See Figure 43.

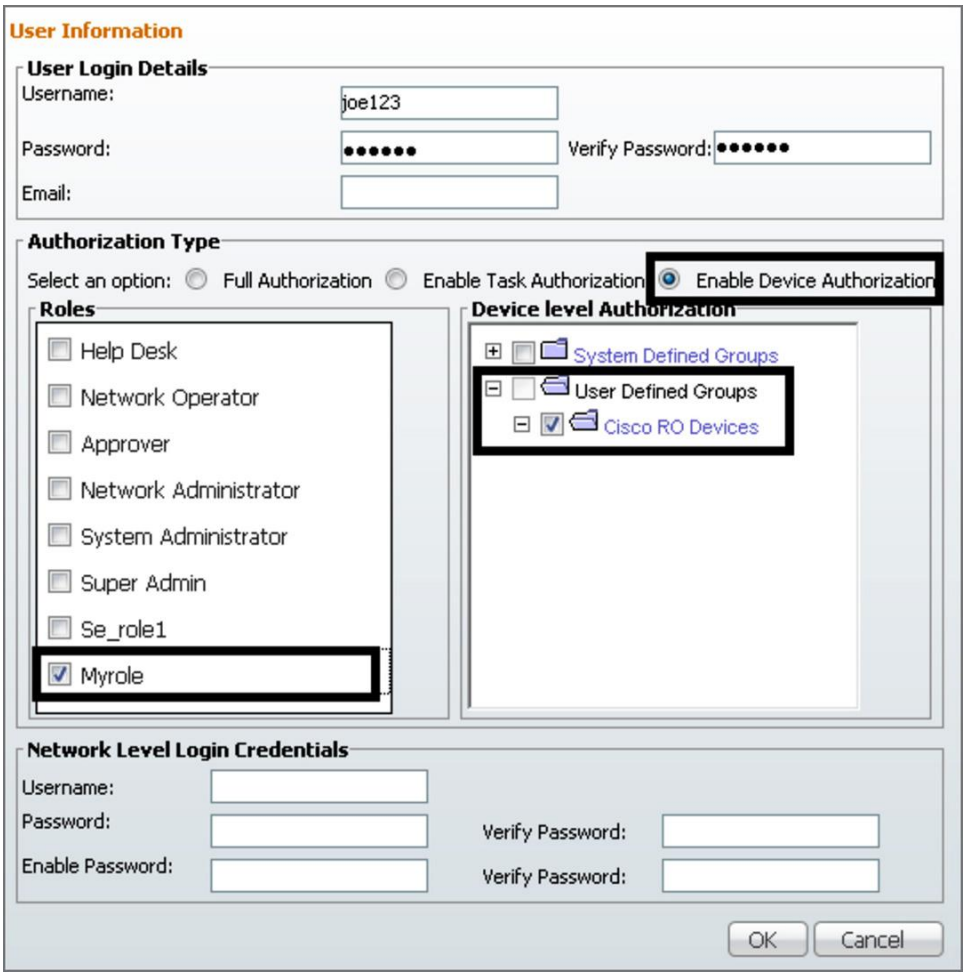
Figure 43. Adding a User-Defined Group



Add a user-defined group, Cisco RO Devices, by adding the devices that you want to be part of this group.

Once you creat this group, you can use theRole Management setup window and assignuser joe123 to manage the Cisco RO device group with Myrole. See Figure 42.

Figure 44. Assigning Roles to Groups



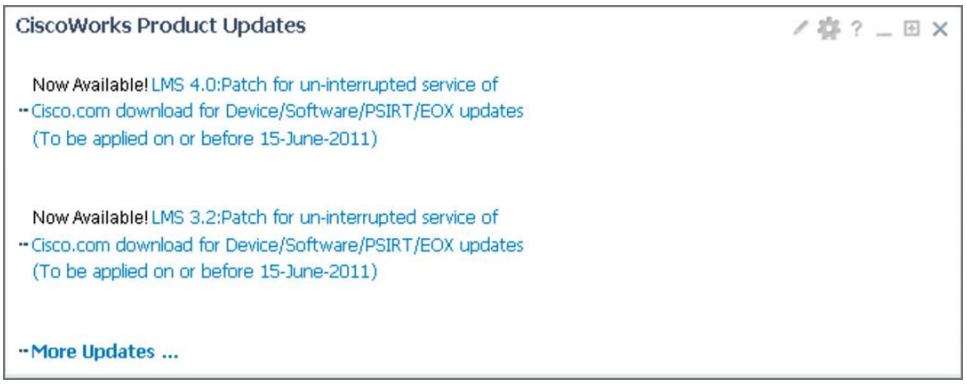
The next step of the work flow is updating software and devices.

Software and Device Updates

LMS periodically releases software and device package updates to keep your server up to date with all the latest patches. With LMS 4.1, there is a ticker functionality available through which you can quickly install these patches.

To access the ticker function, go to **Admin → Dashboards → System**. See Figure 45.

Figure 45. The Ticker Function Allows Quick Installation of Patches



At this stage you do not need to go to the section of software and device updates.

Advanced Configurations

Monitoring

Automonitoring in LMS allows you to select the Link Port groups or All Devices group and monitor the interlink switches automatically. When you want to monitor these groups, pollers are created based on the polling intervals. The polling interval is the duration after which LMS queries the MIB variable on the device. Here the duration is calculated in terms of minutes and hours.

For example, if the polling interval for a poller is set as 15 minutes and the first polling cycle starts at 10:00 a.m., the next polling cycle is scheduled to start at 10:15 a.m.

You can change the polling intervals and select a different interval.

See **Monitoring and Troubleshooting with CiscoWorks LAN Management Solution 4.1** for more information.

Fault Management Settings

Managing polling parameters is a key fault management feature in LMS. This feature allows you to perform the following tasks:

- Viewing polling parameters
- Previewing polling parameters
- Editing polling parameters
- Restoring factory setting polling parameters
- Restoring factory setting polling parameters
- Device polling settings

You can adjust polling parameters only on devices. Port and interface polling is controlled at the device level.

See **Monitoring and Troubleshooting with CiscoWorks LAN Management Solution 41** or more information.

Configuration Management

The Template Center in LMS provides you with a list of system-defined templates. These templates contain configuration commands that can be deployed on the devices in your network. These templates are deployed using Deploy Template jobs in LMS.

See **Configuration Management with CiscoWorks LAN Management Solution 4.1** for more information.

Inventory and Configuration Management

Business Scenario

As enterprise networks grow ever larger, it becomes a tedious job to manage hundreds or even thousands of devices. With the Inventory and configuration management functions in LMS 4.1, we can address tasks such as:

- How do I keep track of the inventory of devices on my network? How do I generate a customized report that digs out just the inventory information I need?
- How do I keep track of the outdated devices and plan for an equipment upgrade budget? How do I keep track of not only outdated hardware but outdated Cisco IOS Software images?
- How do I keep an archive of the configuration and be able to restore the configurations if there is any misconfiguration? How do I push configurations to multiple devices on my network without doing it onebyone through the CLI? How do I keep track of the changes?
- How do I manage compliance by enforcing configuration policies across the network so everyone is following rules when they configure hundreds of devices?
- How do I automatically upgrade the software images on devices without spending too much time and affecting our business?
- How do I monitor the syslog messages and be automatically notified if something happens?

Configuration Management Overview

LMS consists of many automated features that simplify configuration management tasks, such as performing software image upgrades or changing configuration files on multiple devices Configuration Management in LMS consists of the following major components:

- **Configuration Manager:** Maintains an active archive of multiple iterations of configuration files for every managed device and simplifies the deployment of configuration changes. You can use ConfigEditor to change, compare, and deploy configuration to one device, or use NetConfig to deploy to multiple devices. You can design baseline templates for different configuration needs. You can also specify which action to take after the configuration is deployed.
- **Software Manager:** Simplifies and speeds software image analysis and deployment. You can do an automatic upgrade analysis to help you select the right image. Then use the SWIM feature to import images, stage the image locally or remotely, then deploy to groups of devices.
- **Syslog Analysis:** Collects and analyzes syslog messages to help isolate network error conditions. You can filter the syslog messages and designate actions based on the messages.
- **Change Audit Services:** Continuously monitors incoming data versus stored data to provide comprehensive reports on software image, inventory, and configuration changes.
- **Audit Trails:** Continuously monitors and tracks changes made to the LMS server by the system administrator.
- **Compliance Management:** By creating a baseline template, which is essentially sophisticated regular expressions, users can enforce configuration rules to help ensure that the configuration complies with the internal policies or government regulations.

Inventory Management Overview

Inventory Management provides comprehensive device information, including hardware and software details. This information is crucial for network maintenance, upgrades, administration, troubleshooting, and basic asset tracking. The inventory information can also be used by other applications that need access to this same information without the need for additional device queries. Network administrators must often be able to quickly provide information to management on the number and types of devices being used on the network. The more information network administrators have in one central place about all the devices, the easier it is to locate necessary information, resolve problems quickly, and provide detailed information to upper management.

Periodic inventory collection versus periodic inventory polling:

A periodic inventory collection job collects inventory data from all devices (devices in the All Devices group) and updates inventory database. The periodic polling polls all devices to check a certain MIB value to see whether the timestamp has changed. If there is a change in the timestamp, LMS then goes ahead to retrieve inventory changes and collects and updates the inventory database.

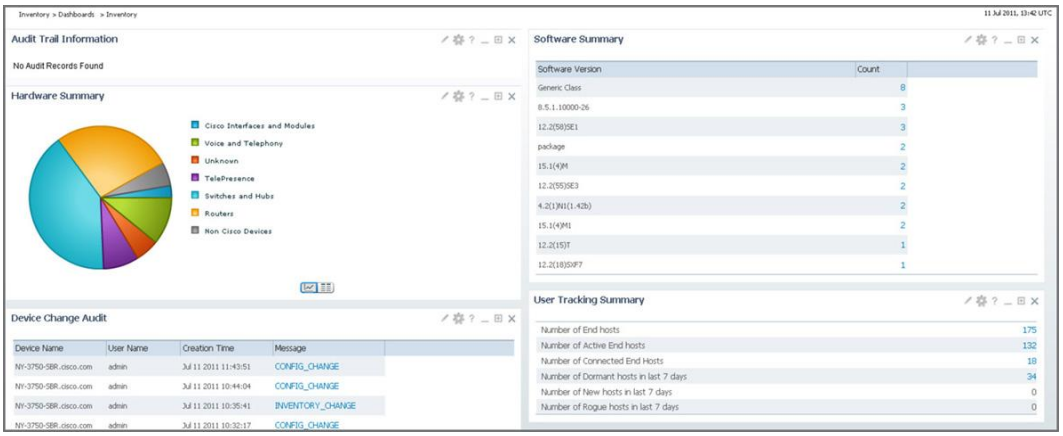
Note: Inventory polling consumes much less bandwidth than inventory collection.

The predefined default periodicity of the collector job is once a week, and the predefined default periodicity of the polling job is once a day.

The polling job detects most changes in all devices, with much less impact on your network and on the LMS server.

The Inventory Dashboard (Figure 46) can be accessed by clicking **Inventory → Dashboards → Inventory**.

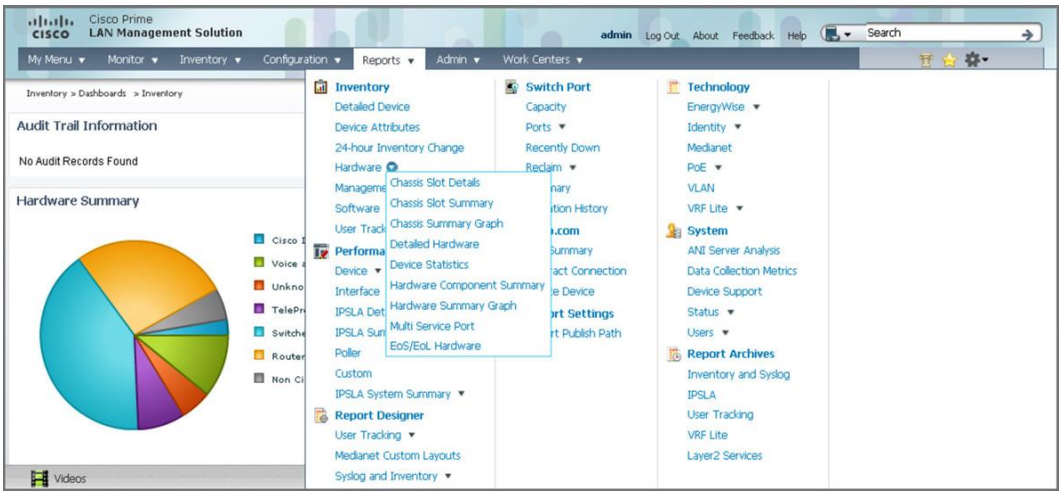
Figure 46. The Inventory Dashboard



Inventory Reports

LMS starts retrieving inventory information based on the default schedule setting. LMS has numerous predefined reports for Inventory. These reports can be viewed by going to **Reports→Inventory→Hardware**. See Figure 47.

