Cisco LAN Management Solution 2.6 Deployment Guide

Table of Contents

1. Cisco LAN Management Solution 2.6 Deployment Guide

Introduction

Network management is critical in today's networks, helping enterprises deploy and manage solutions. With increasing reliance on networks to increase productivity, enterprises are confronted with an ever growing network size. Such increase in the number of network elements creates a challenge for network administrators. How does an enterprise effectively deploy and maintain their network devices?

CiscoWorks LAN Management Solution (LMS) provides the integrated management tools needed to simplify the configuration, administration, monitoring, and troubleshooting of Cisco networks. It provides IT organizations an integrated system for sharing device information across management applications, automation of device management tasks, visibility into the health and capability of the network, and identification and localization of network trouble. By using common centralized systems and network-inventory knowledge, CiscoWorks LMS delivers a unique platform of cross-functional management capabilities that reduces network administration overhead and provides upper-layer systems integration.

This deployment guide considers scenarios where all applications reside on a single server and provides tips and suggestions on configuring the server. Some concepts related to multi-server deployment that have been introduced in LMS 2.6 will also be discussed. References will be provided for detailed discussions in the respective white papers.

Applications Included in LMS 2.6

LAN Management Solution (LMS) 2.6 includes the following components:

- CiscoWorks Common Services 3.0.5

  Common Services 3.0.5 provides a set of shared application services that are used by all LMS applications. Common Services 3.0.5 includes both CiscoView 6.1 and Integration Utility 1.6.

  - CiscoView 6.1.5 provides "front panel" graphical displays of Cisco devices, allowing users to easily interact with device components to change configuration parameters and monitor statistics.
  - Integration Utility 1.6 is an integration module that supports third-party network management systems.
- Resource Manager Essentials (RME) 4.0.5

  To support life cycle management, RME provides the ability to manage device inventory and audit changes, configuration files, and software images—as well as Syslog analysis.
- Campus Manager (CM) 4.0.6

  Campus Manager provides the ability to visualize network topology, manage VLANs, detect network discrepancies, and provide Layer 2 and Layer 3 data and voice traces and end-host user information.

- Device Fault Manager (DFM) 2.0.6

  Device Fault Manager provides the ability to monitor device faults in real-time and determine the root cause by correlating device-level fault conditions. DFM can issue notifications of critical network conditions via email or pager. Fault History lets the operator store and access historical information about alerts and faults that are detected and processed by DFM.

- Internetwork Performance Monitor (IPM) 2.6

  Internetwork Performance Monitor measures network performance based on the synthetic traffic generation technology within the Cisco IOS® software, which is known as Cisco IOS IP SLA. Using synthetic traffic gives the network manager a high degree of flexibility in selecting the end points in a network between which network performance will be measured. This flexibility makes IPM a highly effective performance-troubleshooting tool.

  IPM takes advantage of Cisco IOS IP SLA3 technology by configuring network performance agents, called collectors, in the router. These collectors, as part of their configuration, include a source router, a target device and an operation type.

Versions Available for LMS 2.6

You can select one of the following two versions of LMS 2.6:

- Restricted Version

  The Restricted version of LMS 2.6 is for customers transitioning from LMS 1.x Unlimited version or from LMS 2.x to LMS 2.6. The device limit for this version is 300 devices.

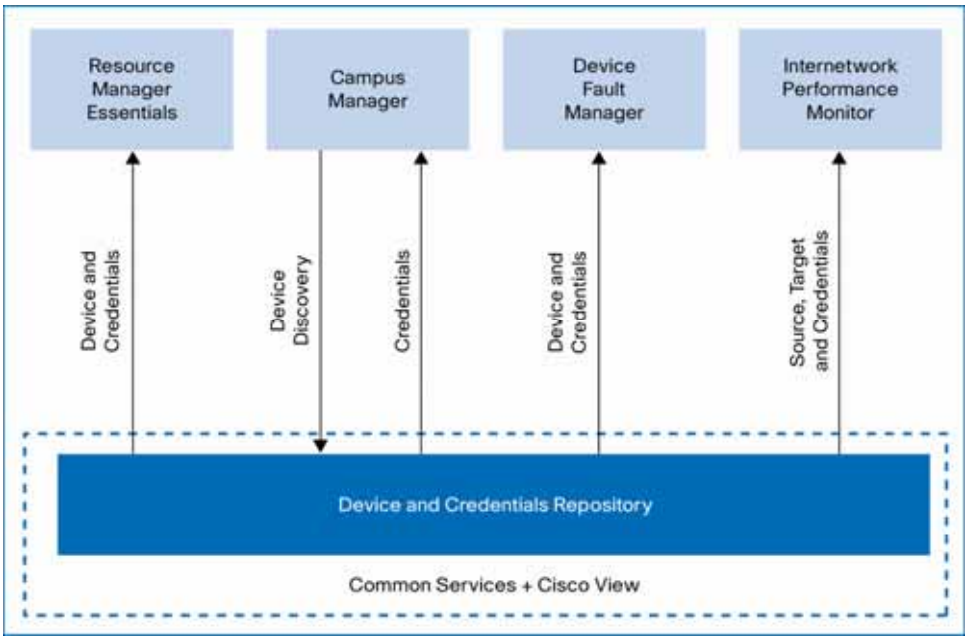
- Large Enterprise Version

  The Large Enterprise version is for customers transitioning from LMS 1.x Unlimited version or from LMS 2.x to LMS 2.6. This version has no limit on the number of devices it can support.

LMS 2.6 Architecture

Figure 1 shows the architecture diagram of an LMS 2.6 server and how the applications residing on a single LMS server interact to obtain device information.

Figure 1. LMS 2.6 Architecture



Common Services and DCR

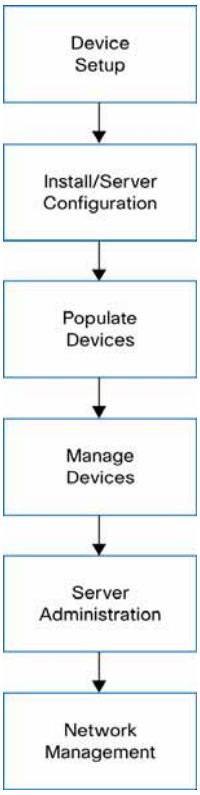
LMS 2.6 applications use Common Services as shown in Figure 1. Device Credential and Repository (DCR) is part of Common Services and acts as a central secure repository for all the device and credential information. All applications within LMS request DCR for device credential information. Since there is a common device and credentials repository, devices populated in DCR can be automatically populated in different applications. For more information on this, see the Application Mode Settings in LMS Applications, page 24.

The Device and Credential Repository also helps in a multi-server setup. This document only briefly describes some of the basic configuration that can be achieved in a multi-server setup.

Device and LMS Workflow

Figure 2 summarizes the device and LMS setup workflow. Subsequent chapters describe the setup and workflow processes in detail.

Figure 2. Device and LMS Setup Workflow



2. Setting up Devices on the Network

LAN Management Solution (LMS) 2.6 helps to manage Cisco devices on the network. But before LMS 2.6 can function correctly, the network devices it touches must be set up correctly. The information provided in this chapter is a general description of the means and procedures recommended to ensure that the network devices are set up correctly.

Note: This chapter provides a great deal of information on the device configuration procedures required to manage devices using CiscoWorks LAN Management Solution. But keep in mind that this document is not intended to be a comprehensive configuration guide for LMS 2.6. For additional configuration details, please contact a Cisco certified network engineer if possible and refer to pertinent documents that are posted on Cisco.com.

Tip: Prior to LMS deployment, in the case of Cisco IOS and Catalyst OS devices, all configuration changes must be saved to non-volatile memory (NVRAM) using the following commands:

`write memory or copy running-config startup-config.`

Please note that these two commands are provided to save pre-LMS deployment configuration changes. After LMS is deployed, configuration changes are saved automatically where appropriate and no user intervention is required. Newer versions of Catalyst OS devices have separate running and startup configurations.

Device Setup Elements

This section describes each of the elements in the device setup that needs to be attended to.

System Name

Each Cisco IOS device in the network must have a unique system name (sysName) to discover all devices. The system name is also populated in the Cisco Discovery Protocol (CDP) table. If there are duplicate system names on the network, 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 by using the following commands:

Cisco IOS Devices

```
hostname <name>
```

Cisco Catalyst OS Devices

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

Domain Name

You can set a domain name on a Cisco IOS or a Catalyst OS device. Set up the domain name by using the following commands:

Cisco IOS Devices

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

Cisco Catalyst OS Devices

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

SNMP Settings

LAN Management Solution uses Simple Network Management Protocol (SNMP) community strings to read and write information from and to the devices.

Note: LMS supports SNMP **AuthNoPriv** mode of SNMP v3.

Enabling SNMP v3 on Cisco IOS Devices

To enable SNMP v3 on Cisco IOS devices, follow these steps:

Step 1. Create a view.

```
snmp-server view campus oid-tree included
```

Step 2. Set the security model.

```
snmp-server group cmtest v3 auth read campus write campus access
access-list
```

Step 3. Create a user and specify the authentication protocol to be used.

```
snmp-server user cmtester campus v3 auth md5 password
```

Step 4. Create a group and associate the user with it.

```
snmp-server user cmtester cmtest v3
```

Enabling SNMP v3 on Catalyst OS Devices

To enable SNMP v3 on Catalyst OS devices, follow these steps:

Step 1. Create a view.

```
set snmp view campus 1.3.6.1 included nonvolatile
```

Step 2. Set the security model.

```
set snmp access cmtest security-model v3 authentication read campus
write campus nonvolatile
```

Step 3. Create a user and specify the authentication protocol to be used.

```
set snmp user cmtester authentication md5 cisco123
```

Step 4. Create a group and associate the user with it.

```
set snmp group cmtest user cmtester security-model v3 nonvolatile
```

Enabling SNMP v1 or v2c on Cisco IOS Devices

To enable SNMP v1 or v2 on Cisco IOS devices, follow these steps:

Step 1. **snmp-server community** <*read-community-string*> **ro**

Step 2. **snmp-server community** <*write-community-string*> **rw**

Enabling SNMP v1 or v2c on Cisco Catalyst OS Devices

To enable SNMP v1 or v2c on Cisco Catalyst OS devices, set as follows:

Step 1. **set snmp community read-only** <*read-community-string*>

Step 2. **set snmp community read-write** <*write-community-string*>

The community strings configured on the devices must match the community strings entered in the DCR (Device Credential Repository) component in LMS.

Enabling Traps in Catalyst OS Devices to Be Sent to a Particular Host

To enable traps in Catalyst OS devices to be sent to a particular host, enter this command:

```
set snmp trap 192.168.124.24 public
```

Enabling Traps in IOS Devices to Be Sent to a Particular Host Using SNMP v2c

To enable traps in IOS devices to be sent to a particular host using SNMP v2c, enter t his command:

```
snmp-server host 192.168.124.24 traps version 2c public
```

In these examples for enabling traps, the public community string helps selective processing of traps on the trap-receiving side.

System Reload

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

The following command is needed on Cisco IOS devices only:

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

Command Line Prompts

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

Note: Customized prompts should also fulfill these requirements.

Cisco IOS Devices

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

For example: Cisco>

- The Enable prompt should end with a pound sign (#).

For example: Cisco#

Cisco Catalyst OS Devices

The Enable prompt must end with “(enable).”