Figure 47. Predefined Inventory Reports



The reports include Chassis Slot Details, which provides information on the slots for the chassis-based devices, and theChassisSlot Summary, among others.

All these reports are generated with a set of predefined query criteria. For example, Software Report will list the software versions based on the categories of the devices. If you want to query a customized list of variables from the inventory, you can use acustom reports template for this as described in the following section.

Some built-in reports are unique in LMS:

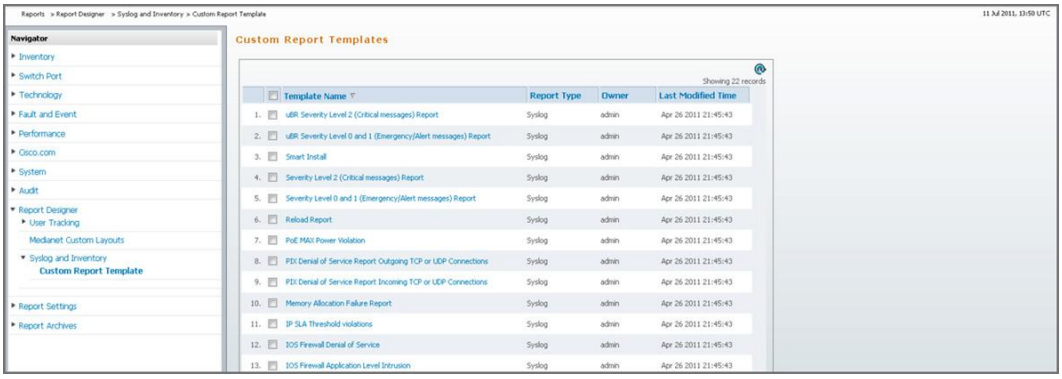
- **PSIRT Summary report:** Introduced in LMS 3.0, this report automates how users track the PSIRT security alert from Cisco. The LMS server can be scheduled periodically to fetch the PSIRT information from cisco.com and correlate to the user's network devices. To run this report, go to **Reports→Fault and Event→PSIRT Summary**.
- **EoS/EoL Hardware report:** Introduced along with the PSIRT report, this report works in a similar way to automate how users track the end-of-sale/end-of-life status of the network devices. Good for budget planning. Some customers schedule it to run every quarter to know how much equipment needs to be upgraded.

Custom Reports

To create a customized report (Figure 46) with your particular query variables, such as "the serial number of all c1701 routers," follow these steps:

1. Create a custom report template. Go to **Reports→Report Designer→Syslog and Inventory→Custom Report Template** and click **Create**.

Figure 48. The Custom Report Templates Window

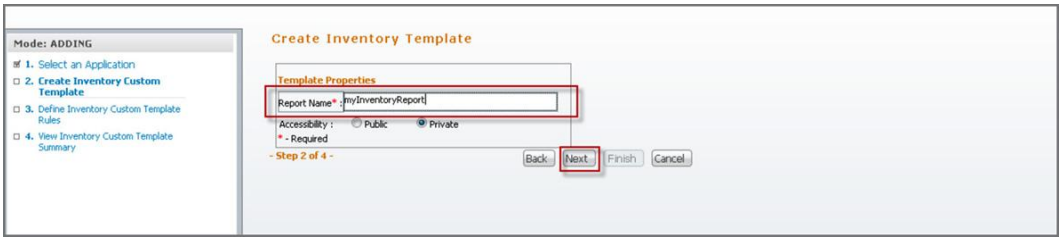


2. Select the **Inventory** radio button and click **Next** (Figure 49).

Figure 49. Click Next After Selectingthe Inventory Radio Button

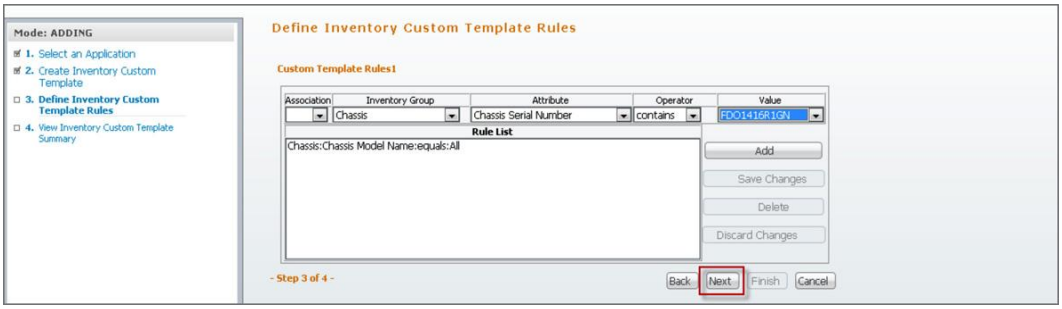
3. In the next screen (Figure 50), give a name such as **myInventoryReport** and choose **Private**. Click **Next**.

Figure 50. Naming the Report



4. Fill in the values as shown to generate a custom report for chassis serial number and click **Next** and **Finish (figure 51).**

Figure 51. Click Next, then Click Finish to Generate a Report Template



This will generate a template. Now based on this template, you can create a custom report.

5. Select **Reports → Inventory → myInventoryReport**
6. Choose the devices, specify the job name and email address and click **Finish**

Note: Successfully generated reports are stored in the archives. You can access the report archives by selecting **Reports→Report Archives.**

Software Image Management

LMS greatly simplifies the work for software image management by building intelligence into the application to help the user pick and access device images from Cisco.com. Follow these steps to perform a software upgrade to your devices.

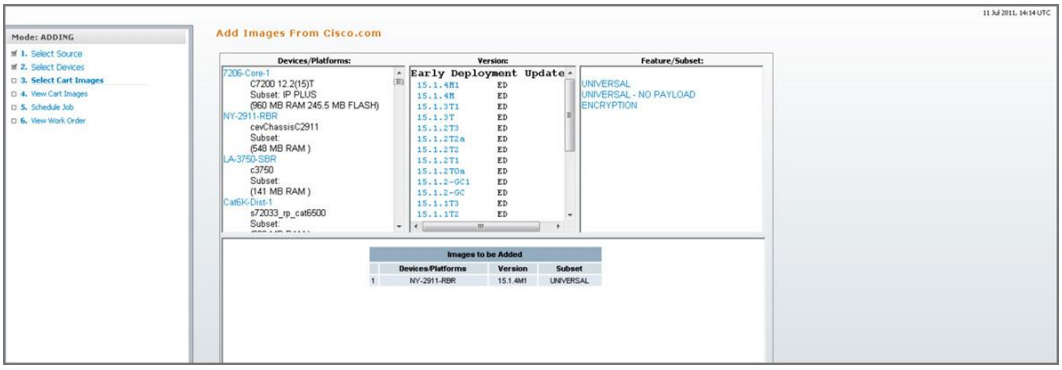
Step 1. Add images to the repository: Instead of browsing around on Cisco.com trying to find the image file, LMS helps the user to locate the image easily online and adds it into the local repository (Figure 52). You can schedule the download immediately or later.

Select **Configuration→Tools→Software Image Management→Software Repository** and click **Add**.

Choose **Cisco.com** and **All devices**.

Note: You can also export the image from the local repository to be used elsewhere.

Figure 52. Adding Image Files to the Local Repository



Step 2. Create a job for image distribution:Instead of manually loading the images one by one through the CLI, the user can schedule a job to deploy images to a group of devices.The methods of distribution include:

- **Basic:** This option allows you to select devices and then perform software image upgrades to those devices. Software management checks the current image on the device and recommends a suitable image for distribution.
- **By Devices [Advanced]:** This option allows you to enter the software image and storage media for the device that you want to upgrade. The selected image and storage media are validated and verified for dependencies and requirements.
- **By Images:** This option lets you select a software image from the software image repository and then use it to perform an image upgrade on suitable devices in your network.

- **Use Remote Staging:** This option allows you to select a software image, store it temporarily on a device, and then use the stored image to upgrade suitable devices in your network. This is helpful when the Resource Manager Essentials server and the devices (including the remote stage device) are distributed across a WAN.

Software Image Baseline Collection

It is recommended that you first import a baseline of all software images running on your network. The baseline imports a copy of each unique software image running on the network (the same image running on multiple devices is imported into the software library only once). The images act as a backup if any of your devices get corrupted and need a new software image or if an error occurs during an upgrade. If some devices are running software images not in the software repository then a synchronization report can be generated for these devices.

To schedule a synchronization report:

1. Select **Configuration→Tools→Software Image Management→Repository Synchronization**. Click **Schedule**. Enter the information and click **Submit**.
2. Import a baseline of all software images.
3. Once the Software Repository Synchronization job has finished successfully, you could create a job to import all software images on your network by performing the following steps:
   a. Select **Configuration→Tools→Software Image Management→Repository Synchronization**. Click **Add**. Select **Network** and **Use Generated Out-of-Sync Report** and click **Next**.
   b. All running images that are not in the software repository will appear; click **Next**. Enter the job control information and click **Next**, and click **Finish** when completed.

Note: If you have not selected the Use Generated Out-of-Sync Report option, it will take more time to show the software image selection dialog box.

Configuration ArchiveManagement

The Configuration Management tab in Cisco Prime LMS 4.1 hasthree applications: Archive Management, Config Editor, and NetConfig.

Archive Management

The Archive Management application maintains an active archive of the configuration of devices managed by LMS. It provides:

- The ability to fetch, archive, and deploy the device configurations
- The ability to handle syslog-triggered configuration fetches, thereby making sure that the archive is in sync with the device
- The ability to compare and label configurations

Configuration Collection/Polling

The configuration archive can be updated with configuration changes by periodic configuration archival (with and without configuration polling). You can enable this using **Admin→Network→Config Collection Settings→Config Collection Settings**.

Note: Scheduled collection and polling are disabled by default as the customer's network may have sporadic bursts of traffic and the network management system should not take up the existing bandwidth. It is best for the customer to select the periodic collection and polling.

You can modify how and when the configuration archive retrieves configurations by selecting one or all of the following:

- Periodic Polling

  Configuration archive performs an SNMP query on the device;if there are no configuration changes detected in the devices, no configuration is fetched.
- Periodic Collection

  Configuration is fetched without checking for any changes in the configuration.

Configuration Collection Transport Settings

- Default protocols are used for a configuration fetch and deploy.
- Many protocols are used for performing a configuration fetch and deploy. The system provides a default order of protocols that will be used to fetch or deploy the configuration on the device. You can set the protocols and order for Configuration Management applications such as Archive Management, Config Editor, and NetConfig jobs to download configurations and to fetch configurations.

The available protocols are:

- Telnet
- TFTP
- RCP
- SSH
- Secure Copy Protocol (SCP)
- HTTPS

Config Editor

You can use the Config Editor application to perform the tasks listed in Table 4.

Table 4. Config Editor Tasks

Task	Launch Point
Set or change your Config Editor preferences.	Select **Configuration→Tools→Config Editor→Edit Mode Preference**.
View the list of previously opened files in private or public work areas.	Select **Configuration→Tools→Config Editor→Private Configs** or Select **Configuration→Tools→Config Editor→Public Configs.**
Open a configuration file for editing in four ways: • **Device and version** • **Pattern search** • **Baseline** • **External location**	Select **RME → Config Mgmt → Config Editor → Config Editor.**
View the status of all pending, running, and completed jobs. You can also create a new job or edit, copy, stop, and delete a job that you have opened.	Select **Configuration→Job Browsers→Config Editor.**

The LMS Config Editor function can be used to edit a device configuration stored in the configuration archive and download it to the device. The Config Editor tool allows the user to make changes to any version of a configuration file, review changes, and then download the changes to the device.

When a configuration file is opened with Config Editor, the file is locked so that no one else will be able to make changes to it at the same time. While the file is locked, it is maintained in a “private” archive available only to the user who checked it out. If other users attempt to open the file to edit it, they will be notified that the file is already checked out and they can only open a “read-only” copy. The file will remain locked until it is downloaded to the device or manually unlocked within Config Editor by the user who checked it out or by a user that has network administrator and system administrator privileges.

NetConfig

You can use the NetConfig application to perform the tasks listed in Table 5.

Table 5. NetConfig Tasks

Task	Launch Point

• **View and create NetConfig jobs using the NetConfig Job Browser.**
• **View job details (by clicking the Job ID hyperlink in the NetConfig Job Browser).**
• **You can also:**
  ◦ **Edit jobs**
  ◦ **Copy jobs**
  ◦ **Retry jobs**
  ◦ **Stop jobs**
  ◦ **Delete jobs**
	Configuration→Job Browsers→NetConfig

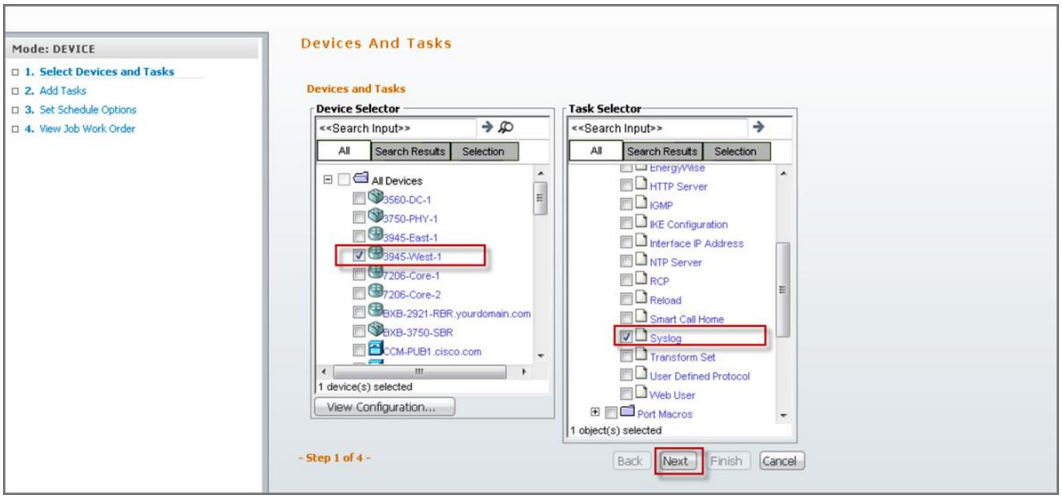
Create and manage user-defined tasks.	**Configuration→Tools→NetConfig→User Defined Tasks**
Assign user-defined tasks to valid CiscoWorks users.	**Configuration→Tools→NetConfig→Assigning Task**

The NetConfig function provides a set of command templates that can be used to update the device configuration on multiple devices all at once. The NetConfig tool provides wizard-based templates to simplify and reduce the time it takes to roll out global changes to network devices. These templates can be used to execute one or more configuration commands on multiple devices at the same time. For example, to change SNMP community strings on a regular basis to increase security on devices, use the appropriate SNMP template to update community strings on all devices using the same job. A copy of all updated configurations will be automatically stored in the configuration archive. NetConfig comes with several predefined templates containing all necessary commands. The user simply supplies the parameters for the command and NetConfig takes care of the actual command syntax. These predefined templates include corresponding rollback commands; therefore, if a job fails on a device, the configuration will be returned to its original state.

Create a NetConfig Job to Enable Syslogs on Devices and Configure LMS Server as Receiver

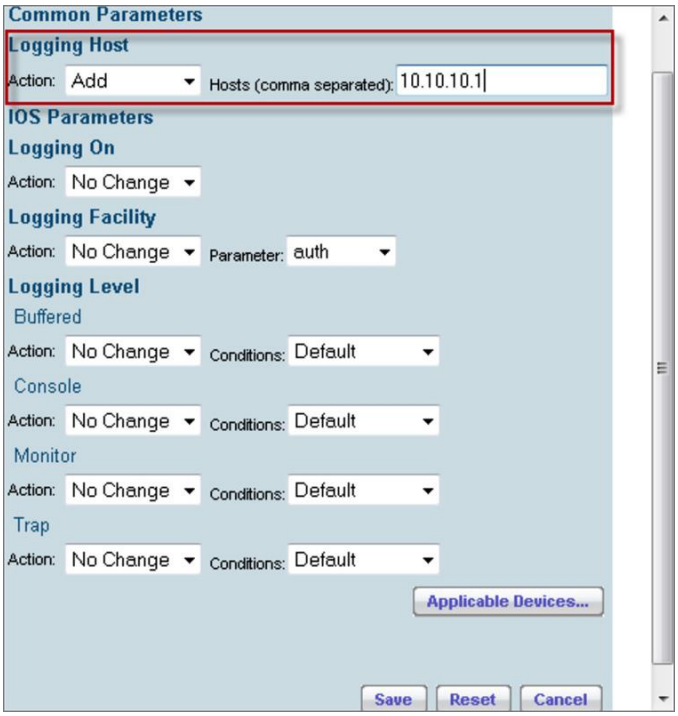
1. Go to **Configuration→Tools→NetConfig** and click **Create**.
2. Choose **Device Based**.
3. Choose the devices on which you want to enable the syslog functionality from the Device Selector.
4. Choose **General**, choose subselector **Syslog**, and click **Next** (Figure 53).

Figure 53. Enabling Syslogs on Devices



5. Click **Add Instance** (Figure 54).

Figure 54. Adding an Instance



6. Click Save.
7. Choose **Add** from the **Action** pull-down menu, and enter the IP address of the LMS server where you want the syslogs to be sent.

Change Management Reports

All changes made on the network through LMS are recorded as part of the change audit. If syslogs are enabled on devices, any out-of-band changes made on the devices are also recorded as part of the change audit. Change audit reports can be viewed by going to **Reports→Audit→Change Audit→Standard**.

Topology

Topology Services is an application that allowsyou to view and monitor your network including the links and the ports of each link.

Topology Services displays the network topology of the devices discovered by LMS through topology maps. Besides these maps, the application generates numerous reports that help you to view the physical and logical connectivity in detail.

To launch Topology Services, go to **Configuration→Topology** (see Figures 55 and 56).

Figure 55. The Topology Services Window

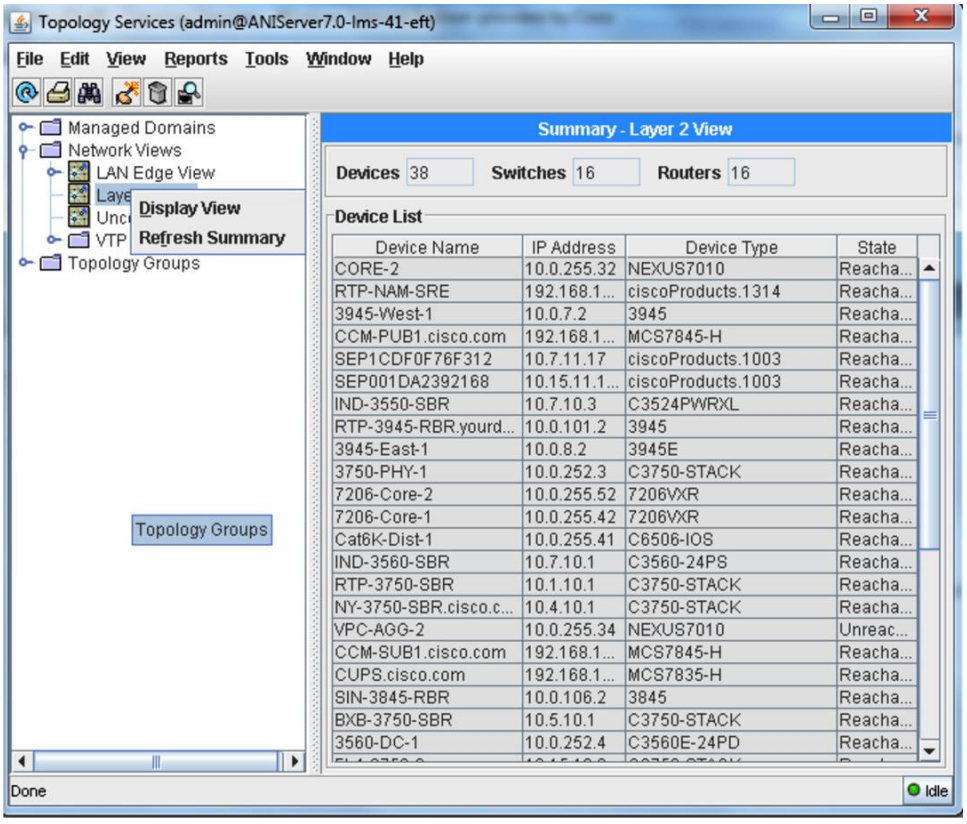
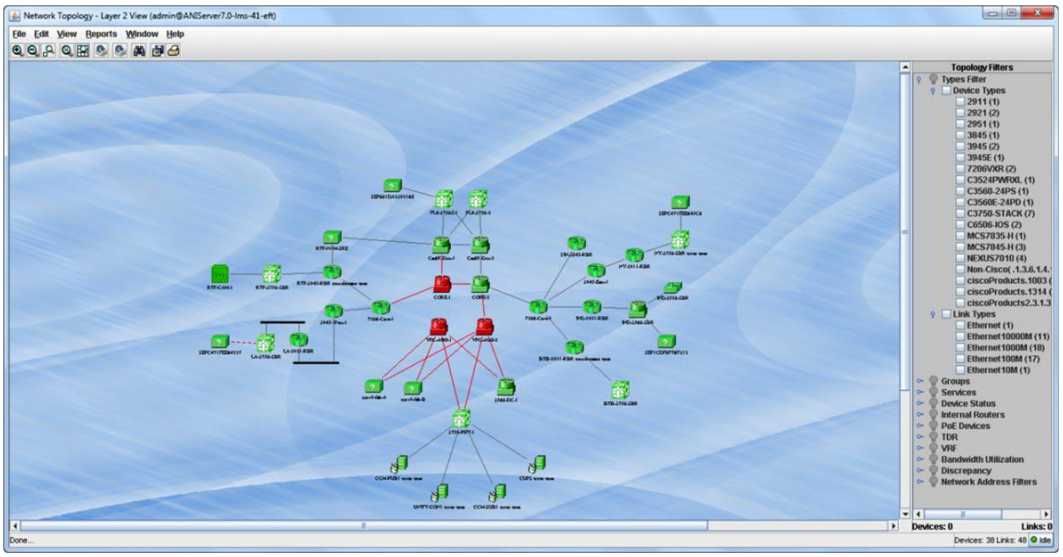


Figure 56. Network Topology



Template Center

The Template Center in LMS provides you with a list of system-defined templates. These templates contain configuration commands that can be deployed on the devices in your network. These templates are deployed using Deploy Template jobs in LMS.

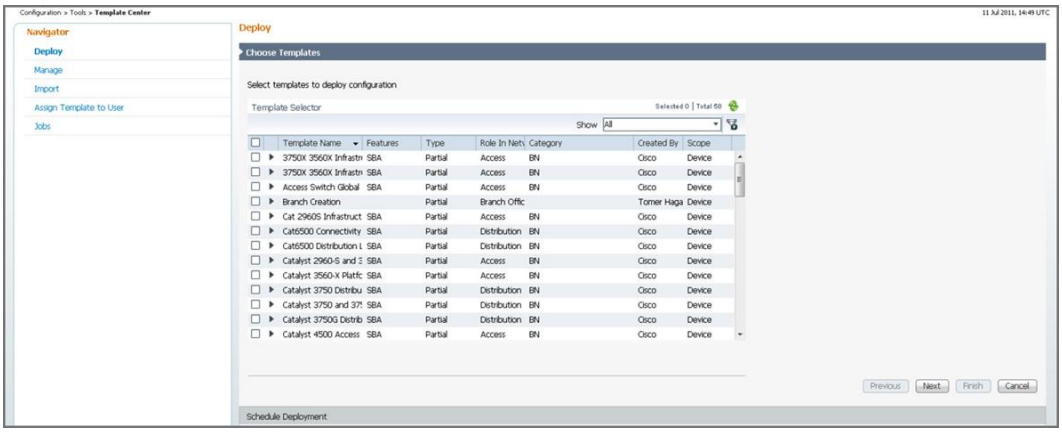
You can modify the system-defined templates and save the modified templates as user-defined templates. You can also import templates from a client machine, and these templates are stored as system-defined templates in LMS.

The following device and port-level system-defined templates are shipped in LMS:

- Layer 2 Access Edge Interface Configuration
- Access PortChannel Interface
- Identity-Change of Authorization
- CAB-3750-Access-Config
- 6500-access-edge-trusted-endpoint
- Smart Business Architecture (prescriptive guide for setting up midsize or enterprise network, http://www.cisco.com/go/sba)

To access the Template Center, go to **Configuration→Tools→Template Center** (see Figure 57).

Figure 57. The Template Center



The user workflow to deploy the templates is as follows:

- Choose the template to deploy.
- Select devices from the Device Selector and click **Next**.
- If you have selected port-related templates, the Choose Port Groups pane appears, displaying the Port Selector.
- If you have selected module-related templates, the Choose Module Groups pane appears, displaying the Device Selector.
- Select port groups from the Port Selector and click **Next**.
- The corresponding template pane appears, allowing you to enter the applicable values for the template.
- Enter the values and click **Next**.
- The Adhoc Configuration for Selected Port/Device Groups pane appears, allowing you to enter the configuration commands that will be deployed on the selected devices or ports in addition to the commands in the template. The commands that you enter here will not be validated by LMS.
- Click **Next**.
- The Schedule Deployment pane appears, displaying Scheduler and Job Options details.
- Enter a **Job Description**, select the **Schedule** and **Job** options, and click **Finish**.
- A notification message appears along with the Job ID. The newly created job appears in the Template Center Jobs.