For example: Cisco(enable)

Telnet/SSH

Telnet is one of the protocols that can be used by RME 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>
login
exec-timeout 0 0
```

Note: More than four VTY lines can be selected for log in.

Different authentication on different VTY lines is not supported.SSH provides for a secure communication with the device.

Cisco IOS

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

```
ip ssh timeout 120
ip ssh authentication-retries 3
```

Catalyst OS

The following examples configure SSH in Catalyst OS:

```
(enable) set crypto key rsa 1024
(enable) set ipNote:
```

Note: For greater access control and logging facilities, use TACACS.

SSH configuration requires that the domain name must be configured.

Syslog Messages

Syslog messages can be enabled on Cisco devices to further use the capability of LMS, especially RME.

Cisco IOS Devices

Enable Syslog messages on Cisco IOS devices from global configuration mode:

```
logging on
logging <server-ip-address>
logging trap <logging-level>
```

Note: To limit the number of messages sent to the syslog servers, use the logging trap configuration command above.

Catalyst OS Devices

To enable Syslog messages on Catalyst OS devices:

```
set logging server enable
set logging server <server-ip-address>
set logging level all <logging-level> default
```

Tip: The <server-ip-address> parameter is the IP address of the LMS server. In case of multiple servers, the server IP address entered here is the address of the RME server. In the case of remote Syslog Analyzer and Collector, this parameter is the IP address of the remote Syslog Analyzer and Collector.

Remote Copy Protocol (rcp)

Remote Copy Protocol (rcp) is one of the protocols that can be used by RME for configuration management and software image management. For LMS to be able to provide configuration and software management using rcp, rcp must be enabled on the network devices—rcp can be enabled only on devices running Cisco IOS as shown in 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 **RCP User** 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 the LMS server: **CWHP > Common Services > Server > Admin > System Preferences**.

Configuring Protocols

This section describes the basic configuration procedures for the following protocols:

- Cisco Discovery Protocol (CDP)
- Remote Copy Protocol (rcp)
- Secure Copy Protocol (scp)
- HTTP and HTTPS Protocols
- Multiple Spanning-Tree Protocol (MST)
- Multiple Instance Spanning-Tree Protocol (MIST)
- Per-VLAN Spanning Tree Protocol (PVST+)
- VLAN Trunk Protocol (VTP)

Cisco Discovery Protocol (CDP)

Cisco Campus Manager uses Cisco Discovery Protocol (CDP) to discover Cisco devices on the network. CDP 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 CDP 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. Campus Manager will use the following protocols in their respective technology: ILMI in LANE/ATM networks and ELMI on Stratacom Frame Relay networks.

Enabling CDP on devices allows Campus Manager to learn information about neighboring devices, and to send SNMP queries to those devices. Campus Manager can discover the network topology only when CDP is enabled on those devices.

Enabling or Disabling CDP on Cisco IOS Devices

CDP is enabled on Cisco IOS devices by default. To enable CDP capability on IOS devices use the following commands.

To enable CDP globally:

```
cdp run
```

To enable CDP on specific interfaces only:

```
cdp enable
```

Use the no command to disable CDP capability on Cisco IOS devices.

Enabling or Disabling CDP on Cisco Catalyst OS Devices

CDP is enabled on Cisco Catalyst OS devices by default. To enable CDP capability on Catalyst OS devices use the following commands.

To enable CDP globally:

```
set cdp enable
```

To enable CDP on specific ports only:

```
set cdp enable [mod/port]
```

To disable CDP on Catalyst OS devices, use the set **cdp disable** command.

Tip: Do not run CDP on links that don't need to be discovered by Campus Manager, for example, a connection to the Internet and end-host connection ports on access switches. To protect from CDP DoS attacks, do not enable CDP on links that are connected to non-Cisco devices.

Note: Certain non-Cisco devices support CDP. If you enable CDP on the Cisco devices connected to non-Cisco devices, they will appear on the Campus map.

For related information, please refer to this URL:

- Configuring CDP on Catalyst 6500 Series switches:
  http://www.cisco.com/en/US/products/hw/switches/ps708/products_configuration_guide_chapter0.9186a00801a5b18.html.

Secure Copy Protocol (scp)

The Secure Copy feature was introduced in Cisco IOS 12.2(2)T.

To enable and configure a Cisco router for SCP server-side functionality, perform the following steps:

	Command	Description
Step 1:	`Router>` **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 AAA authentication at login.
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. **Note:** You may skip this step if a network-based authentication mechanism—such as TACACS+ or RADIUS—has already been configured. Syntax: **username name** *[privilege level] {password encryption-type encrypted-password}*
Step 7:	`Router (config)#` **ip scp server enable**	Enables SCP server-side functionality.

HTTP and HTTPS Servers

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.

Enabling http Mode

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)[1] and Transport Layer Security (TLS) to provide device authentication and data encryption.

Note: As of the LMS 2.6 release, HTTPS mode is supported only for Cisco VPN 3000 Series Concentrators.

To enable HTTPS mode in a VPN 3000 concentrator, access the following URL: http://www.cisco.com/en/US/products/hw/vpndevc/ps2284/products_configuration_guide_chapter09186a008015ce28.html#999607.

Configuring Multiple Spanning-Tree

Use the following procedure to configure Multiple Spanning-Tree (MST) (802.1s):

Step 1. Enable MST on the Cisco switch.

Use the **set spantree mode mst** command to set the spanning tree mode on the switch to MST.

Note: Before you can disable MST, another spanning-tree protocol, such as Per-VLAN Spanning-Tree + (PVST+), must be configured.

Step 2. Define the VLAN-to-instance mappings.

Use the following command to map VLANs to an instance:

set spantree MST instance vlan <*vlans*>

For example, to put VLANs 1 to 10 and 20 into instance 10, you would enter this command:

set spantree MST 10 vlan 1-10,20

By default, all VLANs are mapped to instance 0.

Note: Mapping a VLAN to an instance does not take effect until the configuration is committed.

Step 3. Step 3 Define the MST configuration name and revision number.
Use the following commands to set the configuration and the revision number:

- **set spantree MST configuration name** <*name*>
- **set spantree MST configuration revision** <*revision-number*>

Instances 1 to 15 operate only within the MST region.

On the boundary of the MST region, MST copies the port state from the IST, which communicates with the other spanning-tree protocols, such as PVST+, Common Spanning-Tree (CST), and other MST regions to form a loop-free topology.

MST-enabled switches form an MST region only if they have a matching VLAN-to-IST mapping, MST configuration name, and MST revision number. If any of these three fails, the port will be flagged as a boundary port.

Step 4. Step 4 Commit the MST configuration to apply it on the switch. Use the following command:

set spantree MST config commit

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

- If you find that you need to discard all edits made since the last commit, use the **`set spantree MST rollback`** command.
- If you need to clear changes to the MST configuration made by someone else using another session, use the **`set spantree MST rollback force`** command.

For related configuration information, refer to the following URL:
http://www.cisco.com/warp/public/473/123.html.

Configuring Multiple Instance Spanning-Tree

Use the following steps to configure Multiple Instance Spanning-Tree (MISTP).

Step 1. Step 1 Enable MISTP on the switch.

To set the spanning-tree mode on the switch to MST, use this command:

```
set spantree mode mistp
```

Step 2. Configure the MISTP bridge ID priority.

You can set the *bridge ID priority* for an MISTP instance when the switch is in MISTP or MISTP-PVST+ mode.

The bridge priority value is combined with the system ID extension (that is, the ID of the MISTP instance) to create the bridge ID priority.

You can set 16 possible bridge priority values:

0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, and 61440.

To set the bridge ID priority, use this command:

```
set spantree priority 8192 mistpinstance 1
```

Step 3. Configure the MISTP port cost.

You can configure the *port cost* of switch ports. The ports with lower port costs are more likely to be chosen to forward frames. Assign lower numbers to ports that are attached to faster media (such as full duplex) and higher numbers to ports that are attached to slower media. The default cost differs for different media.

- When using the short method for calculating port cost, the possible cost range is from 1 to 65535.
- When using the long method for calculating port cost, the possible port cost range is from 1 to 200000000.

To set the port cost, use this command:

```
set spantree portcost 2/12 22222222
```

Step 4. Configure the MISTP port priority.

You can configure the *port priority* of switch ports. The port with the lowest priority value forwards frames for all VLANs. The possible port priority values are from **0** to **63**; the default is **32**. If all ports have the same priority value, the port with the lowest port number forwards frames.

To set the port priority, use the following command:

```
set spantree portpri 2/12 40
```

Configuring Per-VLAN Spanning Tree+

Per VLAN Spanning Tree Plus (PVST+) maintains a spanning tree instance for each VLAN configured in the network and allows a VLAN trunk to be forwarding for some VLANs while blocking for other VLANs. Since PVST +treats each VLAN as a separate network, it has the ability to load balance traffic (at Layer 2) by forwarding some VLANs on one trunk and other VLANs on another trunk without causing a Spanning Tree loop. It uses 802.1Q trunking technology rather than ISL. PVST+ is an enhancement to the 802.1Q specification and is not supported on non-Cisco devices.

To configure Per-VLAN Spanning Tree+, follow these steps:

Step 1. Enable PVST+ on the switch.

To set the spanning tree mode to pvst+, enter this command:

```
set spantree mode pvst+
```

Step 2. Configure the PVST+ bridge ID priority.

The bridge ID priority is the priority of a VLAN when the switch is in PVST+ mode.

When the switch is in PVST+ mode *without* MAC address reduction enabled, you can enter a bridge priority value between 0 to 65535. The VLAN bridge ID priority is then set to that value.

When the switch is in PVST+ mode with MAC address reduction enabled, you can enter one of 16 bridge priority values: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, or 61440.

The bridge priority is combined with the system ID extension (that is, the ID of the VLAN) to create the bridge ID priority for the VLAN.

To set bridge ID priority, enter this command:

```
set spantree priority 30000 1
```

Step 3. Configuring PVST+ port cost

You can configure the port cost of switch ports. The ports with lower port costs are more likely to be chosen to forward frames. Assign lower numbers to ports that are attached to faster media (such as full duplex) and higher numbers to ports that are attached to slower media. The default cost differs for different media.

- When using the short method for calculating port cost, the possible port cost is from 1 to 65535.
- When using the long method for calculating port cost, the possible port cost is from 1 to 200000000.

To set the port cost, use the following command:

```
set spantree portcost 2/3 12
```

Step 4. Configure PVST+ port priority.

You can configure the port priority of switch ports in PVST+ mode. The port with the lowest priority value forwards frames for all VLANs. The possible port priority value is 0 to 63. The default is 32. If all ports have the same priority value, the port with the lowest port number forwards frames.

To set port priority, use this command:

```
set spantree portpri 2/3 16
```

For More Information on the Spanning Tree Protocol

The following links provide more information on Spanning Tree Protocol setup and recommendations.

- Configuring STP and IEEE 802.1s MST: http://www.cisco.com/univercd/cc/td/doc/product/lan/cat6000/12_1e/swconfig/spantree.htm
- Spanning Tree Protocol Problems and Related Design Considerations: http://www.cisco.com/en/US/tech/tk389/tk621/technologies_tech_note09186a00800951ac.shtml
- Configuring FDDI 802.10 Trunks: http://www.cisco.com/en/US/products/hw/switches/ps679/products_configuration_guide_chapter09186a008007eeeb.html
- Financial Services Design for High Availability: http://www.cisco.com/en/US/tech/tk828/technologies_white_paper09186a008015a8ad.shtml
- Configuring Spanning-Tree Bridging for the Cisco Catalyst Switch: http://www.cisco.com/en/US/products/hw/contnetw/ps792/products_configuration_guide_chapter09186a00801ee706.html#71577

Default Values for PVST+ Configuration

Table 1 shows the default PVST+ configuration values in Cisco Catalyst 6000 devices.

Table 1. Default PVST+ Configuration Values for Catalyst 6000 Switches

Feature	Default Values
VLAN 1	All ports assigned to VLAN 1
Enable state	PVST+ enabled for all VLANs
MAC address reduction	Disabled
Bridge priority	32768
Bridge ID priority	32769 (bridge priority plus system ID extension of VLAN 1)
Port priority	32
Port cost	• Gigabit Ethernet: 4 • Fast Ethernet: 191 • DFFI/CDDI: 10 • Ethernet: 1002
Default spantree port cost mode	Short (802.1D)
Port VLAN priority	Same as port priority but configurable on a per- VLAN basis in PVST+
Port VLAN cost	Same as port cost but configurable on a per- VLAN basis in PVST+
Maximum aging time	20 seconds
Hello time	2 seconds
Forward delay time	15 seconds

Configuring VLAN Trunk Protocol (VTP)

Virtual LAN (VLAN) Trunk Protocol (VTP) reduces administration in a switched network. When you configure a new VLAN on one VTP server, the VLAN is distributed through all switches in the domain. This reduces the need to configure the same VLAN everywhere. VTP is a Cisco-

proprietary protocol that is available on most of the Cisco Catalyst Family products. VTP is used to configure and communicate VLAN settings across multiple switches. VTP must be configured on all switches in order to manage VLANs via Campus Manager. A VTP domain must be established and the VTP mode must be defined on each device.

In addition, at least one switch in each VTP domain must be defined as a VTP server in order for Campus Manager to create VLANs in that domain. Discovering VLANs established on a switch using VTP Transparent mode is supported from Campus Manager 3.1. (The old restriction of requiring at least one server in a VTP domain to identify VLANs has been removed.) Then Campus Manager can be used to view, create, modify, and delete VLANs via the topology services application, instead of the command line.

Note: This protocol should be enabled and configured as part of the overall network design. This section is included for reference purposes only.

To set a VTP domain and the mode on a Cisco Catalyst switch, use the following commands. Each switch can be in only one VTP domain:

```
set vtp domain <name>
set vtp mode <client | server | transparent>
set vtp v2 <enable | disable>
```

Note: The **set vtp** v2 command is required for Token Ring networks. VTP v2 must be used on Token Ring networks. VTP versions 1 and 2 are not compatible, and they cannot both run in the same domain.

The description of the modes is as follows:

- **Server:** Switch will maintain and communicate VLAN settings to all other switches in the VTP domain.
- **Client:** Switch will synchronize VLAN configuration with advertisements received from VTP servers, and forward advertisements to neighbors.
- **Transparent:** Switch will not participate in VLANs advertised by server, but will forward advertisements to neighbors. Any VLANs configured on a transparent switch will be local to that switch only.

Best Practice Recommendations

The campus best practice recommendations emphasize campus stability and predictability (especially for protocols such as STP). General suggestions for enterprises preferring a cautious approach may include making use of VTP Transparent or VTP off (Catalyst OS 7.x) instead of the typical VTP server/client model.

VTP's major benefit of providing uniform VLAN creation across multiple switches may be outweighed by the drawbacks of the same thing it's supposed to simplify, which is the automatic extension of VLANs of all switches in a domain. This does pose the risk of unenforced STP and its issues cross multiple switches. Spanning tree is not a poor protocol—it's the protocol's defaults that are not ideal.

Another major risk of the VTP client/server model is the possibility of new server versioning overriding the existing VTP Server and deleting VLANs unknown to the new master server from all switches within that domain. Though some of these risks can be reduced by VTP Authentication,

Trunk Clearing, and VTP Pruning, the added complexity of these is not really worth it.

Enabling Trunking on Catalyst Switch Ports

This protocol should be enabled and configured as part of the overall network design. This section is included for reference purposes only.

Trunking is a method of carrying traffic for multiple VLANs over the same link, between two switches or a switch and a router, thus extending the VLANs across the network. In order to perform trunking, ports on each side of the link must be set to trunk ports, and the Inter-Switch Link (ISL) or IEEE 802.1Q protocol must be enabled.

ISL is a Cisco proprietary protocol used to combine traffic from multiple VLANs over one link. IEEE 802.1Q is the industry-standard protocol for performing the same function.

IEEE 802.1Q must be used on Token Ring networks.

To enable trunking on a Catalyst Switch port, use the following command:

```
set trunk <module/port> on [vlans]
```

This establishes the specified module/port as a trunk port and enables the ISL protocol.

You can use the optional **vlans** parameter to specify a specific range of VLANs to be allowed across the trunk (valid ranges are from 1 to 1005).

For example:

```
set trunk 2/1 on 2-10
```

For more information, go to “Understanding and Configuring VLAN Trunk Protocol (VTP)”: http://www.cisco.com/warp/public/473/21.html.

3. Cisco LAN Management Solution 2.6 Installation Requirements

Cisco LAN Management Solution installation is supported in the U.S. English and Japanese versions of the Windows and Solaris operating systems.

Solaris OS Installation Requirements

This section discusses the LMS requirements to install on the Solaris operation system.

Table 2. Recommended Server Requirements for Solaris Systems

Component	Recommended Server System Requirement
CPU	• Sun UltraSPARC IIIi or Sun UltraSPARC IIICu for Restricted license • Dual Sun UltraSPARC IIIi or dual Sun UltraSPARC IIICu for Unrestricted license • Sun UltraSPARC IV
RAM	• 2 GB for Restricted license • 4 GB for Unrestricted license
Software	Solaris 8 (Solaris 2.8) and Solaris 9 (Solaris 2.9)
Disk Space	20 GB or more free space for LMS applications and data
Swap Space	• 4 GB swap space for Restricted license • 8 GB swap space for Unrestricted license • UNIX file system recommended[1] We recommend that you set swap space to twice the size of RAM.

Recommended Solaris Disk Layout

The following layout for the Solaris disk is recommended:

- /opt/CSCOpx partition

This partition holds application executables, libraries, and database files. The size grows in proportion to number of devices, amount of availability data, and the number of syslog messages.

- /var/adm/CSCOpx partition

This partition holds log files, device configurations, software images, and exported reports. The growth of the partition depends on the number of archived configurations, verbosity of debugs, and the number of software images.

- /tftpboot partition

This partition holds configurations and software image images as they are downloaded from or uploaded to devices. This partition must be large enough to handle the biggest SWIM job.

Backup Recommendations

Cisco recommends that you store backups on a separate partition, or preferably, on a separate disk. Backup partitions need to be large enough to store all application databases (for example, RME, ANI, DFM.) as well as device configurations, software images, and user accounts. The backup partition should allow for multiple revisions. Cisco also recommends that you verify all backups that may be needed in the future.

[1] To verify the amount of available disk space in each of the specified partitions and directories, enter: **df –k** at the command prompt.

Windows OS Installation Requirements

This section discusses the LMS requirements to install on the Windows operation system.

Table 3. Recommended Server Requirements for Windows Systems

Component	Recommended Server System Requirement
CPU	• 2.8 GHz Intel Pentium 4 or 2.8 GHz Intel Xeon processor for Restricted license • Dual 2.8 GHz Intel Pentium 4 or dual 2.8 GHz Intel Xeon processor for Unrestricted license
RAM	• 2 GB for Restricted license • 4 GB for Unrestricted license
Software[1] [2] [3]	Any one of the following: • Windows 2000 Professional with Service Pack 4[4] • Windows 2000 Server with Service Pack 4 • Windows 2000 Advanced Server with Service Pack 4 • Windows Server 2003 Standard and Enterprise Editions with Service Pack 1 • Windows 2003 R2 Server Standard and Enterprise Editions LAN Management Solution 2.6 supports only the US English and Japanese versions of these operating systems. Set the default locale to US-English for the US-English version and Japanese for the Japanese version. Installation might proceed in other locales, but there might be problems in the functionality of CiscoWorks.
Disk space	20 GB or more free space for LMS applications and data
Swap space	• 4 GB virtual memory for Restricted license • 8 GB virtual memory for Unrestricted license • NTFS file system[5] required We recommend that you set virtual memory to twice the size of RAM.

Recommended Order for Installing LMS Applications

The recommended order for installing LMS applications is as follows.

Step 1. Install CiscoWorks Common Services 3.0.3.

Step 2. Install Resource Manager Essentials 4.0.3.

Step 3. Install Campus Manager 4.0.3.

Step 4. Install Device Fault Manager 2.0.3.

Step 5. Install Internetwork Performance Monitor 2.6.

Step 6. Install the LMS 2.6 Update.

Note: The only requirement is to install CiscoWorks Common Services 3.0.3 *before* installing any other application. There is no need to follow the order recommended above if you are installing just one application in the CiscoWorks machine.

[1] Installation of LMS 2.6 on a system with Internet Information Services (IIS) enabled is not supported. IIS Service must be disabled on the server before installing the LMS 2.6 applications.
[2] If you are using LMS 2.6 on a Windows 2000 operating system (all versions), disable Hyper-Threading Technology (HTT).See http://www.intel.com/support/processors/sb/CS-017343.htm.
[3] Installation of LMS 2.6 applications on a system with Terminal Services enabled in Remote Administration mode is supported. However, installation of LMS 2.6 applications on a system with Terminal Services enabled in Application mode is not supported.
[4] To verify the Service Pack version on Windows, select **Start > Run**, then enter **winver**.
[5] Install LMS 2.6 on an NTFS file system. Do not install LMS 2.6 on a FAT file system. To verify the file system, open My Computer on the Windows desktop, right-click the drive and select **Properties** from the popup menu. The file system field appears in the General tab of the Properties dialog box.

Ports Used by LMS Applications

The following table lists the ports used by the various CiscoWorks components.

Table 4. LAN Management Solution Port Usage

Protocol	Port Number	Service Name	Application(s)	Direction (of Establishment) of Connection
ICMP	7	Ping	RME, CM, and DFM	Server to Device
TCP	22	Secure Shell (SSH)	CiscoWorks Common Services and RME	Server to Device
TCP	23	Telnet	CiscoWorks Common Services, CiscoView, and RME	Server to Device
TCP	25	Simple Mail Transfer Protocol (SMTP)	CiscoWorks Common Services (PSU), RME	Server Internal
TCP	49	TACACS+ and ACS	CiscoWorks Common Services, RME, CM, and DFM	Server to ACS
TCP	80	HyperText Transfer Protocol (HTTP)	CiscoWorks Common Services, CiscoView	Client to Server
TCP	443	CiscoWorks HTTP server in SSL mode	CiscoWorks Common Services	Sever Internal
TCP	514	Remote Copy Protocol	CiscoWorks Common Services	Server to Device
TCP	1683	Internet Inter-ORB Protocol (IIOP)	CiscoWorks Common Services, and CM	Client to Server
TCP	1684	IIOP	CiscoWorks Common Services, and CM	Server to Client
TCP	1741	CiscoWorks HTTP Protocol	CiscoWorks Common Services, CiscoView, and RME	Client to Server
TCP	1783	IIOP for IPM Gatekeeper	IPM	Client to Server
TCP	1784	IIOP for IPM Gatekeeper	IPM	Client to Server
TCP	8088	HIOP	CiscoWorks Common Services	Server to Client Client to Server
TCP	8898	Log Server	DFM	Server Internal
TCP	9007	Tomcat shutdown	CiscoWorks Common Services	Server Internal
TCP	9009	Ajp13 connector used by Tomcat	CiscoWorks Common Services	Server Internal
TCP	9088	HIOP port for	IPM	Server to Client
		IPM gatekeeper		Client to Server
TCP	9191	HIOP port for IPM Gatekeeper	IPM	Server Internal
TCP	9192	IIOP port for IPM Gatekeeper	IPM	Server Internal
TCP	9193	IIOP port for IPM Gatekeeper	IPM	Server Internal
TCP	9194	HIOP port for IPM Gatekeeper	IPM	Server Internal
TCP	15000	Log server	DFM	Server Internal
TCP	40050-40070	CSTM ports used by CS applications, such as OGS, Device and Credential Repository (DCR)	CiscoWorks Common Services	Server Internal
TCP	40401	LicenseServer	CiscoWorks Common Services	Server Internal

TCP	42340	CiscoWorks Daemon Manager - Tool for Server Processes	CiscoWorks Common Services	Server Internal
TCP	42344	ANI HTTP Server	CiscoWorks Common Services	Server Internal
TCP	42351	Event Services Software (ESS) Listening (Alternate port is 44351/tcp)	CiscoWorks Common Services	Server Internal
TCP	42352	ESS HTTP (Alternate port is 44352/tcp)	CiscoWorks Common Services	Client to Server
TCP	42353	ESS Routing (Alternate port is 44352/tcp)	CiscoWorks Common Services	Server Internal
TCP	43441	CMF Database	CiscoWorks Common Services	Server Internal
TCP	43455	RME Database	RME	Server Internal
TCP	43443	ANIDbEngine	CM	Server Internal
TCP	43445	Fault History Database	DFM	Server Internal
TCP	43446	Inventory Service Database	DFM	Server Internal
TCP	43447	Event Promulgation Module Database	DFM	Server Internal
TCP	43500-43530	CSTM Port for DFM	DFM	Server Internal
TCP	44341	IPM Database	IPM	Server Internal
TCP	44342	IPM Name Server (OSAGENT)	IPM	Client to Server (Applicable to IPM standalone client)
TCP	47000-47040	CSTM Port for RME	RME	Server Internal
TCP	55000-55020	CSTM Port for Campus Manager	CM	Server Internal
TCP	57860	JRun - JRun Server Manager Control Server	CiscoWorks Common Services	Server Internal
UDP	69	Trivial File Transfer Protocol (TFTP)	CiscoWorks Common Services and RME	Server to Device Device to Server
UDP	161	Simple Network Management Protocol (SNMP)	CiscoWorks Common Services, CiscoView, RME, CM, and DFM	Server to Device Device to Server
UDP	162	SNMP Traps (Standard Port)	CiscoWorks Common Services, and DFM	Server to Device Device to Server
UDP	514	Syslog	CiscoWorks Common Services and RME	Device to Server
UDP	9000	DFM trap receiving (if port 162 is occupied)	DFM	Client to Server
UDP	9002	DFM trap listening	DFM	Client to Server
UDP	14004	Lock port for ANI Server singlet on check	CM	Server Internal
UDP	16236	UT Host acquisition	CM	Device to Server
UDP	42342	OSAGENT	CiscoWorks Common Services	Server Internal (Common Services)
UDP	42350	Event Services Software (ESS) (Alternate port is 44350/udp)	CiscoWorks Common Services	Server Internal

Licensing Terminology and Process3

The section describes the LMS 2.6 software-based product registration and license key activation terminology and technologies.

Table 5. Licensing Terminology

Licensing Term	Description
Product Identification Number (PIN)	The PIN is printed on the software claims certificate. The LMS installation program prompts you to enter the PIN during installation. If an authenticated license cannot be obtained during installation, use the PIN to proceed with the installation. If a PIN only is entered, LMS will run normally, but you will be periodically be reminded to complete the license process.
Product Authorization Key (PAK)	The PAK is printed on the software claims certificate. Use the PAK to get a license from Cisco.com. You may obtain and install your license key at any time while you are working on LMS, not necessarily only at the time you install the product.
License File	When you register your LMS purchase on the product licensing area of *Cisco.com*, you will receive a license file. You need to provide your PAK to receive your license file. If you are a registered user of Cisco.com, get your license file from: http://www.cisco.com/go/license If you are not a registered user of *Cisco.com*, use this site to get your license file: http://www.cisco.com/go/license/public.

Licensing Items of Note

- When you first install CiscoWorks Common Services 3.0, you will not be prompted to register your PIN/PAK during the process.
- The first LMS application you install will prompt you to provide the LMS licensing information.

  The LMS installation program prompts you to enter the license file, or the PIN and PAK. If the licensing information is provided during the installation of the first LMS application, then it need not be provided during the installation of the other applications.
- If you have received LMS as an evaluation copy, you need not register the product during the 90-day evaluation period.

4. Initial Setup of the LAN Management Solution 2.6 Server

This chapter will guide you through the initial setup of the LAN Management Solution server. This chapter also provides information on the default settings in the applications and how to update the application settings for easier management of devices across the LMS server.

Application Mode Settings in LMS Applications

Application mode settings are available in LMS applications to help control the flow of device and credential information to the applications from the Device Credential and Repository (DCR).

Note: Please note that you must specify the application mode in each of the applications user interfaces.

The two LMS application modes are:

- Manual mode
- Auto Synchronize mode

In *Manual mode*, the LMS applications (Campus Manager, Device Fault Manager, Resource Manager Essentials and Internetwork Performance Monitor) will not automatically get device updates (device add, delete, and credential updates) from DCR.

In *Auto Synchronize* mode, the LMS applications will automatically get device updates (device add, delete and credential updates) from DCR. In response to the device updates, the applications may do data collection, performance monitoring, and fault monitoring on the modified devices.

- Campus Manager (CM): CM by default is in Auto Synchronize mode. The application mode in CM cannot be disabled. Hence all devices added in DCR will automatically be managed in CM, unless filters (such as IP address range or VTP domain) have been set up to override the application mode.
- Device Fault Manager (DFM): By default, DFM is also set up in an Auto Synchronize mode. All devices added in DCR will automatically be managed in DFM.

  To disable Auto Synchronize mode in DFM:

a. From the Device Fault Manager, choose **Device Management > Device Selector**.

b. Deselect the **Synchronize with Device Credential Repository** option.

- Resource Manager Essentials (RME): By default, RME is in Auto Synchronize mode. Devices imported into Device Credential Repository (DCR) will be automatically added in RME.

  To disable Auto Synchronize mode in RME:

a. From Resource Manager Essentials, choose **Administration > Device Management**.

b. Then deselect the **Automatically Manage Devices from Credential Repository** option.

- Internetwork Performance Monitor (IPM): IPM source and data collectors can be set up after DCR has been populated.

Note: For easier management of devices across all LMS applications, it is advisable to leave Auto Synchronize mode enabled.

When multiple CiscoWorks servers are installed and a large number of devices are to be managed between the CiscoWorks servers, Manual mode should be enabled.

If Auto Synchronize mode is enabled for RME to get devices from the DCR, two instances of RME installed in two different servers can be managing the same set of devices. User intervention is required to select dissimilar set of devices to be managed by the two RME servers.

Protocol Setup

RME also uses various protocols for configuration and software management. Network administrators can assign the protocols to be used in RME for Configuration Management and Software Management.

Configuration Management

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 (Trivial File Transport Protocol
- RCP (Remote Copy Protocol)
- SSH (Secure Shell)
- SCP (Secure Copy Protocol)
- HTTPS (Hyper Text Transfer Protocol Secured)

Set Up Protocol Ordering

Protocol ordering can be set up for these configuration applications: Archive Management, Config Editor, and NetConfig. To set up protocol ordering for Config Management:

Step 1. From Resource Manager Essentials, choose **Administration > Config Management**.

Step 2. Select the desired application from the **Application Name** drop-down list.

Step 3. Select the protocol order by clicking **Add** or **Remove**, then click **Apply**.

Note: For secure communication between the server and a device, use SSH.

To order the Software Management protocol:

Step 1. Click **Software Mgmt.**

Step 2. Select **View/Edit Preferences** from the Table of Contents.

Step 3. Use the **Add** and **Remove** buttons for selecting the protocol order.

Software Image Management

Software Management downloads 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.

To define the protocol order that Software Management has to use for software image download:

Step 1. From Resource Manager Essentials, **choose Administration > Software Mgmt > View/EditPreferences**.

Step 2. In the View/Edit Preferences dialog box, define the protocol order.

Step 3. Use the **Add** and **Remove** buttons for selecting the protocol order.

Setting Up Security

By integrating with the Cisco Secure ACS server, LMS 2.6 provides the following security features:

- Secure the user access to devices.
- Secure browser client communication to the server.

Certificate Setup

Every CiscoWorks server needs to have a System Identity user set up for system processes to use while performing background tasks that are not user initiated. A system identity user is set up by default when the CiscoWorks server is installed.

Setting Up the System Identity User

To view the System Identity User default settings or to change the default settings:

Step 1. Navigate to **CWHP > Common Services > Server > Security > Multi-Server Trust Management**.

Step 2. Select the **System Identity Setup** link.

Step 3. Edit the necessary details.

Setting Up a Peer Server Account

If a CiscoWorks server has to exchange information (such as device credentials) with other CiscoWorks servers, every CiscoWorks server needs to have a peer server account set up. A peer server account should have the System Identity user information of other CiscoWorks servers.

Peer server accounts can also be used for providing access to a third-party application to access the CiscoWorks server and authenticate and authorize it. Create a peer server account as described here and provide the credential information to the third-party user.

To set up a peer server account:

Step 1. Create the System Identity user as described in the previous section.

Step 2. Navigate to **CWHP > Common Services > Server > Security > Multi-Server Trust Management**.

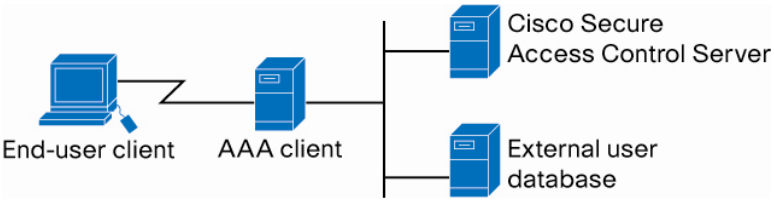
Step 3. Select the **Peer Server Account Setup** link.

Step 4. Make sure that the System Identity users of the other CiscoWorks servers are created.

Setting up the Cisco Secure Access Control Server

Cisco Secure Access Control Server provides authentication, authorization, and accounting (AAA) services to network devices that function as AAA clients, such as a network access server, PIX Firewall, or router. Figure 3 shows the AAA client model.

Figure 3. AAA Client Model



Common Services 3.0 integrates with ACS server to leverage the AAA functionality for restricting user access to devices. Common Services provides a way to configure secondary and tertiary ACS servers to support redundancy.

Integrating LMS Servers with ACS

To integrate LMS servers with ACS, follow these steps:

Set Up the System Identity and Peer Server Account Users in the LMS Server

To ensure that the System Identity User is set up:

Step 1. Navigate to **CWHP > Common Services > Server > Security > Multi-Server Trust Management**.

Step 2. Select the **System Identity Setup** link.

Step 3. If there are third-party applications integrating with the LMS server, create a peer server account for this purpose because the third-party applications do not need to know the System Identity Setup credentials.

Set Up the ACS Server

To set up the Access Control Server, follow these steps:

Step 1. Log in to the ACS Server.

Step 2. To add the CiscoWorks LMS server(s) as AAA client(s) of the ACS server, from the Network Configuration menu, choose **Add Entry**.

Step 3. Provide the IP address and host name of the CiscoWorks LMS server(s) that you are going to set up.

Step 4. Specify a secret Key.