Job Management

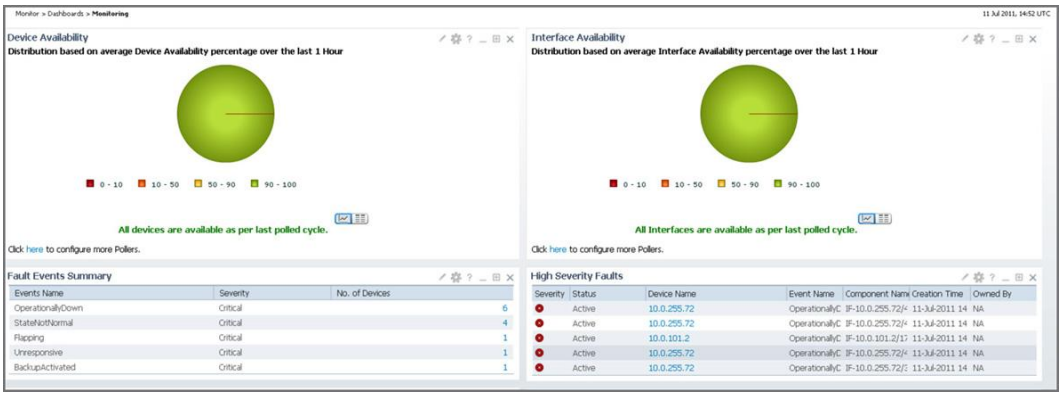
Jobs need to be created for performing archive management, editing of configurations, downloading of configurations, and Cisco IOS/Catalyst OS device image management. All these jobs can be viewed by clicking the links under **Configuration→Job Browsers→NetConfig, Configuration→Job Browsers→Software Image management**, and so on.

Monitoring

Monitoring Dashboard

Figure 58 Shows the Monitoring Dashboard.

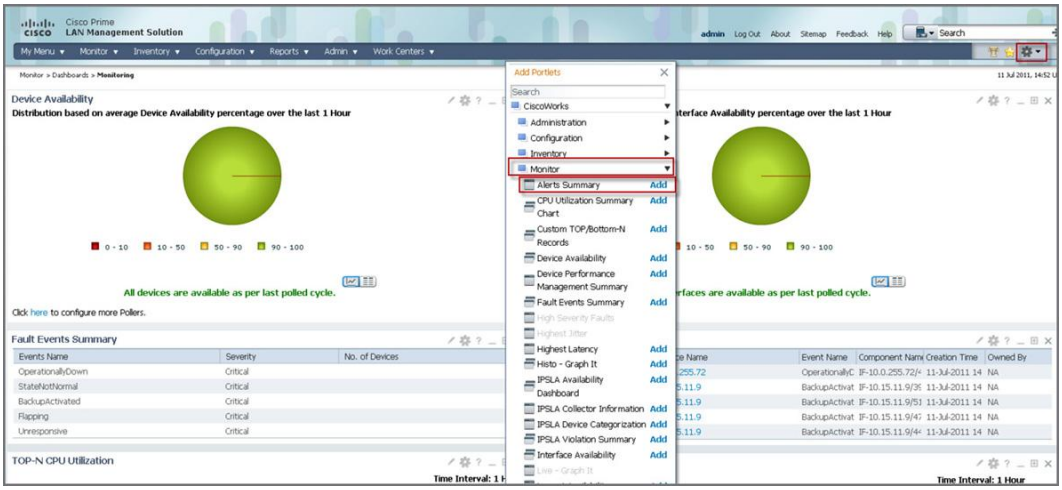
Figure 58. The Monitoring Dashboard



Customizing the Monitoring Dashboard Using Portlet

Click the **Add Portlet** icon as shown get the list of portlets.Choose a portlet, for example, Alert Summary, to add that portlet. See Figure 59.

Figure 59. Adding Portlets



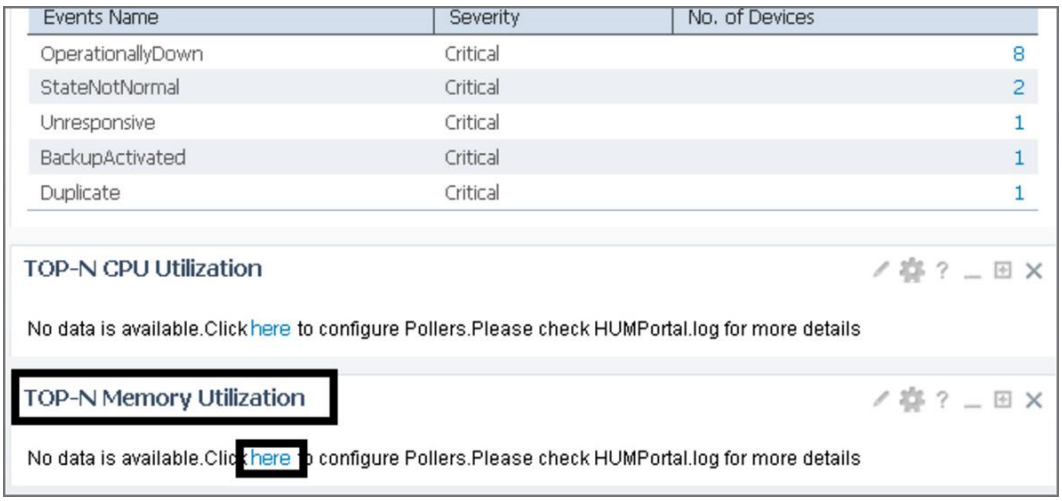
Poller Configuration on an Existing Portlet

A few of the portlets may not have any data when the user initially logs in. For example, in the monitoring dashboard, the Top-N Memory Utilization portlet does not have any data.

To configure a new poller, go to **Monitor → Dashboard → Monitor**. See Figures 60 and 61.

Figure 60. Configuring a New Poller

Figure 61. Configuring the Poller to Start Memory Utilization



Click the **here** link to configure the poller to get the memory utilization polling started. You need to create a poller for memory utilization (which is not created by default). See Figures 62 and 63.

Figure 62. Creating the Poller

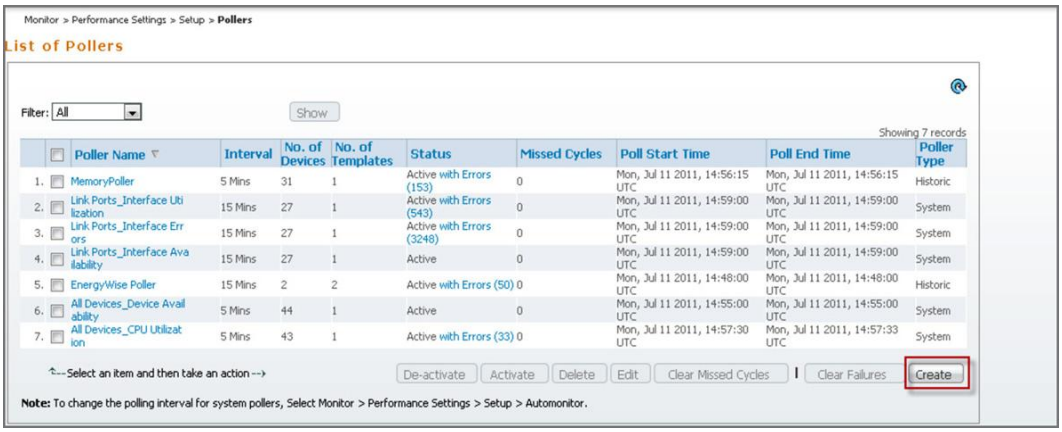
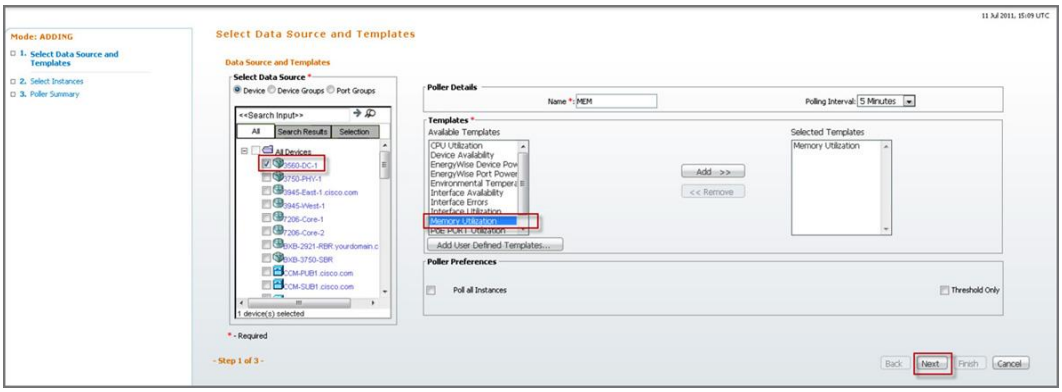


Figure 63. Adding Memory Utilizaton to the Poller



Once the poller is created the portlet will be populated with the Top-N memory utilization data.

Fault Management

Business Scenarios

On a daily basis, network administrators face many challenges to maintain a healthy running network to support business needs. They constantly ask questions like:

- How do I quickly and easily detect, isolate, and correct network faults?
- How do I monitor not only up and down status, but also potential problems?
- How do I provide valuable insight into the relative health of a device and the network?
- How do I address problems before network service degradation affects users?
- How do I minimize downtime and service degradation?

Cisco Prime LMS 4.1proactively monitors the network for indicators of device or network faults, helping enable the network administrator to know exactly where the problem is and what to fix, thus avoiding costly network service degradation. LMS has the built-in intelligence to determine what variables and events to look for to determine the health of a Cisco device, without user intervention, for true fault management.

Cisco Prime LMS uses SNMP polling and SNMP traps to discover and display real-time faults. LMS provides rules to analyze events that occur and help determine when a probable fault has occurred on Cisco devices. It allows you to configure immediate notifications on certain types of faults and stores events and alerts for 31 days in the fault history.

LMS already knows which MIB variables to poll for each different device to determine the status and health of the device. The necessary threshold values have also been predefined based on extensive testing.

Fault Monitor

LMS Fault Monitor is a centralized browser where you can view the information on faults and events of devices in a single place.

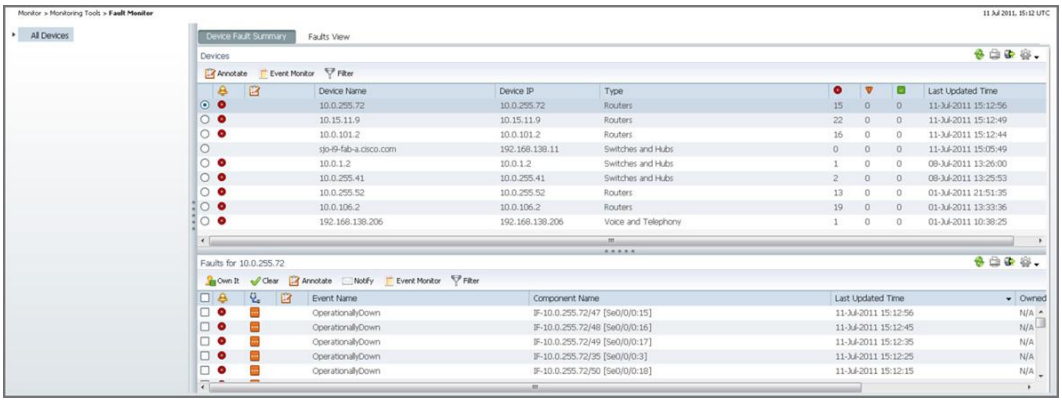
A fault refers to a problem in the device or in the network. Examples for faults include Device Down, Link Down, and High Utilization.

Fault Monitor collects information on faults and events from all devices in realtime and displays the information by a selected group of devices. It allows you to own the faults or clear them. You can also annotate the devices.

Fault Monitor has two tabs: Device Fault Summary View and Fault View. It provides a launch point for Event Monitor and event forensic data collected.

To view the faults, navigate to **Monitor→Monitoring Tools→Fault Monitor** (Figure 64).

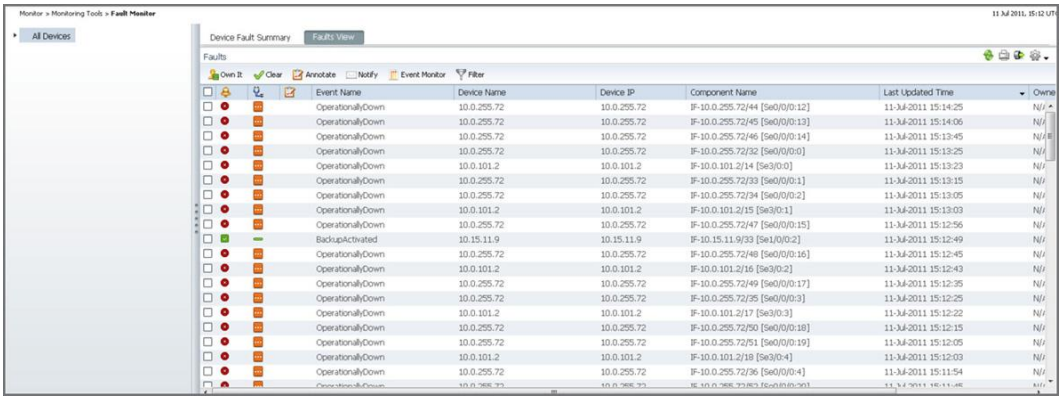
Figure 64. The Device Fault Summary



In figure 64, the top portion shows the devices. By clicking in any row, the bottom portion of the window shows the faults from the selected device.

To see all the faults, click the **Fault View** tab (Figure 65).

Figure 65. The Faults View Tab



In this window, you can clear, own, notify, or annotate an event.

- **Own it:** Changes the event status to Acknowledged
- **Clear:** Clears and deletes alarms and events
- **Annotate:** Suspends polling and trap processing on the device or device component by opening a Detailed Device View (DDV), from which you can perform the suspend command
- **Notify:** Sends email notification of the alert

By selecting a fault and choosing **Notify** you can send an email for this fault to an email recipient.

Clicking **Event Monitor**, by default, shows the **Fault History**, which is a 24-hour fault history report.

Note: Network devices have to be configured to send syslogs and traps to the LMS server to receive, process, and create faults and events.

Performance Monitoring

Business Scenarios

For network administrators, monitoring the network is an essential requirement in their network management tools. Not only do they need to be able to monitor any MIB object on the networkbut they also need to have a meaningful reporting capability that shows the top issues on the network and proactively provides alerts when things happen. They also need to keep track of the trends of network events to understand the network in a dynamic environment.

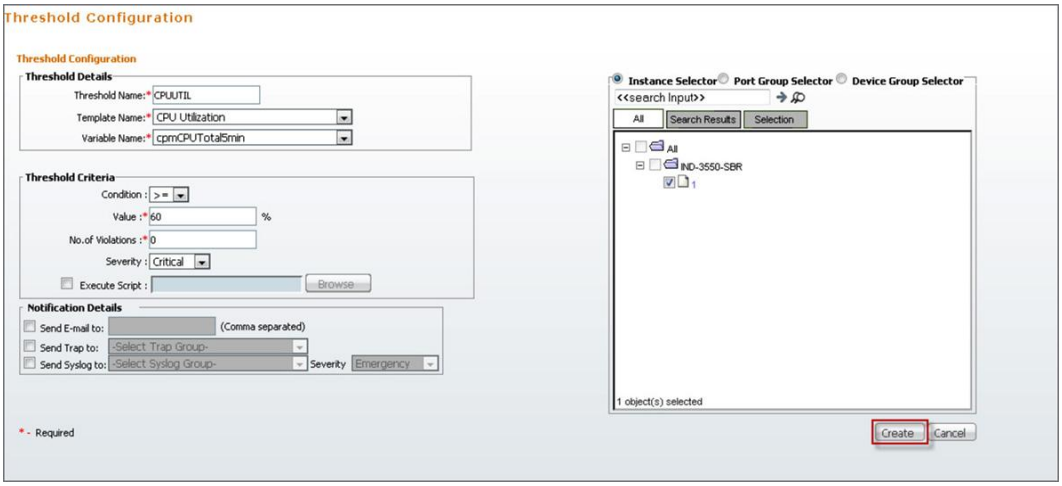
Cisco PrimeLMS provides organizations with:

- CPU, memory, Interface/portmonitoring for utilization and availability levels
- Support for system-defined MIB templates that facilitateeasy polling setup
- The capability for users to create custom MIB templates
- Historical reporting on a daily, weekly, monthly, and annual basis
- Threshold breach event notification, reporting, and event handler support
- Comprehensive reporting such as Device Dashboard, Custom Reports, Top-N/Bottom-N Reports
- Historical trending on a daily, weekly, monthly, and annual basis

Creating Thresholds and Notifications

Select **Monitor→Threshold Settings→Performance** and click **Create** (see Figure 66).

Figure 66. Creating and Configuring Thresholds



Workflow for Creating a Threshold

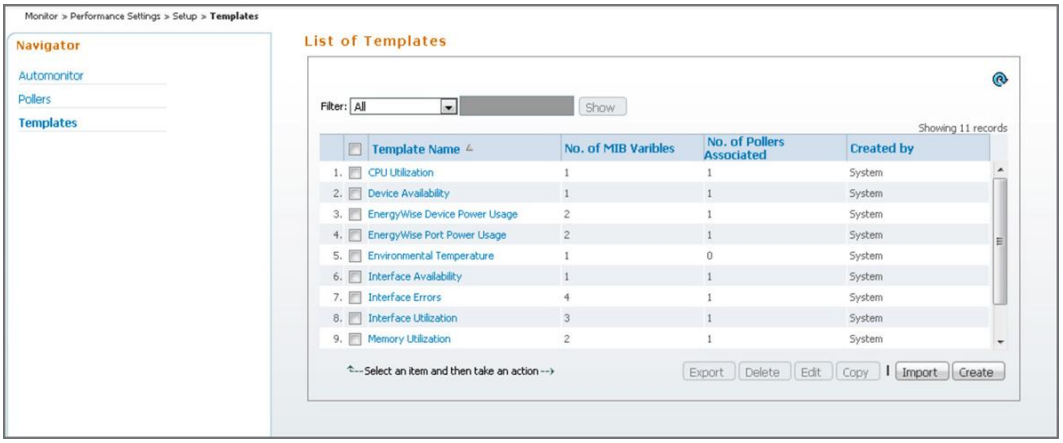
- Choose the variable from the template that you need to set the threshold on.
- Define the condition: threshold value, severity.
- Define the action - email, trap, or syslog generation - if the threshold condition occurs.
- Choose the device where you want to monitor this threshold.

Understanding the Templates

System-Defined Templates

System-defined templates are logical groups of MIB objects users want to poll. You can view the available LMSsystem-defined templates by selecting **Monitor→Performance Settings→Setup→Templates** (see Figure 67).

Figure 67. LMS System-Defined Templates



System-defined templates support all Cisco devices that support the following MIB files:

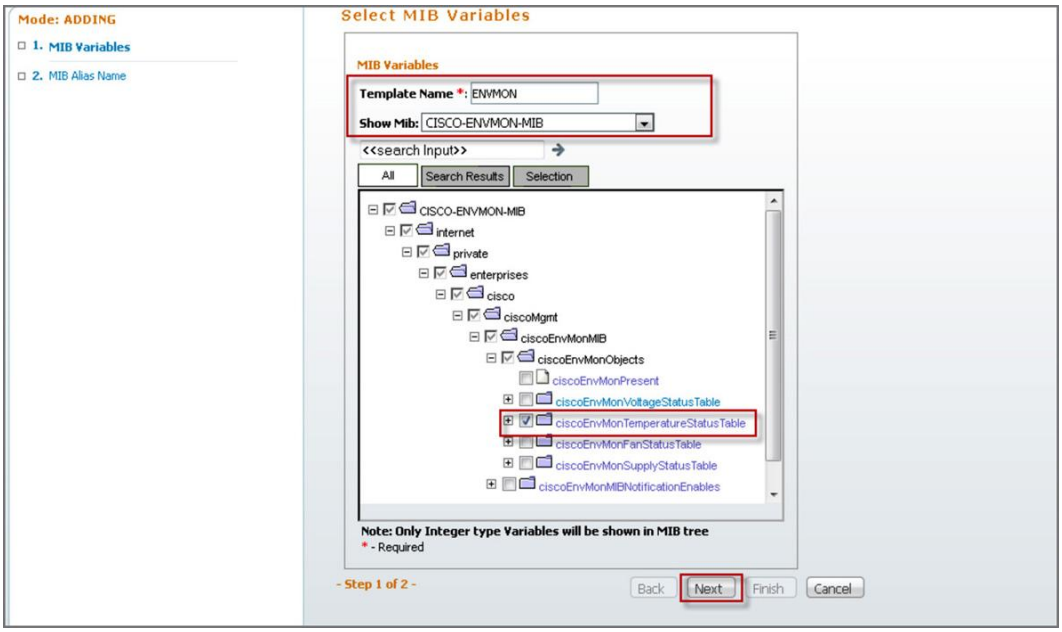
- CISCO-ENHANCED-MEMPOOL-MIB
- CISCO-ENVMON-MIB
- CISCO-MEMORY-POOL-MIB
- CISCO-PROCESS-MIB
- ENTITY-MIB
- OLD-CISCO-CHASSIS-MIB
- RFC1213-MIB
- IF-MIB
- CISCO-POWER-EHTHERNET-EXT-MIB
- POWER-EHTHERNET-MIB
- CISCO-RTTMON-MIB

User-Defined Templates

Users can also create their own templates to poll MIB objects they are interested in. To create a template, go to **Monitor→Performance Settings→Setup→Templates** and click **Create**.

In this example, we will create a template to poll the temperature MIB objects using the CISCO-ENVMON-MIB (Figure 68).

Figure 68. Creating a Template to Poll the Temperature MIB Objects

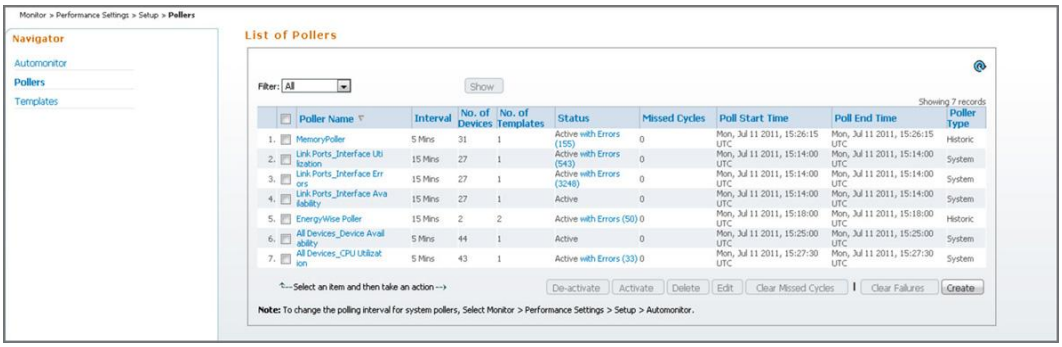


Pollers - How to Create

After you get the templates to poll the MIB objects in which you are interested, create a poller to poll the MIB objects on a specified schedule.LMS provides some system-defined pollers as shown in Figure 69.

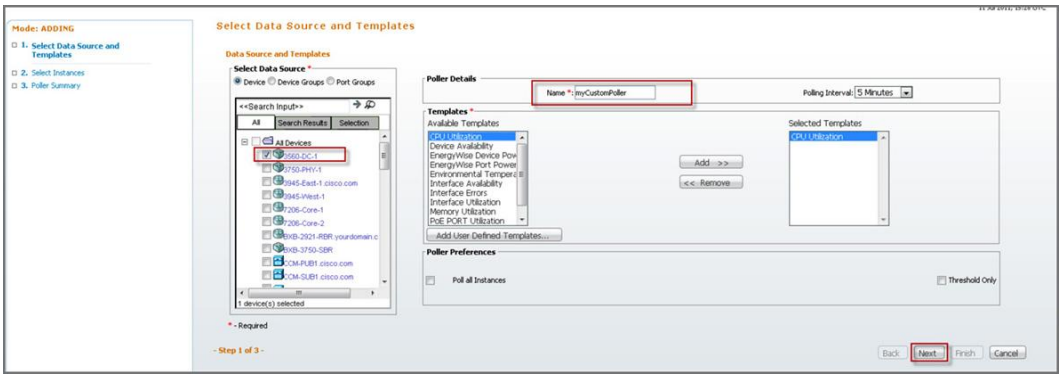
Select **Monitor→Performance Settings→Setup→Pollers** and Click **Create**.

Figure 69. Creating a Poller to Poll the MIB Objects on a Specified Schedule



Here, we will create a poller called myCustomPoller, which polls the selected two devices using the system-defined CPU Utilization template. The setup options include poller name, devices, template, and polling interval (Figure 70).