Step 5. For the Authentication method, choose **TACACS+**.

Step 6. Assign the CiscoWorks LMS server(s) to a new NDG group.

Step 7. To create a new NDG group, from the Network Configuration menu, choose **Add Entry**.

Step 8. Add a System Identity User as a registered user in the ACS Server.

a. To do this, navigate to **User Setup**.

b. Enter the username, then click **Add/Edit**.

c. In the User Setup section, enter the password for the user.

Note: Make sure the user is created with the same password as the password specified for the LMS servers.

Step 9. Add the group to **Default Group**, then click **Submit** (located on the lower frame).

Note: The same procedure must be done to add any other peer server username (especially the user created for third-party applications) to the ACS server.

Set Up the LMS Server to Communicate with the ACS Server

To set up the LMS server to communicate with the ACS server, follow these steps:

Step 1. Log in to LMS server.

Step 2. Navigate to Common Services Panel in CiscoWorks Home Page.

Step 3. To configure Common Services to be in ACS login mode, choose **Server > Security > AAA Mode Setup > Select ACS Type**.

Step 4. Enter the primary ACS server IP address, ACS Admin User Name and Password, and Shared Secret Key

Note: These values for these fields must be the same as the values entered in the ACS server.

Step 5. Restart the LMS server.

- If using a Windows server, enter either the **net stop crmdmgtd** command or the **net start crmdmgtd** command.
- If using a Solaris server, enter the **/etc/init.d/dmgtd stop** command or the **/etc/init.d/dmgtd start command**.

Configure the System Identity User in the ACS Server

In this procedure, you will learn how to assign a *System Administrator* privilege to the User Group on the Device Group to which the LMS server is assigned.

Note: The System Identity User is quite unique and not the same as any other user created in the ACS server. The only difference between this setup and the peer server user setup is that the peer server username need not be assigned an Administrator privilege to the NDG group.

To configure the System Identity User in the ACS server, follow these steps:

Step 1. Navigate to **Group Setup**.

Step 2. Select the **User Group**.

Step 3. Click **Edit Settings**.

Step 4. Browse to the applications CiscoWorks, CiscoView, Resource Manager Essentials, Device Fault Manager and CiscoWorks Campus Manager, and provide *System Administrator* privilege for the device group containing the LMS server.

Configure the ACS Server to Change Default Permissions and Task to Role Mapping (Optional)

There are five default roles defined by CiscoWorks:

- System Administrator
- Network Administrator
- Network Operator
- Approver
- Help Desk

These roles are by default assigned permissions to various tasks in CiscoWorks. An ACS user can change the task to role mapping as required.

Step 1. Log in to the ACS server.

Step 2. To change the task to role mapping, click **Shared Profile Components** (in the navigation bar on the left).

Step 3. Choose the application for which you need to set the task to role mapping.

For example, you can click **CiscoWorks Common Services**, click on a user role and change the tasks assigned to that role.

Create Network Device Groups, User Groups and Assign Roles to Network Device Groups in the ACS Server

To create Network Device Groups, user groups, and assign roles to those groups, follow these steps:

Step 1. Log in to the ACS server.

Step 2. To create Network Device Groups, click **Network Configuration** (in the left navigation bar).

Step 3. Add devices to the Network Device Group.

Step 4. To add users to User Groups, click **Group Setup**, then click **Users in Group**.

Step 5. To assign User Groups permissions (System Administrator, Network Administrator, etc.) on the various Network Device Groups, click **Group Setup**, then click **Edit Settings**.

Setting Permissions for Performing Tasks on Devices

If a Security Administrator wants to restrict a user to performing only a selected set of tasks (for example tasks t1, t2, and t3) on a device in the LMS server, then follow these steps.

Step 1. Put the LMS server(s) in ACS security mode

Step 2. Set up the Cisco Secure ACS server as described in “Setting Up the Cisco Secure Access Control Server” section on page 28.

Step 3. Log in to the ACS server.

Step 4. Make sure that a role (for example Network Administrator) is available so that it has permissions to perform only the restricted list of tasks.

Step 5. Click **Shared Profile Components**, then select an application that has tasks t1, t2 and t3.

Step 6. Click **Network Administrator** and enable only the tasks t1, t2, and t3 for this role.

Step 7. Click **Group Setup**, then select the user group to which the user is assigned.

Step 8. Click **Edit Settings**, go to the application where the tasks t1, t2 and t3 are present, and assign the role **Network Administrator** to the user selected in the previous step.

Enabling HTTPS on an LMS Server

You can enable HTTPS on an LMS server to provide secure communication between the server and client.

Step 1. SSL can be enabled on the server by going to **Common Services > Server > Security > Single-Server Management**.

Step 2. Select **Browser-Server Security Mode Setup**.

Step 3. Select **Enable**.

Notes

- HTTPS communication will work only after restarting the LMS server.
- Any link and/or application registration will work fine after you change the *CiscoWorks security* mode from **http** to **https**.
- To restart the LMS server.
  - If using a Windows server, enter either the **net stop crmdmgtd** command or the **net start crmdmgtd** command.
  - If using a Solaris server, enter the **/etc/init.d/dmgtd** stop command or the **/etc/init.d/dmgtd** start command.
- To access the LMS server, use https://server-url:1742.

Single Sign-On

This task is optional and applicable in a multiple CiscoWorks server setup only.

Single Sign-on is the ability to log in into multiple computers or servers with a single action and the entry of a single password. This is especially useful where, for example, a user on a LAN or WAN requires access to a number of different servers.

In SSO mode, one of the CiscoWorks servers acts as the SSO Authentication server or master and all other CiscoWorks servers act as the slave or SSO regular server. All authentication is done by the master server for any access to slave or master servers.

To setup Single Sign-on, follow these steps:

Step 1. Complete the security certificate setup described in the section above.

Step 2. One of the CiscoWorks servers should be set up as the authentication server. Navigate to **CWHP > Common Services > Server > Security > Multi Server Trust Management**.

Step 3. Select the **Single Sign-on** Setup link.

Step 4. Choose the **Master (SSO Authentication Server)** mode.

The same link can be used to set up other CiscoWorks servers as slaves.

5. Populating Devices in Cisco LAN Management Solution 2.6

The tasks described in Chapter 4, “Initial Setup of the LAN Management Solution 2.6 Server” should complete the initial configuration on the LMS server. LMS is now ready to start importing devices for management.

Devices can be populated in the LMS server through one of the three tasks listed below:

- Campus Manager Device Discovery, page 32
- Bulk Device Import to Device and Credentials Repository, page 33
- Device Credentials Update, page 34

Campus Manager Device Discovery

Campus Manager has the ability to discover Cisco devices present in the network using Cisco Discovery Protocol (CDP). Hence to have the ability to discover devices using Campus Manager, CDP should be enabled on the network. If CDP is enabled on your network, you can enter a single or multiple *Seed Devices* in Campus Manager.

Note: A *seed device* should generally be core device. A core switch (or switches) should be the seed device because this device will have a lot of CDP neighbors and this hastens the discovery process.

In LMS 2.6, Campus Manager processing has been partitioned into two separate processes: one of the processes is called *Device Discovery*, while the other is called *Campus Data Collection*.

Device Discovery within Campus Manager uses seed devices to discover the network using CDP. In the device discovery process, Campus Manager populates the Device and Credentials Repository (DCR) with the list of discovered devices in the network. Information about the devices is fetched by Campus Manager only during the data collection process.

To gather the list of devices, you musts first initiate the Device Discovery process.

Defining a Seed Device in Campus Manager

To define a seed device in Campus Manager, follow these steps:

Step 1. **Choose Administration**.

Step 2. Then select the **SNMP Settings** link.

Note: Only the read community string needs to be entered in the SNMP Settings page. **Add** or **Edit** the read community strings depending on the number of community strings configured in the network. By default only the SNMPv2 read string is populated.

Step 3. To populate SNMPv3, select the **SNMPV3** radio button.

Step 4. After editing the SNMP strings, click **Apply** on the SNMP Settings screen.

Step 5. To enter a seed device, click the **Discovery Settings** link (under TOC).

Step 6. Configure the seed devices, then click **Apply**.

This action triggers an immediate Device Discovery process.

Address filters are available to either to discover or not discover devices in a particular network.

Step 7. To configure the address filters, click **IP Address Range**.

Note: If the device discovery is scheduled, devices in LMS would be populated only after Campus Manager Device Discovery has taken place.

Step 8. To verify the device discovery status, click the **Go to Campus Administration** link.

Step 9. Refresh the page to update the device discovery status and verify the number of devices discovered when in *Idle* state.

All the devices discovered by Campus Manager should now be populated in the DCR.

Bulk Device Import to Device and Credentials Repository

LMS also supports bulk import into the Device and Credentials Repository.

To do bulk device import, navigate through **CWHP > Common Services > Device Management > Bulk Import**.

Bulk import into DCR can be done by one of the three formats listed below.

- File Import

  Select the **File** option to import devices from a CSV or XML file.

  The input file should have the format as specified in the online help. In this case, all device credentials can be provided along with the device name and IP address.

  If the imported device does not have a device type associated with it, then it will be a member of the group */Device Type Groups/Unknown Device Type*.

  You can then assign a device type to the device by selecting the device in Device Management screen and clicking **Edit**.

- Local NMS Import

  To import devices from either HP OpenView Network Node Manager 6.x or IBM Tivoli NetView 7.x installed in the same machine as the CiscoWorks server, select the **Local NMS** option. You will have to provide the installation location of HP OpenView NNM 6.x or IBM Tivoli NetView 7.x.

- Remote NMS Option

  To import devices from either HP OpenView Network Node Manager 6.x or IBM Tivoli NetView 7.x installed in a different machine from the CiscoWorks server, select the **Remote NMS** option.

Note: In LMS 2.6, the importing devices is allowed only from a remote Unix NMS server or a remote Windows NMS server that supports the RSH protocol.

Editing the Credentials for the Imported Devices

Once the devices have been imported through the **Local NMS** or **Remote NMS** options, you can edit the credentials for these devices by selecting the groups to which the devices belong, then in the Device Management screen, click **Edit**.

Note: If you have CDP enabled on your network, populating the Cisco devices through Campus Manager Device Discovery is recommended.

Device Credentials Update

To utilize the complete functionality of LMS, device credentials other than the SNMP read credentials need to be entered in the Device and Credentials Repository.

To perform credential update in DCR:

Step 1. Navigate to **CWHP > Common Services > Device and Credentials > Device Management**.

Step 2. Select the devices under the *All Devices* group by checking the *All Devices* group, then click **Edit**.

Note: Don't select any device in the screen that follows.

Step 3. Click **Next**, which will by default select all the devices.

Step 4. Enter the device credentials, then click **Finish**.

Step 5. If you need to enter *User Fields* for devices, click **Next** and enter up to four user-defined fields.

If all the devices have the same credentials, use the above step to Edit their credentials.

Step 6. However, if the devices have different credentials, create groups of devices having the same credentials by going to **CWHP > Common Services > Groups**.

Step 7. Create groups underneath the *CS@server-name/User Defined Groups*.

Device Management

Device discovery just populates devices in LMS. Additional information about the devices such as configuration files and software images on the network needs to be added. All applications within LMS should be populated with the imported devices.

Adding Devices to RME From DCR

If RME has not been set up in Auto Synchronize mode, devices can be added into RME from the Device and Credentials Repository using either of following procedures:

- If all the devices added in DCR are also to be managed by RME, the Auto Synchronize option in RME should be enabled.

  You can enable Auto Synchronization by:

a. Going to the CiscoWorks Home Page and navigating to **RME > Administration > Device Management > Device Management Settings**.

b. Check **Automatically Manage Devices from Credential Repository**.

- If only a subset of devices available in DCR are to be managed in RME, the Auto

Synchronize option can be left turned off.

If the devices have been populated through Campus Manager Device Discovery or a third party NMS and if the Auto Synchronize option on RME was enabled, the initial configuration collection of devices would fail since the credentials (SNMP write, Telnet/SSH) needed for configuration collection were not available in LMS.

Viewing Configuration Collection Status in RME

You can view configuration collection status in RME by:

a. Going to **CWHP > Resource Manager Essentials > Config Management > Archive Management**.

b. To see the list of devices that failed the archive operation, click the **Number of Failed Devices** link.

Since the credentials have been updated in LMS, you would need to run the synchronize operation to collect the configuration files for the managed devices.

Collecting Devices' Startup and Running Config

To collect the startup and running configuration of devices:

Step 1. Go to **TOC > Sync Archive**.

Step 2. You must schedule a Sync Archive job. To do so, select the devices under **RME** group.

Step 3. Check **Fetch Startup Config**.

This can be done only for the devices that failed the initial synchronize archive operation.

Taking these steps should populate the managed devices in the server. To ensure that the applications are working properly, step through the verification process described in the following section.

Verification of Device Import Status in LMS Applications

This section describes the verification of device import procedures in Resource Manager Essentials, Campus Manager, and Device Fault Manager.

Resource Manager Essentials

The following RME device verification tasks are described in this section:

Confirm Configuration File Collection

To confirm if the configuration files have been collected:

1. To verify job status, go to **Config Management**, then select the **Archive Management** link.
2. To view the archive collection status or view the job details, refresh the screen.

Check Device Credentials

To check the device credentials:

1. Check device credentials by going to **Resource Manager Essentials > Devices > Device Management > Device Credential Verification**.
2. To verify the type of device credentials to be checked, click **Check Device Credential**.
3. To view the report and see if the device credentials are correct, click **View Credential Verification Report**.

4. If you need to change the credentials on devices, click **Edit Device Credentials**.

Campus Manager

To get the current status of devices in Campus Manager:

Navigate to **CWHP > Campus Manager > Administration**.

- You can find the discovery status of devices under *Device Discovery*.
- You can view the data collection status of a device under *Data Collection*.

Device Fault Manager

To get the current status of devices in DFM:

Navigate to **CWHP > Device Fault Manager > Device Management > Discovery Status**.

- Devices should be in status *Known*.
- DFM Processing should be *Active*.

6. Server Administration in Cisco LAN Management Solution 2.6

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

Common Services

Common Services provides an operating foundation that allows Cisco Works applications to share data and system resources. It also provides a common desktop for launching Cisco Works applications and centralizes login, user role definitions, and access privileges. Periodic updates to Cisco Works Common Services are made available for download.

For installation and user guide documentation, please refer to the following documents: http://www.cisco.com/en/US/products/sw/cscowork/ps3996/tsd_products_support_series_home.html.

Creating User Defined Groups

Grouping devices in Common Services is used to create user-defined groups based on the User Defined field defined by DCR for the devices. These groups can then be used by Resource Manager Essentials, Campus Manager, Device Fault Manager, or Internetwork Performance Monitor to launch tools pertinent to that application.

To create user defined groups, follow these steps:

Step 1. Navigate to **CWHP > Common Services > Groups**.

Step 2. Select the **Group Admin** link.

Step 3. In the Group Administration window, select **/CS@server-name/User Defined Groups** from the group selector, then click **Create**.

Step 4. Enter a group name and click **Next**.

Step 5. Select the **Variable** drop-down box.

The *Variable* field offers four possible values*: user_defined_field_0, user_defined_field_1, user_defined_field_2,* and *user_defined_field_3*.

Step 6. Select an operator and value that matches the device value in DCR, then click **Add Rule Expression** and click **Next**.

All the devices that match the criteria are shown in the right panel.

Step 7. Click **Next**.

Step 8. To create the new group under */CS@server-name/User Defined Groups*, click **Finish**.

This newly created group can be accessed from any application screen in LMS.

Backing Up LMS Data

Cisco recommends that the backup data should not be stored in the directory where LMS is installed (by default, under the NMSROOT directory in Windows or Solaris). Please note that the DCR Master/Slave mode is also backed up.

To backup LMS data:

Step 1. Navigate to **CWHP > Common Services > Admin**.

Step 2. Select the **Backup** link.

Step 3. You can provide a backup directory name.

The backup job can either be run immediately or be scheduled.

Restoring LMS Data

Restoring LMS data can be done only via the command line interface.

Step 1. Log in to the LMS server.

Step 2. Shutdown the daemon manager:

- For a Windows server: Execute the **net stop crmdmgtd** command.
- For a Solaris server: Execute the **/etc/init.d/dmgtd stop** command.

Step 3. Change directory to *NMSROOT/bin*.

Step 4. Execute the script **restorebackup.pl**.

Example Restore Operation (Solaris)

An example of the restorebackup.pl operation in a Solaris server is given below.