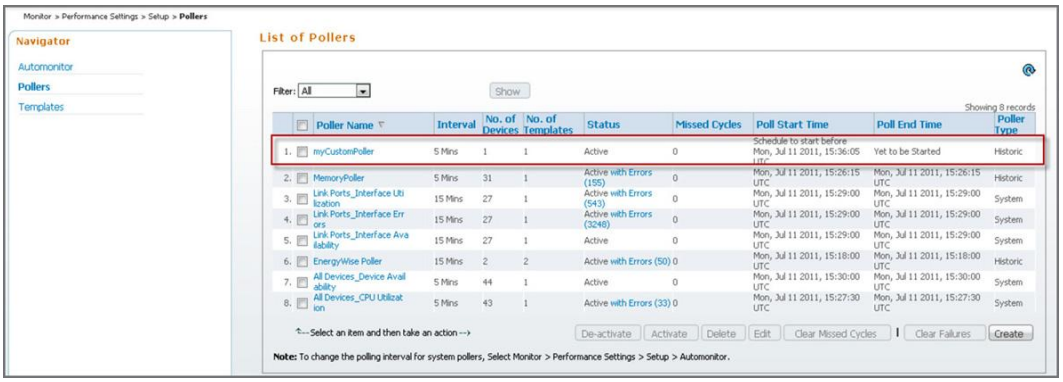
Figure 70. Creating a Custom Poller



Choose the instances from the next screen and click **Next**.

The poller, myCustomPoller, appears in the list of pollers (Figure 71).

Figure 71. myCustomPoller Is Added to the List of Pollers



IPSLA Monitoring

Business Scenarios

Managing mission-critical networks has become an integral component of today's businesses. Customers no longer see the IP network as an unreliable infrastructure on which to build their business. Internet service providers (ISPs) and even internal IT departments now have to offer a defined level of service - a service-level agreement (SLA) - to provide their customers with a degree of predictability. How to measure network response time, determine device availability, resolve connectivity issues, analyze response time patterns, and provide critical reports, both real time and historical, have taken on an even higher priority.

Cisco Prime LMS 4.1 allows generation of IP SLA reports using Cisco IOS IP SLA technology to monitor the end-to-end performance of multiprotocol networks. Using IP SLA, Cisco Prime LMSmeasures and displays five key network performance statistics between a source and a target device. These five statistics include latency, availability, jitter, packet loss, and errors.

SLA was formerly known as RTR or SAA. For more information on Cisco IOS IP SLA, visit http://www.cisco.com/go/ipsla.

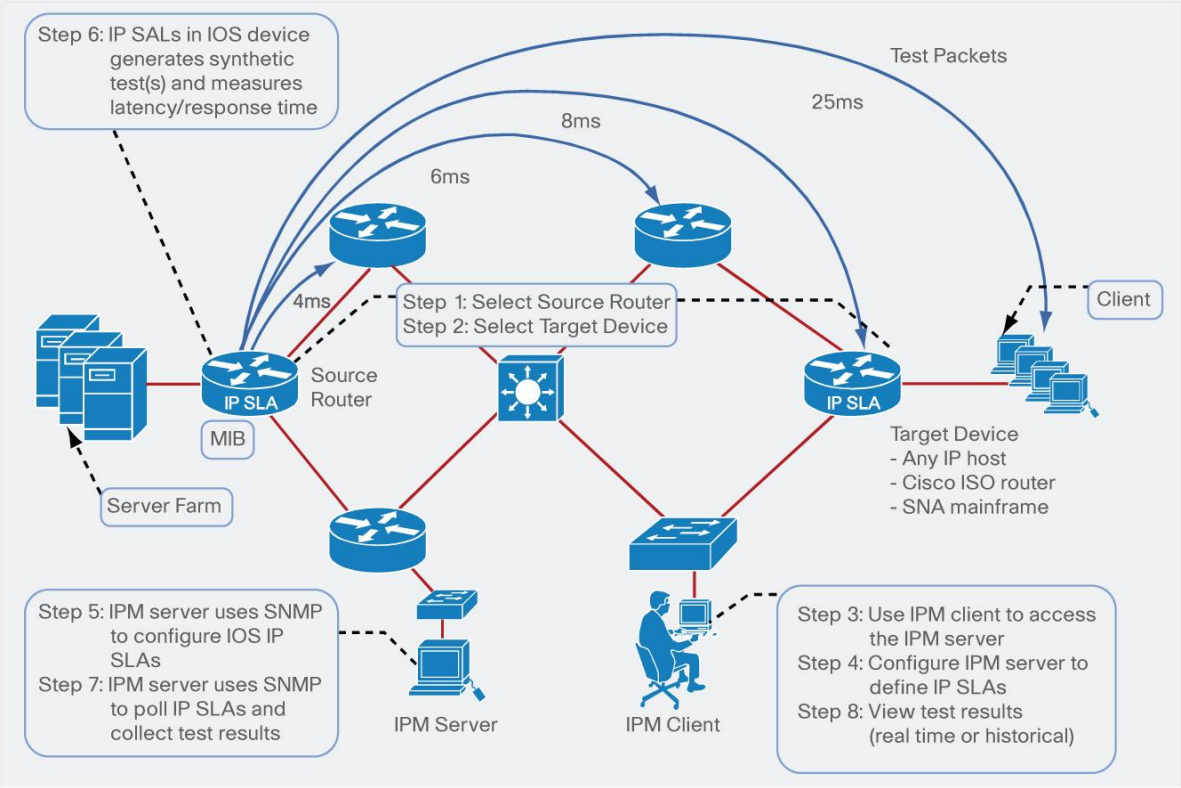
Workflow for the IPSLA Monitoring

To use LMS for performance management, users need to define collectors to gather the performance data. A collector is made of four components.

- **Source router:** Originating point from which LMS makes latency and availability measurements. This is where the LMS server uses SNMP to configure Cisco IOS IP SLAs. A source router must run Cisco IOS Software with the IP SLA feature.
- **Target router:** Destination of the source router operations (IP SLA measurements) from which response data should be collected. A target can be an IP host, another Cisco IOS device with IP SLA, or a Systems Network Architecture (SNA) host.
- **Test operation:** The traffic test operations simulate actual network traffic for a specific protocol. For example, to measure the latency for a voice-over-IP (VoIP) session, an Enhanced UDP test operation is created and defined to send a series of 60-byte UDP packets with a specified type of service (ToS) value and target port number.
- **Collection schedule:** A collector can be scheduled to run at any point in time, or continuously over any time interval. This flexible scheduler makes IP SLAs suitable for both service-level monitoring and troubleshooting.

The workflow for IPSLA management is illustrated below:

Figure 72. IPSLA workflow



As in this workflow diagram, we define the collector from step 1 to step 5. In the first and second steps, the source router and target device are defined. For Cisco IOS devices, we need to turn on IP SLAs in the Cisco IOS Software.

In step 6, IP SLAs in the source router generate the synthetic tests and measure latency/response time. The IPM server will then poll the collectors to collect test results and generate the results in real-time or historical reports.

The following sections will discuss each step in detail.

Source Router and Target Device

The first thing for the user to do is to select the source router and target device. For example, to measure the response time between clients and an application server, the source router will be a Cisco IOS router running software version 11.2 or later on the same segment where the application server will be placed. The target device is placed on the same segment where many clients would access the application server.

Define an Operation

LMS has a number of built-in test operations. Following is a list of the built-in test operations:

- Echo
- Path Echo
- UDP Echo
- ICMP Jitter
- UDP Jitter
- VoIP Post Dial Delay
- VoIP Gatekeeper Registration Delay
- RTP
- DNS
- DHCP
- HTTP
- FTP
- DLSw
- TCP Connect

Finally we tie together the four components of the collector, that is, source and target devices, test operation, and schedule by creating a collector at **Monitor→Performance Settings→IPSLA→Collectors**. Click **Create**. See Figures 73 and 74.

Figure 73. Collector Management window

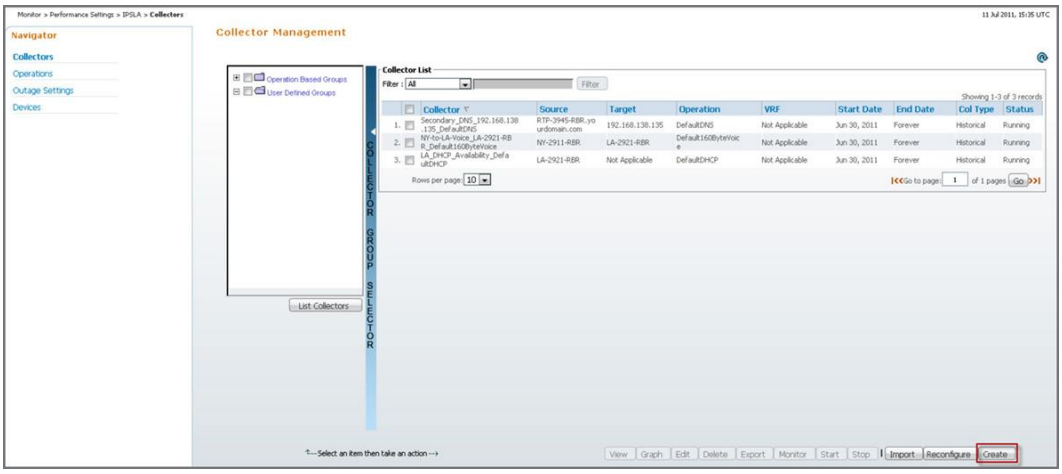
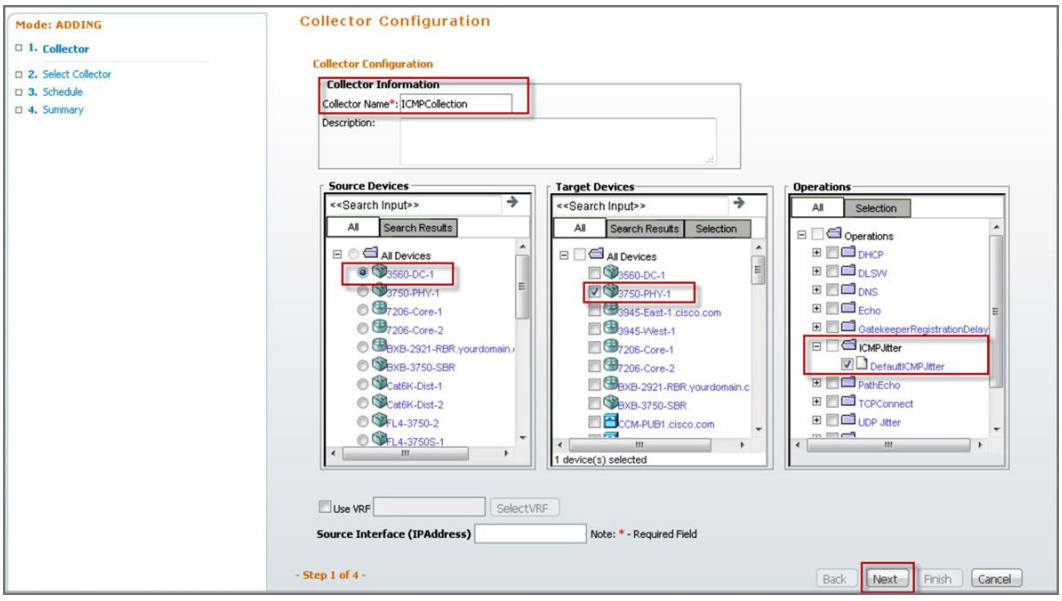


Figure 74. Adding a Collector in the Collector Configuration Window



After the collector is created, you can schedule the collector to run so that it collects the Internet Control Message Protocol (ICMP) jitter matrix.

Reports

Reports Management in Cisco Prime LAN Management Solution 4.1 provides a single launch point for all the reports that can be generated and viewed in Cisco Prime LMS 4.1.

All the reports have been grouped under various headings based on the information displayed.

- **Inventory**

  This section of reports contains reports pertaining to devices, hardware, End-of-Sale (EoS) and End-of-Life (EoL).

- **Switch Port**

  This category of reports contains reports such as switch capacity reports, switch port summary reports, and utilization history (over specified time).

- **Technology**

  These are reports specific to the Cisco IOS technologies such as EnergyWise, Identity, Powerover Ethernet (PoE), VRF Lite.

- **Fault and Event**

  These contain threshold violation, device fault, syslog, and PSIRT reports.

- **Performance**

  These contain CPU utilization, memory utilization, interface utilization, interface error, and IPSLA reports.

- **Cisco.com**

- **System**

  These contain:

  - Reports such as the number of users logged in, collection details, and so on
  - Configuration file change reports
  - Twenty-four-hour change report: All configuration changes in the last 24hours

- **Audit**

  Change audit reports show software image distribution and download history for software changes made.

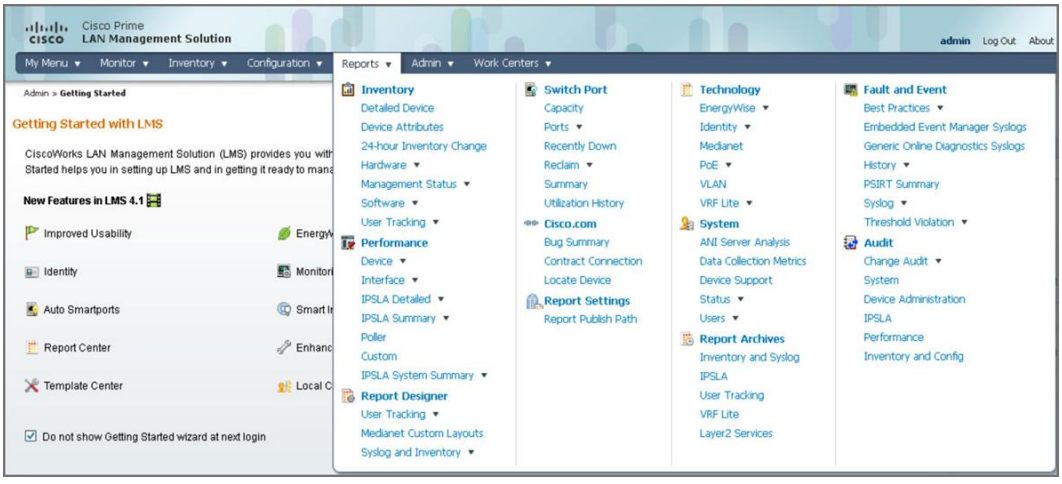
- **Report Designer**

  As the name indicates, this is a tool to generate custom reports, especially for syslogs and inventory.

- **View Report Archives**

  The report output that is created from a scheduled report is stored in the reports archive. The archive displays the list for completed report jobs, and you can view or delete them (Figure 75).

Figure 75. A List of Completed Report Jobs Is Available in the Reports Archive



Report Generation and Viewing Paradigm

Use case: We want to generate a detailed hardware report for a few devices. See Figures 76 and 77.

Figure 76. Select the Detailed Hardware Report

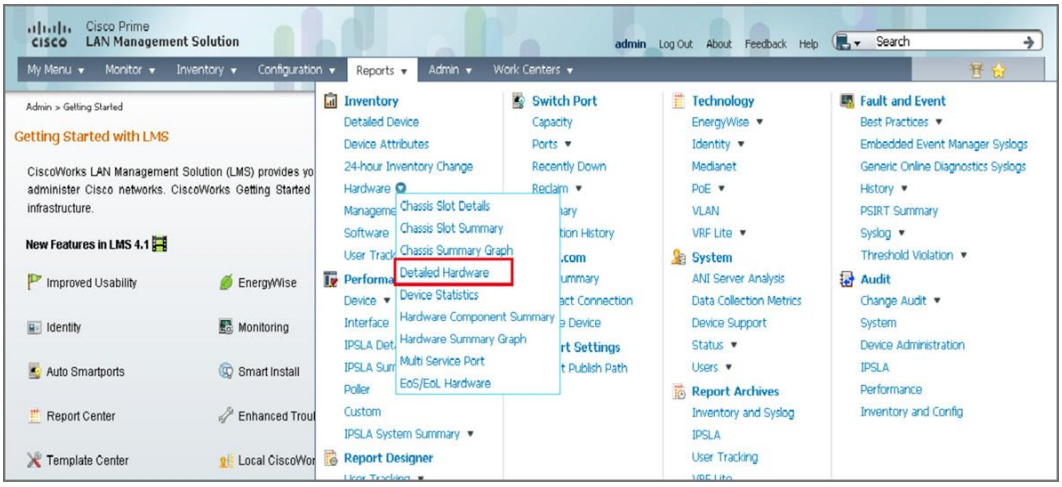
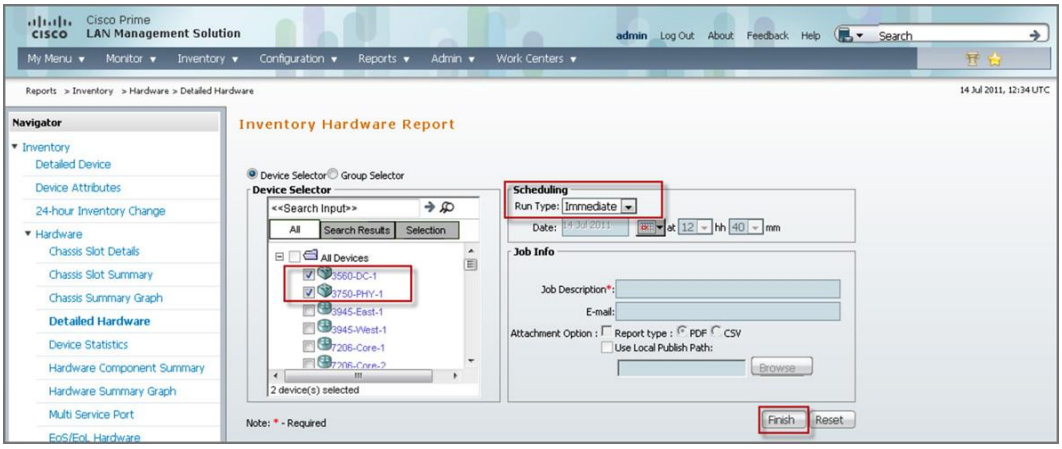


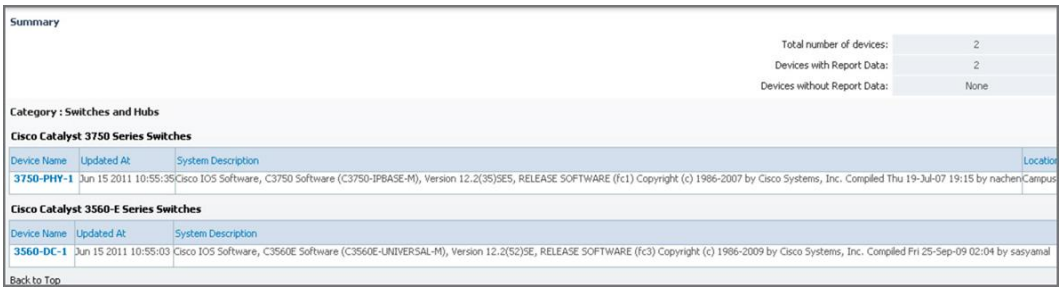
Figure 77. Select the Devices You Want to Include in the Report



- Select the devices that you want in the detailed hardware report.
- Choose the scheduling option.You can generate the report immediately or schedule it to be generated at the specified time.
  - If you choose to schedule it, specify the **Job Info** and click **Finish**. The finished report will appear under **Reports→Report Archives→Inventory and Syslog**.

If you choose Immediate as the scheduling option, the report (Figure 78) will be generated immediately.

Figure 78. The Detailed Hardware Report Specified in Figures 76 and 77



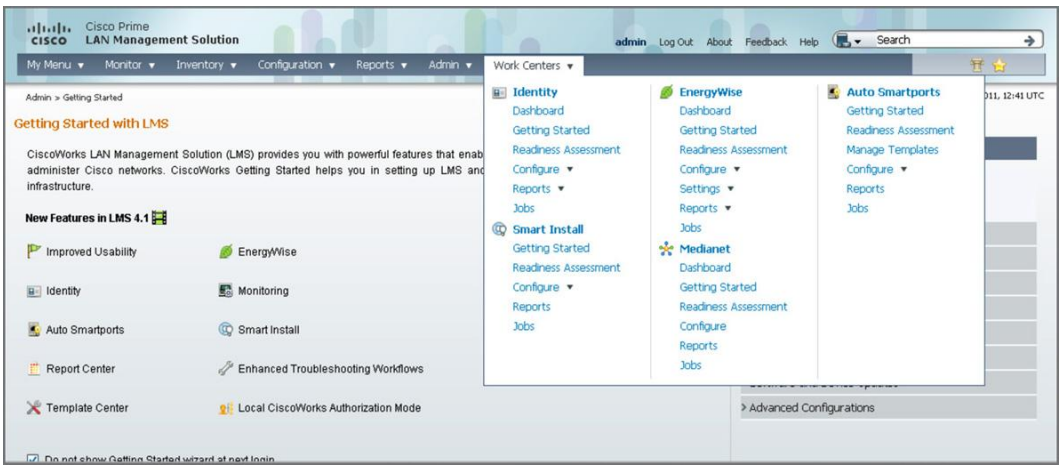
Work Centers

Cisco Prime LMS 4.1 provides complete lifecycle management of:

- Identity
- EnergyWise
- Medianet
- Auto Smartports
- Smart Install

LMS 4.1 provides a workflow-oriented approach for Day-1 to Day-**n** operations of Identity, EnergyWise, Medianet, Auto Smartports, and Smart Install (Figure 79). This workflow includes readiness assessment, configuration, monitoring, reporting, and troubleshooting.

Figure 79. Work Centers in Cisco Prime LMS 4.1



A detailed description of each of these workcenters will be discussed in a separate whitepaper.

Server Administration

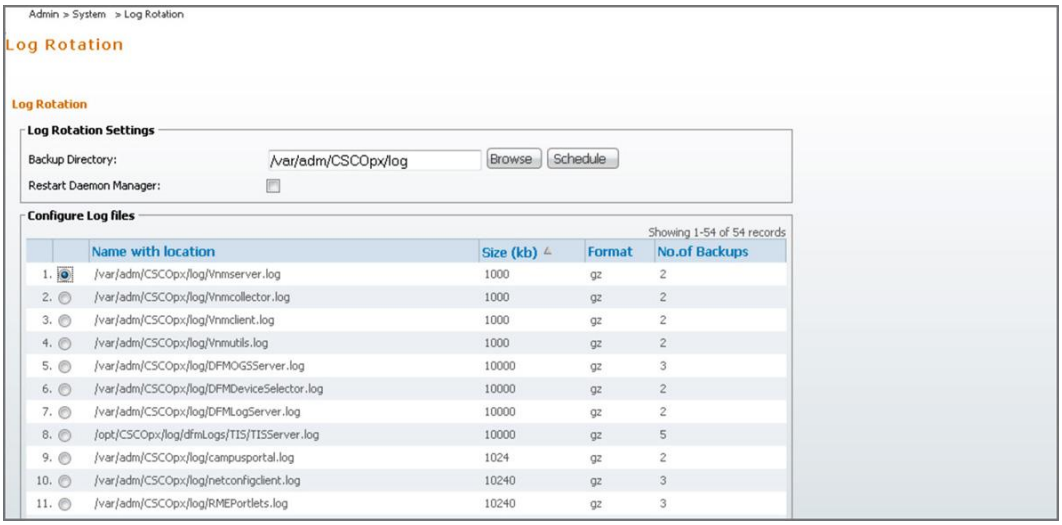
This chapter deals with server administration to utilize optimally the resources of the server while also maintaining a current status of the network topology.

Log Rotation

One common problem in LMS server maintenance is to control the size of log files. Log rotation helps you manage the log files more efficiently. In previous versions, a command-line utility, logrot, is configured and run to rotate the log files. From LMS 3.1, logrot can be configured and scheduled to run on the GUI.

To configure log rotation, go to **Admin→Log Rotation**. See Figure 80.

Figure 80. Configuring Log Rotation



The backup directory stores the rotated log files. The default directory is:

- NMSROOT\log on Windows
- /var/adm/CSCOpx/log on Solaris and Soft Appliance

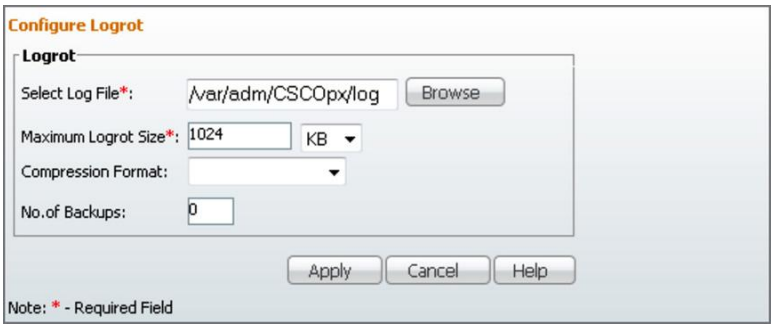
If you do not specify a backup directory, each log file will be rotated in its current directory.

You can also specify **Restart Daemon Manager** to stop and start the daemon before the log rotation starts. This is optional. To stop and start daemons in:

- Windows
  - net stop crmdmgtd
  - net start crmdmgtd
- Solaris or soft appliance
  - /etc/init.d/dmgtd stop
  - /etc/init.d/dmgtd start

To add the log files for rotation, click the **Add** button to add log files one by one.