```
/opt/CSCOpx/bin/perl /opt/CSCOpx/bin/restorebackup.pl –d /tmp
```

In the above command, */tmp* is the location of the backup directory.

Restore Program Help

The Help on the restorebackup Perl script provides the following information:

To run the restore command, the command syntax is:

```
/opt/CSCOpx/bin/perl /opt/CSCOpx/bin/restorebackup.pl <-d
BackupDirectory> [-gen GenerationNumber] [-t TempDirectory] [-help]
```

- BackupDirectory: Directory where the backup archive is present.
- GenerationNumber: Generation to be restored.
- TempDirectory: Temporary directory for the Restore program.

Default TempDirectory for this Restore program: `/opt/CSCOpx/tempBackupData`

Use **`-t`** *`TempDirectory`* to define your own temp directory.

To see a list of the Backed Up generations available, use the following command line:

```
/opt/CSCOpx/bin/perl /opt/CSCOpx/bin/restorebackup.pl -h -d
BackupDirectory
```

Campus Manager

In Campus Manager 4.0, the discovery mechanism can be categorized into the following three areas:

- Device Discovery
- Data Collection
- User Tracking Major Acquisition

Campus Manager Device Discovery

Device Discovery can be run on a predetermined schedule or initiated by an operator.

The following are some key facts about Device Discovery:

- Device Discovery performs Network Discovery using Cisco Discovery Protocol as the discovery mechanism.
- Device Discovery determines the management IP address of the device.
- Devices in DCR and user-configured seed devices from Campus Manager are used by the device discovery process. It populates the Device and Credentials Repository with the following discovered information:
  - Host name
  - Domain name
  - Management IP address
  - Display name
  - sysObjectID
  - SNMP credentials

Discovering a device is not equivalent to managing the device in Campus Manager.

Optimizing Network Discovery

To optimize the discovery of the network, the following tasks can be performed.

Setting up IP Filters

IP filters can be set if only certain subnets need to be discovered. IP address filters help a user to define IP address ranges inside of which devices need to be discovered. These IP address ranges typically fall inside the same subnet.

To set up IP filters:

1. Navigate to **Campus Manager Administration > Admin > Device Discovery > Discovery Settings**.
2. Under *IP Address Range*, click **Configure**.

Disabling DNS Lookup

DNS lookup could be one potential area for device discovery to slow down, so DNS lookup can be disabled.

To disable DNS lookup:

1. Navigate to **Campus Manager Administration > Admin > Device Discovery > Discovery Settings**.
2. Uncheck the **DNS Lookup** checkbox.

Troubleshooting Device Discovery

To troubleshoot device discovery:

1. Navigate to the **Campus Manager Panel from CWHP > Campus Manager Administration > Reports > Discovery Reports**.
2. Check to see if the SNMP settings are correct for the devices to be discovered correctly.

3. If the log file shows any SNMP timeout exceptions, you can increase **SNMP Timeout** and **Retry** values.

Campus Manager Data Collection

You can run Data Collection on a predetermined schedule or through operator action.

The following are some key facts about Campus Manager Data Collection:

A list of devices and corresponding credentials in Device and Credentials Repository are used for data collection.

Only devices in DCR are managed. If a device is not in DCR, then it cannot be managed by Campus Manager.

A filtering mechanism can be applied to manage a subset of devices found in Device and Credentials Repository. The filtering is based on either IP address or VTP domain.

Optimizing Data Collection

To optimize the data collection for devices in the network, complete the following tasks:

Setting IP Address or VTP Domain Filters

You can set IP address or VTP domain filters by navigating to **Campus Manager Administration > Admin > Campus Data Collection > Data Collection Filters**.

Optimizing According to the Number of Devices

- When data collection is done for more than 5,000 devices, the ANIServer process (Java based) reaches a threshold of 1,024 MB.
- If data collection is done for a device count close to 5,000, Cisco recommends you increase the heap size for the ANIServer from *–Xmx1024m to –Xmx1280m*.

  Modifying the heap size. To modify the heap size in the ANIServer, edit the file *NMSROOT/objects/dmgt/dmgtd.conf* file.

  In this file, there is an entry for starting the ANIServer process. This entry has a string **-Xmx1024**. Change this string **to -Xmx1280m**.

Note: Any edits to *dmgtd.conf* file can be done only after the LMS server is shutdown. You must restart the LMS server the edit to the *dmgtd.conf* file is complete.

User Tracking Module

In addition to the Campus Manager data collection feature, the User Tracking module in Campus Manager can acquire data on end hosts, IP phones, and subnets. There are two major types of acquisition in User Tracking:

- *Major Acquisition*: Collects data on end hosts, Cisco IP phones, and subnets in the network.
- *Minor Acquisition*: Polls the end hosts and IP phones to keep the User Tracking data current.

Initiating a UT Major Discovery

1. Navigate to **CWHP > Campus Manager > User Tracking > Admin > Acquisition**.
2. Initiate a **UT Major Discovery**.

The following is the list of some important options that can be selected for a major acquisition:

- *Enable User Tracking for DHCP environment*: This is an option for tracking the end hosts in case the IP address changes.
- *Use DNS to resolve host names*: This is an option for resolving the host names.
- *IP phone acquisition on dot1q trunks for IOS switches*: This is an option for fetching end hosts that are connected to a switch in Voice VLAN Setup.

Setting a Schedule for a Major Acquisition

To set a schedule for running a major acquisition:

1. Navigate to **Campus Manager > User Tracking > Admin > Acquisition**.
2. Then select the **Schedule Acquisition** link.

Ping Sweep on IP Addresses in a Subnet

You can enable a ping sweep on all IP addresses in a subnet before starting a major acquisition. There is an option to exclude certain subnets from the ping sweep.

Purge Policies

You can delete end hosts and IP phones from User Tracking either on demand or on a specified interval after major acquisition:

Navigate to **CWHP > Campus Manager > User Tracking > Admin > Acquisition > Delete Interval**.

Archives or jobs older than a particular date can also be purged:

Navigate to **CWHP > Campus Manager > User Tracking > Admin > Reports > User Tracking Purge Policy**.

Hierarchical Groups in Campus Manager

Hierarchical groups help users to visualize the topology implemented for user-defined groups. Hierarchical groups are created on top of Topology groups.

Step 1. Navigate to **CWHP > Campus Manager**.

Step 2. Select the **Topology Services** link.

Step 3. In the window that opens up, select **Topology Groups**, then right-click **/Campus@server-name/System Defined Groups**.

Step 4. Select the **Display View** option.

The three immediate subgroups are shown as maps. You can click on the maps and choose to show aggregate links between two maps. This view shows the aggregate links between all devices contained inside those two maps.

Resource Manager Essentials

This section describes the LMS server administration tasks for Resource Manager Essentials.

Inventory Collection/Polling

At the time of RME installation, system jobs are created for both Inventory collection and polling, with their own default schedules. 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 inventory changes and collects and updates the inventory database only if there is a change.

The default (out of the box) periodicity of the collector job is once a week and the default (out of the box) periodicity of the poller job is once a day.

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

To change the default settings, navigate to **Resource Manager Essentials > Administration > Inventory > System Job Schedule**.

The System Job Schedule dialog box displays the current collection or polling schedule, change the values and click Apply.

Configuration File Collection and Polling

The configuration archive can be updated with configuration changes by periodic configuration archival (with and without configuration polling). You can enable this using **Resource Manager Essentials > Administration > Config Mgmt > Archive Mgmt > Collection Settings**.

Note: A scheduled collection and polling are disabled by default as the customer’s network may have sporadic bursts of traffic and the NMS 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 a 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.

1. Select **Resource Manager Essentials > Administration > Config Mgmt > Archive Mgmt > Collection Settings**.
2. Select one or all the options.
   - Default Protocols used for 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. The order of protocols that are used can be re-arranged or some protocols can be removed from the list if it is not relevant to your network.

     The default order of protocols used and the option to change the order can be accessed by navigating to **Resource Manager Essentials > Administration > Config Mgmt**.

Purge Policies

Configuration Management

You can specify when to purge archived configurations. This frees disk space and keeps your archive at a manageable size. You can purge configurations based on two criteria:

- Their age. Configurations older than the number of days you specify are purged.
- The maximum number of versions of each configuration to keep.

The oldest configuration is purged when the maximum number is reached. For example, if you set the maximum versions to keep to 10, when the eleventh version of a configuration is archived, the first is purged to keep the total number of archived versions at 10.

By default, the purging jobs are disabled.

1. Choose **Resource Manager Essentials > Administration > Config Mgmt > Archive Mgmt > Purge Settings**.

The Archive Purge Setup dialog box appears.

2. Select **Enable**.
3. To schedule a purge job, click **Change**.
4. To specify when to purge configuration files from the archive, select one or both of the following options:

a. To retain and then enter the number of configurations to retain, click Maximum Versions.

b. Click **Purge versions older than**, then enter a number and select *days, weeks,* or *months*.

c. To delete the labeled configuration files, click **Purge labeled files**.

The purged labeled files will be deleted only if it satisfies these conditions Maximum versions to retain and Purge versions older than.

5. Click **Apply**.

Syslog

A default policy can be specified for the periodic purging of Syslog messages.

To specify the default purge policy:

1. Choose **Resource Manager Essentials > Administration > Syslog > Set Purge Policy**.
2. Specify the number of days in the Purge records older than field.

Only the records older than the number of days that you specify here, will be purged. The default value is 7 days.

Defining Message Filters

You can exclude messages from Syslog Analyzer by creating filters.

1. Choose **Resource Manager Essentials > Tools > Syslog > Message Filters**.

   A list of all message filters is displayed in a dialog box, along with the names, and the status of each filter—Enabled, or Disabled.

2. Specify whether the filters are for dropping the Syslog messages or for keeping them, by selecting either **Drop or Keep**.
   - If you select the **Drop** option, the Common Syslog Collector drops the syslogs that match any of the "Drop" filters from further processing.
   - If you select the **Keep** option, Collector allows only the syslogs that match any of the "Keep" filters, for further processing.

Note: The **Drop or Keep** option applies to all message filters and is not on a per-filter basis.

Change Audit

You can schedule a periodic purge or a forced purge of Change Audit data. This frees disk space and maintains the Change Audit data at a manageable size.

1. Select **Resource Manager Essentials > Administration > ChangeAudit > Set Purge Policy**.
2. To save the purge policy that you have specified, enter the values for each field. then click **Save**.

Setting Up Inventory Filters

Certain inventory attributes can change often and these changes can get logged whenever there is a collection. This may cause a lot of change audit messages to accumulate over a period of time. To prevent this inventory change filters can be enabled to not track change audits for these attributes.

You can set inventory filters by navigating to **Resource Manager Essentials > Administration > Inventory > Inventory Change Filter**.

Defining Exception Periods

An Exceptions period is a time you specify when no network changes should occur.

1. Set the Exception period by navigating to **Resource Manager Essentials > Tools > Change Audit > Exception Period Definition**.
2. Select **Days of the week** from the Day drop-down list box.
3. Specify the start time and the end time from the Start Time and the End Time drop-down list box, then click **Add**.

SWIM Baseline Collection

We recommend 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 become 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. Choose **Resource Manager Essentials > Software Mgmt > Software Repository > Software Repository Synchronization**.
2. Click Schedule. Enter the information, then click **Submit**.
3. Import a baseline of all software images.

   Once the Software Repository Synchronization job finishes successfully, you can create a job to import all software images on your network by following these steps:

4. Choose **Resource Manager Essentials > Software Mgmt > Software Repository**, then click **Add**.
5. Select **Network** and **Use generated Out-of-sync Report**, then click **Next**.

   All running images that are not in the software repository will appear.

6. Click **Next**.
7. Enter the Job Control Information, click **Next**, then click **Finish**.

Note: If you do not select the **Use generated Out-of-sync Report** option, it will take more time to show the software image selection dialog box.

Job Management

Jobs need to be created for performing archive management, edit of configuration, download of configuration and device IOS/CatOS image management. There is a central location where all jobs created for various purposes in RME can be viewed.

The central location can be accessed by navigating to **CWHP > Resource Manager Essentials > Job Mgmt > RME Jobs**.

All jobs can be searched on criteria such as status of the jobs and type of job.

Configuring Job Approval

RME allows approval of jobs before they are executed. The following are the logical steps to configure job approval.

1. Specify Approver Information. Navigate to **CWHP > Resource Manager Essentials > Administration > Approval > Approver Details**.

Note: The user created here should have Approver role in the system (be it local security mode or ACS security mode).

2. Specify Approver Lists. You must create a list of approvers. The list has to be named and assigned approvers.

a. Navigate to **CWHP > Resource Manager Essentials > Administration > Approval > Create/Edit Approver Lists**.

b. Provide an Approver name in the top left text field, then click **Add**.

c. Select users from the list of available users field in the middle, then click **Add**.

d. Save the configuration of approval lists.

3. Assign approval lists with the various functions such as NetConfig, Config Editor, Archive Management and Software Management.
4. Enable Approval policies on the various functions like NetConfig, Config Editor, Archive Management and Software Management.

The steps described above require all jobs created for NetConfig, Config Editor, Archive Management and Software Management to be approved before being executed.

Viewing Jobs Pending Approval

To view all jobs pending approval, navigate to **CWHP > Resource Manager Essentials > Job Mgmt > Job Approval**.

The approver can either accept or reject the job. If a job is rejected, the status of the job is updated for the user who created the job.

Importing Devices into Internetwork Performance Monitor

Once the devices are added into the Device and Credentials Repository, you can import devices from DCR into Internetwork Performance Monitor. IPM interacts with this repository to get the device list, device attributes, and device credentials.

Note: Before you import devices from Device and Credential Repository, ensure that there are devices in the repository. Also, there is no mechanism to import only selected devices from DCR into IPM. All the devices in DCR will be imported into IPM. Those devices in DCR that cannot be an IPM source will be not added and in the import log file there will be an error message for that device.

You can import devices as:

- Sources

  When you import devices as Sources, IPM contacts the device and adds them only if they are running IOS image with IP SLA feature and if the Read and Write community strings are provided.

- Target IP SLA responders

  When devices are imported as Target IP SLA Responders, if the device has a read community string, IPM verifies whether the IP SLA responder is enabled or not on the target. If there is not a read community string, the target's IP SLA responder status is not verified.

- Target IP devices

  When you import devices as Target IP Devices, IPM adds the device without either contacting the device or making any verification.

When you import devices from the Device and Credentials Repository, if the devices already exist in IPM, they are updated.

Import status log file

IPM creates a separate log file for the Device and Credentials Repository Import status. You can view the log file in: IPMROOT/etc/source or IPMROOT/etc/target.

View the results of importing devices

You can view the results of importing devices from the CiscoWorks home page by clicking View Import Source Log or View Import Target Log.

Device Fault Manager

Administration of the DFM Server can be categorized into the following sections.

Daily Purging Schedule

Set up a daily purging schedule for fault history information in the DFM.

To set up a purge schedule, navigate to the **DFM panel and choose Configuration > Other Configuration > Daily Purging Schedule**.

Forwarding SNMP Traps

This configuration can be made to blindly forward traps that come into the trap receiver of the DFM. These are traps that are received from the devices in the network.

To set up trap forwarding, navigate to the DFM panel and choose **Configuration > Other Configuration > SNMP Trap Forwarding**.

Note: It is not NB trap generation for applications like HP Open View

Receiving SNMP Traps

This configuration is made for setting the global port for receiving traps in DFM.

To set the port used for trap receiving, navigate to DFM panel and choose **Configuration > Other Configuration > SNMP Trap Receiving**.

Default SMTP Server

DFM has an email notification service that can send emails when alerts or events are generated. This email notification service needs SMTP Server information for forwarding emails.

To set the SMTP Server information for sending emails, navigate to the DFM panel and choose **Configuration > Other Configuration > SMTP Default Server**.

Rediscovery

Rediscovery is limited to the list of devices that are known to DFM. You can schedule multiple rediscoveries.

To schedule a rediscovery, navigate to **Configuration > Other Configuration > Rediscovery Schedule**.

Note: Rediscovery does not add devices into the DCR as it would in Campus Manager.

Group Administration

Group administration's function is to create, edit or delete groups internal to DFM. These groups can be shared with other applications.

To create DFM groups, navigate to **Configuration > Other Configuration > Group Administration**.

Polling and Threshold Management

For the faults and events to show up in DFM, polling and threshold parameters need to be set.

Polling and Threshold parameters can be set by navigating to **CWHP > Device Fault Manager > Configuration > Polling and Threshold**.

- Polling parameters are used to make DFM Server poll the devices in the various groups in specified intervals.
- Threshold Parameters are used to determine the thresholds for various devices. When these thresholds are crossed for the various types of devices alerts are raised in DFM Server.

View Management

View Management allows the user to see alerts and activities on a group of devices. A view can be created on a list of groups and this view will be visible in the Alerts and Activities Window under Device Fault Manager.

To create views, navigate to **Configuration > Other Configuration > Alerts and Activities Defaults**.

CiscoView

Cisco View provides real time chassis view of the devices. Cisco View now provides a light weight

HTML-based client. It also incorporates IPv6 functionality with the manageability over IPv4 address.

To launch Cisco View, choose **CWHP > Cisco View > Chassis View**.

Device Center

Device Center is a portal within the LMS bundle that provides the ability to gather and debug information about a particular device. The “Summary” in device center provides information about the device IP address, Device type, 24-hour Change Audit Summary, Last inventory and configuration collection times, Syslog summary, and any fault related alerts for the device and the neighboring devices.

Device Center also provides a set of functions that help facilitate debugging, run reports on the device and any management tasks such as changing credentials.

Device Center is installed as part of the Common Services install and can be launched from **CWHP > Device Troubleshooting > Device Center**.

The procedure to launch debugging utilities on a particular device is given below.

- Browse through the group hierarchies to select a device or search for a particular device by typing in the name in the search utility provided above the group selector. Click on the link on the device name after you have selected it. This launches the summary and tools page for the device.
- You can look at the 24-hour reports on the device in the top half of the right frame and launch tools in the bottom half of the right frame.
- A suggested list of tools to be launched in a particular order as follows. The list below is not complete but helps to understand some of the tools available in Device Center.
  - Ping: Ping the device to see if it is reachable from the LMS server.
  - Launch Credential Verification Report: Launch the Credential Verification Report to check for any missing credentials.
  - If the credentials are missing, launch the Edit Device Credentials tool to edit the credentials.
  - Launch the Detailed Device Report on the device to view memory, flash, image, IP address information.
  - Launch the Fault History Report to view any faults that occurred in the last 24 hours or 31 days.
  - If some faults are found, go to the CiscoView tool to view the chassis and make some changes on the interfaces or ports.
  - If the device is a switch, you can launch the Switch Port Usage Report for recently up, down or unused ports.
  - You can synchronize the archive or download a previous archive of the configuration or

do an image upgrade.

7. Network Management in Cisco LAN Management Solution 2.6

This chapter provides more details on the network management tasks in LMS across the various applications: Device Fault Manager, Resource Manager Essentials, Campus Manager, Internetwork Performance Monitor, and Common Services.

Fault Monitoring

The Device Fault Manager (DFM) gives you the option of monitoring faults in three distinct ways:

- You can look at historic fault data using fault history.
- You can choose to be notified by email, trap messages, or Syslog messages.
- You can look at the current faults in real-time in an alerts and activities window.

Set Up Tasks

The following tasks must be completed before fault monitoring can be enabled in Device Fault Manager:

Add List of Devices to the DCR

A list of devices must be added from Device and Credentials Repository into DFM.

Navigate to **CWHP > Device Fault Manager > Device Management > Device Selector** tool.

Check Status of Devices

The status of all devices should be in the Known state:

Choose **Device Fault Manager > Device Management > Device Summary**.

Polling and Threshold Configuration

Faults and events show up automatically for all devices because default polling settings are used for polling the devices.

To set the Polling and Threshold parameters:

1. Navigate to **CWHP > Device Fault Manager > Configuration**.
2. Then select the **Polling and Threshold link**.

This **Polling and Threshold** link provides an option to either change the default polling and threshold setting or to seta new polling and threshold setting for the user-defined device interface and port groups.

Polling parameters are used to make the Device Fault Manager server poll the devices in the various groups at specified intervals.

Threshold parameters determine the thresholds for various devices. When these thresholds are crossed, alerts are raised in the Device Fault Manager server.

Fault and Alerts Notification Services

Various notification services are available in Device Fault Manager to notify you of a fault or alert that occurred in the device.

Step 1. Navigate to **CWHP > Device Fault Manager**.

Step 2. Select the **Notification Services** link.

Step 3. Create a Notification Group by clicking the **Notification Groups** link.

Step 4. Select a group from the group selector, then choose one of the following:

- Alert severity
- Event severity
- Alert status
- Event status for the devices in the group to send notification

Step 5. Click **Next**.

Step 6. Provide the notification group name and click **Next**.

Step 7. Click **Finish** to create the notification group.

Step 8. To send traps to NB applications like HP Open View Network Node Manager when a notification needs to be raised per notification group, click the **SNMP Trap Notification link**.

Step 9. To send email notification to a user when a notification needs to be raised per notification group, click the **E-Mail Notification** link.

Step 10 To send syslog messages to other machines when a notification needs to be raised on a notification group, click the **Syslog Notification** link.

Fault History

No configuration is needed in Fault History. All faults in the devices are automatically accumulated and can be viewed:

Navigate to **Device Fault Manager**, then select the **Fault History** link.

You can view the faults by searching for a single device, a group of devices, a fault ID, or an event ID.

Alerts and Activities

The Alerts and Activities window shows the real-time display of faults on devices or views.

To launch the Alerts and Activities window:

Navigate to **CWHP > Device Fault Manager, then click the Alerts and Activities** link.

Baseline Configuration

All enterprises need to enforce some standard policy across all the devices in the network. Enterprise networks need to audit the policy periodically and enforce the policy if any devices are found in violation of it.

With the RME Baseline template and compliance check you can execute this functionality:

First identify a set of standardized policy-based commands that you want to have on a set of devices. Then create Baseline templates with those set of commands identified. After creating the baseline templates, you can accomplish following tasks.

- Compare device configurations and generate a report that lists all the devices that are non-compliant to the baseline template.
- Deploy the baseline template to the same category of devices in the network.
- Schedule a compliance check job and deploy the baseline template on to the devices.

Preprovisioning Devices

There is a new device status group in RME called *pre-deployed devices*. In the pre-deployed device state, the device has not been contacted by RME through protocols (such as SNMP, Telnet, and SSH). If RME successfully contacts the device through SNMP polling or pre-provisioned job completion, the device moves to a normal state.

The pre-deployed device state indicates that the devices are not reachable from the management server (either they are not in the network or sufficient credentials have not been provided).

Certain RME tasks that don't need prior device information can be performed on pre-deployed devices as they would on normal state devices. So you could pre-provision all the tasks (write a software image, get baseline configurations, etc.) in RME before the devices are online. After the RME server can contact the devices, those tasks can be pushed to the devices.

Data Extraction from LMS Applications

This section describes the Campus Data Extraction Engine and the RME Data Extraction Engine.

Campus Data Extraction Engine

Campus Manager provides a data extraction engine to extract data about the following:

- User tracking data
- Layer 2 topology
- Discrepancies in the network configuration

Data Extraction can be done either through the command-line interface or Servlet access.

The cmexport Utility

You can access the command-line interface utility ***cmexport*** by going to the *NMSROOT/campus/bin* directory.

The top-level Help provides the following information.