Figure 81. Using Logrot to Specify Files for Log Rotation



As shown in the Figure 81, you specify the log file name, maximum logrot size (the default is 1024KB, the maximum size is 4096MB), the compression format, and the number of backups. If you do not want to keep any archive, enter 0 for the number of backups.

Database Backup

You can backup the LMS database either through GUI or CLI. Before LMS 3.2, it is not possible to do selective backup/restore. The backup process backed up all configuration files from the application databases. In this release, you can back up the required system configurations and data from the command-line interface.

The following data is backed up when you run a backup from the user interface or from CLI:

- Cisco Primeuser information
- Single sign-on configuration
- DCR configuration
- Peer certificates and self-signed certificates
- Peer server account information
- Login module settings
- Software Center map files
- License data
- Core client registry
- System identity account configuration
- Cisco.com user configuration
- Proxy user configuration
- Database jobs and resources data, DCR data, groups data, and other data stored in the database
- Discovery settings and scheduled jobs
- ACS credentials
- Local user policy setup
- System preferences

When you run a selective data backup from CLI, all the data mentioned above gets backed up except:

- Software Center map files
- Software Center jobs data

- DCR jobs data

Backing Up Using CLI

To back up data using CLI on Windows, Solaris, and Linux:

- On Windows, run:

  ```
  NMSROOT\bin\perl NMSROOT\bin\backup.pl<BackupDirectory><[LogFile]>
  [Num_Generations]
  ```

- On Solaris and Linux, run:

  ```
  /opt/CSCOpx/bin/perl /opt/CSCOpx/bin/backup.pl<BackupDirectory><[LogFile]>
  [Num_Generations]
  ```

  where:

  `BackupDirectory` is the directory that you want to be your backup directory. This is mandatory.

  `LogFile` is the name of the log file that contains the details of the backup.

  `Num_Generations` is the maximum number of backup generations to be kept in the backup directory.

To back up only selective data using CLI on Windows and Solaris:

- On Windows, run:

  ```
  NMSROOT\bin\perl NMSROOT\bin\backup.pl-dest=BackupDirectory {-system | -
  history}[-log=LogFile] [-email=E-mail][-gen=Num_Generations]
  ```

- On Solaris and Linux, run:

  ```
  /opt/CSCOpx/bin/perl /opt/CSCOpx/bin/backup.pl-dest=BackupDirectory {-system|-
  history} [-log=LogFile] [-email=E-mail] [-gen=Num_Generations]
  ```

  where:

  `-dest=BackupDirectory` is the directory where the backed up data to be stored. This is mandatory.

  `-system` is the command-line option that allows you to back up only the selected system configurations from all applications instead of backing up the complete databases. This is mandatory.

  `-log=LogFile` is the name of the log file that contains the details of the backup.

  `-gen=Num_Generations` is the maximum number of backup generations to be retained in the backup directory.

Restoring Data on Solaris and Linux

To restore the data:

1. Log in as the superuser, and enter the root password.
2. Stop all processes by entering:

   ```
   /etc/init.d/dmgtd stop
   ```

3. Restore the database by entering:

   ```
   /opt/CSCOpx/bin/perl /opt/CSCOpx/bin/restorebackup.pl [-ttemporary directory] [-
   gengenerationNumber] [-dbackup directory] [-h].
   ```

   Where:

- `[-ttemporary directory]`: The restore framework uses a temporary directory to extract the content of the backup archive.
- By default the temporary directory is created under **NMSROOT** as **NMSROOT/tempBackupData**. You can customize this, by using this - **t** option, where you can specify your own temp directory. This is to avoid overloading **NMSROOT.**
- `[-gengenerationNumber]`: Optional. By default, it is the latest generation. If generations 1 through 5 exist, then 5 will be the latest.
- `[-dbackup directory]`: Required. Which backup directory to use.
- `[-h]`: Provides help. When used with `-d`<backup directory> syntax, shows correct syntax along with available suites and generations.

  To restore the most recent version, enter:

  `/opt/CSCOpx/bin/perl /opt/CSCOpx/bin/restorebackup.pl-dbackup directory`

  For example, `-d /var/backup`

1. Examine the log file in the following location to verify that the database was restored by entering:

   `/var/adm/CSCOpx/log/restorebackup.log`

2. Restart the system:

   `/etc/init.d/dmgtd start`

Restoring Data on Windows

To restore the data on Windows, make sure you have the correct permissions, and do the following:

1. Stop all processes by entering the following at the command line:

   `net stop crmdmgtd`

2. Restore the database by entering:

   NMSROOT`\bin\perl`**NMSROOT**`\bin\restorebackup.pl [-t`**temporary directory**`] [-gen` **generationNumber**`] [-d`**backup directory**`] [-h]`

   where **NMSROOT** is the Cisco Prime LMSinstallation directory. See the previous section for command option descriptions.

   To restore the most recent version, enter the following command:

   NMSROOT\bin\perlNMSROOT\bin\restorebackup.pl-dbackup directory

3. Examine the log file in the following location to verify that the database was restored by entering:

   NMSROOT**\log\restorebackup.log**

4. Restart the system by entering:

   `net start crmdmgtd`

While restoring using a backup taken from a machine that is in ACS mode, the machine on which data is restored needs to be added as a client in ACS. Contact the ACS administrator to add the restored machine as an ACS client. See also, Setting the Login Module to ACS, at the online help.

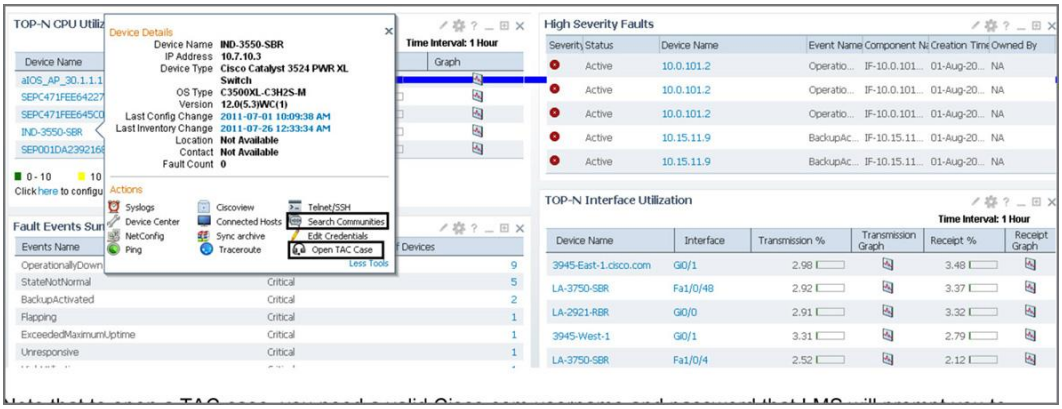
Cisco Smart Interactions

Cisco Prime LMS provides a new functionality called Cisco smart interactions to deliver personalized, automated self-help tools that speed the resolution of network problems, outages and trouble tickets. Cisco smart interactions are a key element of the Cisco smart services strategy to deliver actionable insight into the network through personalized, proactive capabilities. Cisco smart services bring Cisco industry knowledge, expertise, and tools to IT teams to help them predictably manage the health and stability of their networks.

Today, Cisco smart interactions for Cisco Prime for Enterprise products support two innovative features:

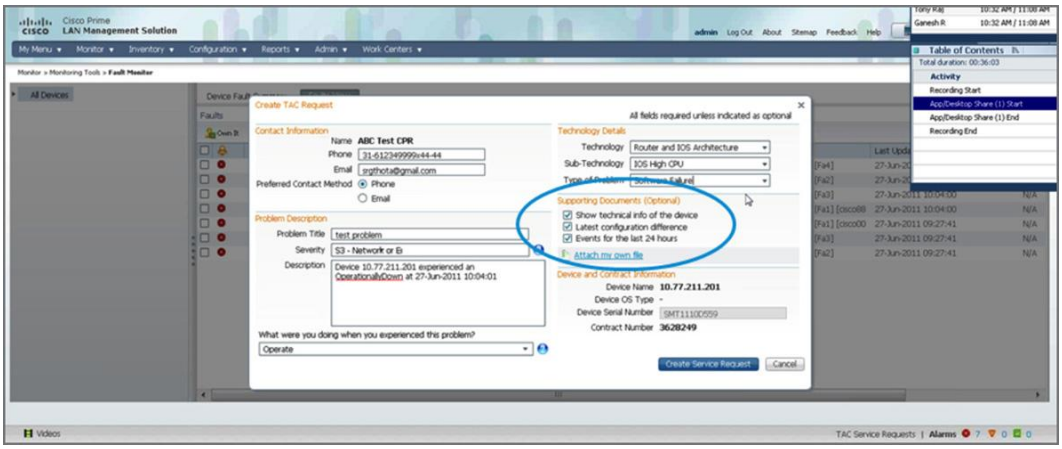
- **Automated context-based help:** This tool supports real-time access to the Cisco support community. It helps IT organizations reduce and in many cases eliminate the need to create TAC cases. It facilitates a context-relevant search across Cisco support communities, online documentation, and expert comments to automatically find the information most relevant to the problem.
- **Automated Cisco Technical Assistance Center (TAC) case creation and management:** This tool can automatically open, update and track a Cisco TAC case. This tool saves a significant amount of time for IT operators because all of the steps that they have taken to try to resolve the problem, including alarms, automated troubleshooting logs, and other contextual reference information from the management platform, can be included with the initial TAC case request. Cisco Smart Interaction can be accessed by hovering your mouse over any device name and using the device details pane (Figure 79).

Figure 82. Hover the Mouse over a Device Name for Details about the Device



Note that to open a TAC case, you need a valid Cisco.com username and password that LMS will prompt you to enter as you open the case. Also, make sure that your LMS server has Internet access to communicate with Cisco.com for authentication as well as for TAC database. See Figure 83.

Figure 83. Opening a TAC Case



Appendix A: List of Acronyms and Features

Acronym/Feature	Meaning
AAA	Authentication, authorization, and accounting.
ACS	Access Control Server, an AAA server software from Cisco.
Certificate Setup	This feature allows the creation of self-signed security certificates, which can be used to enable SSL connections between the client browser and management server.
CWHP	CiscoWorks homepage. A web page that a CiscoWorks user accesses after logging into a CiscoWorks server.
DCR	Device and Credentials Repository is a common repository of devices, their attributes, and the credentials required to manage devices in a management domain. DCR will enable the sharing of device information among various network management applications.
ELMI	Enhanced Local Management Interface. It is a protocol used in Metro Ethernet.
FR	Frame Relay.
ILMI	Integrated Local Management Interface. It is an ATM standard.
IOS	Internetwork Operating System. It is an operating system that runs Cisco routers and switches.
LMS	LAN Management Solution.
MISTP	Multiple Instances Spanning Tree Protocol. It is a Cisco proprietary standard.
MST	Multiple Spanning Tree Protocol. It is an IEEE standard derived from MISTP.
NDG	Network Device Group. A term used in ACS to group devices.
NMIM	Network Management Integration Module.
NMS	Network Management System.
NMSROOT	Installation of folder of LMS. On Windows the default is c:\program files\CSCOpx; on Solaris it is /opt/CSCOpx.
Peer Server Account Setup	This feature helps you create users who can programmatically login to CiscoWorks servers and perform certain tasks. These users should be set up to enable communication between multiple CiscoWorks servers.
Peer Server Certificate Setup	This feature allows you to add the certificate of another CiscoWorks server into a trusted store. This will allow one CiscoWorks server to talk to another, using SSL.
PVST	PerVLAN Spanning Tree Protocol.
RCP	Remote Copy Protocol.
IP SLA	Cisco IOS IP Service Level Agreement (SLA), a network performance measurement feature in Cisco IOS Software, provides a scalable, cost-effective solution for service-level monitoring. It eliminates the deployment of dedicated monitoring devices by including the “operation” capabilities in the routers.
SCP	Secure Copy Protocol.
Single Sign-On	A feature by which a single browser session is used to navigate transparently to multiple CiscoWorks servers without having to authenticate to each server.

Acronym/Feature	Meaning
SNMP	Simple Network Management Protocol.
SSH	Secure Shell Protocol.
SSL	Secure Sockets Layer. It is an encryption protocol.
SSO	Single sign-on: The ability to login to multiple computers or servers with a single action and the entry of a single password. Especially useful where, for example, a user on a LAN or WAN requires access to a number of different servers.
STP	Spanning Tree Protocol. A protocol to avoid loops in a switched network.
System Identity Setup	Communication between multiple Cisco Prime LMS servers is enabled by a trust model addressed by certificates and shared secrets. System Identity Setup should be used to create a “trust” user on slave/regular servers for communication to happen in multiserver scenarios.
TACACS+	Terminal Access Controller Access Control System Plus. It is an authentication protocol.
TLS	Transport Layer Security.
VLAN	Virtual local area network.
VTP	VLAN Trunk Protocol. A protocol used in a trunk link of two switches to maintain VLAN information in a switched network.

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