```
cmexport <-h | -v | commands> <arguments>
```

Core Commands

The core data extraction commands are described in Table 6.

You must invoke the **cmexport** command with one of the core commands specified in Table 6. If no core command is specified, **cmexport** can execute the **-v** or **-h** options only.

Table 6. Core Commands: Campus Manager Data Extraction

Core Command	Description
ut	Generates User Tracking data in XML format.
l2topology	Generates Layer 2 topology data in XML format.
discrepancy	Generates discrepancy data in XML format.
-f	Specify the filename and the directory for storing the Data Extraction Engine output.
-h	(Null option) Lists the usage Help information for this utility.
-v	Displays the version of the **cmexport** utility.

Archival Locations

Data generated through the **cmexport** command-line interface is archived at the following locations by default.

- For User Tracking:

  PX_DATADIR/cmexport/ut/timestamput.xml
- For Layer 2 Topology:

  PX_DATADIR/cmexport/L2Topology/timestampL2Topology.xml
- For Discrepancy:

  PX_DATADIR/cmexport/Discrepancy/timestampDiscrepancy.xml

Directory Locations

- The PX_DATADIR directory is at these locations:
  - Windows: *%NMSROOT%\files folder*
  - Solaris: */var/adm/CSCOpx/files*
- *NMSROOT* is the directory where you installed Campus Manager.
- *timestamp* is the time at which the log was written in this format:

  YearMonthDateHourOfDayMinuteSecond format.

This utility does not inherently delete the files created in the archive. You should delete these files when necessary. However, using the same filename and directory twice would cause the previous file to be overwritten.

Possible Combinations of cmexport Commands

User Tracking

Table 7. User Tracking cmexport Parameters

Parameter	Description
-layout	User tracking host data is exported in XML format for the layout given in *layoutname*. The layout is a custom layout defined by the user in UT. This parameter is applicable only when **–host** is chosen
-layoutPhone	User tracking phone data is exported in XML format for the layout given in **layoutPhone**. This parameter is applicable only when **–phone** is chosen.
-query	User tracking host data is exported in XML format for the query given in *queryname*. This parameter is applicable only when **–host** is chosen.
-queryPhone	User tracking phone data is exported in XML format for the query given in *phonequeryname*. This parameter is applicable only when **–phone** is chosen.
-view	Specifies the format in which the user tracking XML data is presented. It currently supports two options: • *switch*: User tracking data is displayed based on the switch. • *subnet*: User tracking data is displayed based on the subnet in which they are present.

Example Commands

```
cmexport ut –u admin –p admin –host
cmexport ut –u admin –p admin –phone
cmexport ut –u admin –p admin –host -query dupMAC –layout all
cmexport ut –u admin –p admin –host -query dupMAC –layout <name>
cmexport ut –u admin –p admin –phone -queryPhone <name> –layoutPhone
<name>
cmexport ut –u admin –p admin –host -f ut.xml
cmexport ut –u admin –view switch –host
```

Layer 2 Topology or Discrepancy Commands

```
cmexport L2Topology|Discrepancy –u admin –p admin
cmexport L2Topology|Discrepancy –u admin –p admin -f 013104L2.xml
```

Servlet Access to the Data Extraction Engine

The Servlet access to Campus Manager Data Extraction Engine is described below.

The Servlet accepts users request and authenticates the requesting user's identity using Common Services authentication mechanism. The command to export user tracking, topology, and discrepancy can be sent as HTTP or HTTPS requests.

The Servlet requires a payload file that contains details about the user's credentials, the command you want to execute, and optional details, such as log and debug options as inputs in XML format. The Servlet then parses the payload file encoded in XML, performs the operations, and returns the results in XML format. Typically, Servlet access is used to extract data from a client system. While generating data through the Servlet, the output will be displayed at the client terminal.

The input XML file contains various tags for username, password, core command, and optional tags.

Extracting the Export File From the Servlet

The steps to extract the export file from the Servlet are as follows:

Step 1. Generate the necessary payload XML file with the required data.

Step 2. Use a script to perform a POST operation to the Servlet with the payload file. The Servlet is: http://Campus-Server:1741/CSCOnm/campus/servlet/CMExportServlet

The HTTP response of the Servlet contains the XML file generated by executing the **cmexport** command on the server with the parameters provided in the payload file.

Step 3. Extract the XML file from the content of the HTTP response and save it to a local file.

Sample Payload

```
<payload>
<!–The following element specifies the username (valid CiscoWorks or
ACS user ID) of the person initiating this DEE call -->
   <username>username</username>
<!– The following element specifies the valid password of the user ID
-->
   <password>password</password>
<!–The following element specifies the DEE command used for
extracting UT host, phone, discrepancy and L2 topology information --
>
```

```
   <command>ut_host</command>
<!—The following element specifies the logfile where all logs need to
be output -->
   <logfile>filename</logfile>
<!—The following element specifies the debug level at which the log
is output. -->
   <debug>1</debug>
<!—The following element specifies the custom report name created in
the User Tracking user interface by navigating to CWHP > Campus
Manager > User Tracking > Reports > Custom Reports.>
   <view></view>
   </payload>
```

Sample Perl Script to Access the Servlet

Note: Sample scripts are available in the Campus Manager Data Extraction Engine online Help.

```
#!/opt/CSCOpx/bin/perl
use LWP::UserAgent;
$| = 1;
$temp = $ARGV[0] ;
$fname = $ARGV[1] ;
if ( -f $fname ) {
open (FILE,"$fname") || die "File open Failed $!";
while ( <FILE> )
{
   $str .= $_ ;
}
close(FILE);
}
url_call($temp);
#-- Activate a CGI:
sub url_call {
   my ($url) = @_;
   my $ua = new LWP::UserAgent;
   $ua->timeout(5000);
   my $hdr = new HTTP::Headers 'Content-Type' => 'text/html';
   my $req = new HTTP::Request ('GET', $url, $hdr);
   $req->content($str);
   my $res = $ua->request($req);
   my $result;
   if ($res->is_error)
   {
   print "ERROR : ", $res->code, " : ", $res->message, "\n";
   $result = '';
   }
   else
   {
   $result = $res->content;
```

```
if($result =~ /Authorization error/)
{
print "Authorization error\n";
}
else
{
print $result ;
}
}
```

The Perl script listed above will invoke the servlet with the use of *payload .xml* file. The command will look similar to these commands for HTTP and HTTPS modes:

- In HTTP mode

  *./perl script.pl http://server:1741/campus/servlet/CMExportServlet payload.xm*l
- In HTTPS mode:

  ./perl script.pl https://server/campus/servlet/CMExportServlet payload.xml

Any user using the Data Extraction Engine is authenticated and authorized. The username and password are either provided as part of the command-line interface and Servlet call or the password is put in a password file for retrieval by the Data Extraction Engine. The access permissions to the file can be set to prevent any unauthorized access. When using this option, the CMEXPORTFILE environment variable should be set so it points to the file containing the credentials. The command should be entered in the following format:

`cmexport ut –u admin –host`

This syntax enables **cmexport** to find the relevant password associated with the username (in the example here, for the username *admin*).

Resource Manager Essentials Data Extraction Engine

Resource Manager Essentials provides a data extraction engine to extract data about the following:

- Inventory
- Change audit
- A device's configuration details

Data extraction can be done by either through the command-line interface or Servlet access.

The command-line interface utility **cwcli** can be accessed by going to *NMSROOT/bin* directory.

The top-level Help command `cwcli –help` provides the following information:

General syntax to run a command with arguments is:

`cwcli <application/command> <arguments>`

For detailed help on a command and its arguments, run:

`cwcli` *`<application/command>`* **`-help`**

You must invoke the **cwcli** command with one of the core commands specified in Table 8. If no core command is specified, **cwcli** can execute the *-v* or **-help** options only.

Table 8. Core Commands: Resource Manager Essentials Data Extraction

Core Command	Description
config	Provides a set of commands that are used to download and fetch configurations, compare two different configurations, delete the archived configuration files, and reload the device.
export	Exports inventory/configuration/change audit data in XML.
inventory	A command-line interface tool to create, delete, and cancel an inventory collection job. It also helps in importing or exporting the data in inventory as XML files.
invreport	List all custom reports and generates CSV formatted inventory report(s) for given template(s).
netconfig	A command-line interface tool to create, delete, and cancel a NetConfig job. It also helps in importing or exporting the User Defined Template XML files
-v	Displays the version of the **cwcli** utility.
-help	(Null option) Lists the usage information for this utility.

Command-Line Syntax

The command line syntax of the application is in the following format:

```
cwcli export command GlobalArguments AppSpecificArguments
```

- **cwcli export** is the CiscoWorks command line interface for exporting inventory, configuration, and changeaudit details into XML format.
- *Command* specifies which core operation is to be performed.
- *GlobalArguments* are the additional parameters required for each core command.
- *AppSpecificArguments* are the optional parameters, which modify the behavior of the specific cwcli export core command.

The order of the arguments and options are not important. However, you must enter the core command immediately after **cwcli export**.

On UNIX, you can view the cwcli export man pages by setting the MANPATH to: */opt/CSCOpx/man/man1*

The man pages to launch the **cwcli export** command are **man cwcli-export** to launch the **cwcli export** command.

- To launch the cwcli export changeaudit command: **man export-changeaudit**
- To launch the cwcli export config command: **man export-config**
- To launch the cwcli export inventory command: **man export-inventory**

Data Archiving Location

Data generated through the `cwcli export` command-line interface is archived at the following locations by default:

- ChangeAudit
  - On Solaris: */var/adm/CSCOpx/files/rme/archive/YYYY-MM-DD-HH-MM-SS-changeaudit.xml*
  - On Windows: *NMSROOT\files\rme\archive\ YYYY-MM-DD-HH-MM-SS-changeaudit.xml*
- Config
  - On Solaris: */var/adm/CSCOpx/files/rme/cwconfig/YYYY-MM-DD-HH-MM-SS-MSMSMS-Device_Display_Name.xml*

- On Windows:
  NMSROOT\files\rme\cwconfig\ YYYY-MM-DD-HH-MM-SSMSMSMS-Device_Display_Name.xml

- Inventory
  - On Solaris: */var/adm/CSCOpx/files/rme/archive/YYYY-MM-DD-HH-MM-SS-inventory.xml*
  - On Windows: *NMSROOT\files\rme\archive\ YYYY-MM-DD-HH-MM-SS- inventory.xml*

RME Servlet

The details of Servlet access to RME Data Extraction Engine is given below.

The name of the Servlet is `/rme/cwcli`. The following is the Servlet to be invoked to execute any command:

For a post request
http://<rme-server>:<rme-port>/rme/cwcli <payload XML file>

For a get request
http://<rme-server>:<rme-port>/rme/cwcli?command=cwcli config <commandname>-u <user> -p<BAse64 encoded pwd> -args1 <arg1value>...

Note: Use <arg> and <argval> tags when the argument is a file.

The contents of the payload xml file are as follows.

```
<payload>
<command>
cwcli config export -u admin -p <Base64Encoded pwd> -device 1.1.1.1 -xml
</command>
<arg>
</arg>
<arg-val>
</arg-val>
</payload>
```

For example, to execute the import command payload.xml is as follows:

```
<payload>
<command>
cwcli config import -u admin -p <Base64Encoded pwd> -device 10.77.240.106
<arg>
-f
</arg>
<arg-val>
banner motd "welcome,Sir"
</arg-val>
</command>
</payload>
```

The Remote Access Servlet creates a temporary file with the contents specified between the arg -val tags for the **import** command. On the server, the command is executed as

```
cwcli config import -u admin -p <Base64Encoded pwd> -device
10.77.240.106 -f tempfile
```

Here the tempfile contains the line banner motd "welcome, Sir".

For example:

Perl samplescript.pl http(s)://<rme-server>:<rme-port>/rme/cwcli <payload XML file>

Note: For the secure mode (HTTPS), the port number is 443. The default port for CiscoWorks server in HTTP mode is 1741.

Sample Script to Invoke the Servlet

```
#!/opt/CSCOpx/bin/perl
use LWP::UserAgent;
$temp = $ARGV[0] ;
$fname = $ARGV[1] ;
open (FILE,"$fname") || die "File open Failed $!";
while ( <FILE> )
{ $str .= $_ ;
}
print $str ;
url_call($temp);
#-- Activate a CGI:
sub url_call
{
my ($url) = @_;
my $ua = new LWP::UserAgent;
$ua->timeout(1000);
# you can set timeout value depending on number of devices
my $hdr = new HTTP::Headers 'Content-Type' => 'text/html';
my $req = new HTTP::Request ('POST', $url, $hdr);
$req->content($str);
my $res = $ua->request ($req);
my $result;
if ($res->is_error)
{
print "ERROR : ", $res->code, " : ", $res->message, "\n"; $result =
'';
}
else {
$result = $res->content;
if($result =~ /Authorization error/)
{ print "Authorization error\n";
}
else {
print $result ;
```

```
}
}
}
```

Internetwork Performance Monitor Export

There has been no change in the way the data can be exported in Internetwork Performance Monitor from the previous version of the product. The **ipm export** command line interface is the command to do IPM export.

The IPM Export Command

The following example shows the command syntax and help that is displayed when you use the **ipm export** Help command:

You must be logged in as the root user (in Solaris) or administrator (in Windows) to use export IPM data using the **ipm export** command.

```
ipm export
    [-q] [[-k <letter>] | -w] [-h]
    [ ( -c | -s | -t | -o | -cs) [<CollectorName>] ]
    | [ (-dh | -dd | -dw | -dm) <StartTime> <EndTime> [
    <CollectorName> ] ]
    | [ (-jh | -jd | -jw | -jm) <StartTime> <EndTime> [
    <CollectorName> ] ]
    | [ (-ph | -pd | -pw | -pm) <StartTime> <EndTime> [
    <CollectorName> ] ]
    | [ -r [<WhichDay>] ]
    | [ -all [<StartDate>] [<EndDate>]]
```

General Options

[ipmRoot] Root location of IPM, such as */opt/CSCOipm*.

-q Quiet output: Display no column headings. Only applicable in plain text output format.

-k Delimiter: Set the field delimiter to <letter>. By default, this is set to a comma ','. This is only applicable in plain text output format.

-w HTML output: A web page will be generated from the output of this command.

-h Help - output this usage help

Format:

Time - <StartTime> and <EndTime> input as:
MM/DD/YYYY-hh:mm:ss

Date - <WhichDay> input as:
MM/DD/YYYY

<StartDate> and <EndDate> input as:
MM/DD/YYYY

The DCR Command Line Interface

Using the command line interface, you can add, delete, modify devices and change DCR modes. You can also view the list of DCR attributes that can be stored in DCR, and view the current DCR mode.

The main command to launch is at:

NMSROOT/bin/dcrcli

The steps are as follows:

Step 1. NMSROOT/bin/dcrcli –u *username*

Step 2. Enter the password corresponding to the username.

Step 3. Select one of the various top level commands

- add: Adds a device
- del: Deletes a device
- mod: Modifies a device
- lsattr: Lists the attributes stored in DCR
- details: View device details
- lsmode: Lists the DCR mode as Master, Slave, or Standalone
- setmaster, setstand, setslave: Sets the DCR to Master, Standalone, or Slave mode
- impFile, impNms, impRNms, impACS: Imports device list from File, Local NMS, Remote NMS and ACS (AAA server)
- exp: Exports to a file

UT Reports

You can generate UT Reports by navigating to **CWHP > Campus Manager > User Tracking > Reports**.

The following reports can be generated.

- UT provides the ability to quickly view reports on end hosts and IP Phones. A simple query can be input to view a subset of the end hosts or IP Phones present in UT.
- UT can run reports on switch port usage statistics of the switches. The switch port usage reports can be run for recently down, unused down and unused up ports.
- UT can list the jobs that are run periodically to generate reports. These jobs are for generating reports on end hosts, IP Phones, duplicate device entries and switch port usage. You can find the report job listing by navigating to **User Tracking > Reports > Report Jobs**.
- You can generate Custom Reports for end hosts and IP Phones by selecting a group, evaluating a query on the group to subset the number of end hosts and IP Phones.

  You can generate Custom reports by navigating to **User Tracking > Reports > Custom Reports**.

  You can save the custom reports.

You can use the custom reports while generating detailed reports on end hosts or IP phones by going to **User Tracking > Reports > Report Generator**.

Configuring Syslog on Devices

LMS has the ability to collect and analyze syslogs received from devices in the network. The ability to collect syslogs helps manage the network more effectively. Enabling syslogs provides a multi fold advantage:

- LMS will collect and update any configuration and inventory changes on the network.
- Received syslogs can be analyzed and can also be used for further triggering automated actions

Syslogs can be enabled on devices using NetConfig. A template for enabling Syslogs is built in NetConfig. You can access the template under **Resource Manager Essentials > Config Mgmt > NetConfig**.

Create a NetConfig job by clicking NetConfig Jobs under the TOC.

Once the device configurations are being managed by RME, you can enable syslogs through NetConfig. RME 4.0 provides the ability to schedule a single job for devices using Cisco IOS and Catalyst OS.

VLAN Recommendations

Campus Manager provides the ability to view VLANs and the ability to get recommendations on spanning trees. The different types of spanning trees that are supported for recommendations are PVST, MIST and 802.1s. Since most of the switched traffic is directed through the root bridge, it is essential to have the proper switch designated as the root bridge. Campus Manager provides the ability to select the root bridge based on the following criteria:

1. Least depth

   The least depth method would help the user select a root for the particular VLAN that would provide the least from each node in the network to the root. The spanning tree formed in this selection would have the minimum depth.

   The least depth spanning tree recommendation can be seen by the following sequence:

a. Go to **Topology Services > Network Views > LAN Edge View**.

b. Select the desired Switch Cloud and click **Display View**.

c. To run optimal root and instance reduction and instance recommendation reports, in the Switch Cloud view, select **Reports**, then select **Per VLAN STP Recommendations, Cisco MISTP Recommendations,** or **IEEE 802.1s Recommendations**.

2. Least cost

   Least cost recommendation will provide a recommendation on a root that would be the least cost from all the nodes in the switch cloud.

3. Traffic data

   Campus Manager also has the ability to recommend Root Bridge based on the traffic in the network.

Campus Manager accepts traffic information from two sources, one of the sources is NAM and the other source is the NetFlow collector.

Ether Channel and Trunk Deployment

Campus Manager Topology Services Layer 2 view also provides the ability to configure Ether channels and Trunks.

Ether Channel Configuration

For channel configuration, follow these steps:

1. Select a link on the Layer 2 View, right-click and select **Configure Ether Channel**.

   The Ether Channel Configuration window appears. The protocol for Ether Channel is PagP and the channel mode is *Desirable*.

2. The distribution protocol can be set to **ip, mac,** or **port** and the distribution address type can be set to **source, destination,** or **both**.

   The Ether Channel Configuration window also shows all the links between the two devices where the Ether channel is being set up. You can select the links that should be part of the Ether channel.

   The configuration window also provides the ability to copy running configuration to startup configuration.

Trunk Configuration

To configure Trunk configuration:

1. Right-click on a particular link and select **Create Trunk**.
2. Select the type of encapsulation **802.1Q, ISL** or **Negotiate**.
3. Enter the Allowed and Disallowed VLANs on that trunk.

Change Management

RME Config Editor

The RME 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 Function

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.

Change Audit

All changes made on the network through LMS are recorded as part of 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.

1. To view Change Audit reports, go to **Resource Manager Essentials > Reports > Report Generator**.
2. Select **Change Audit** as the application.

   The report type can be either a 24-hour report, Standard Report or Exception Period Report. These reports help manage the changes on the network.

Audit Trail

Resource Manager Essentials also provides the capability to have an Audit Trail. Audit Trail provides a trail of all the changes that are being on the server, for example, the addition or deletion of devices, or a credential change.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

Printed in USA C07-400501-01 02/08

