Setting Up Change and Configuration Management

Cisco Prime Network Change and Configuration Management (CCM) allows you to manage the device configurations and software images used by the devices in your network. These topics explain how to use CCM:

Whether you can perform these setup tasks depends on your account privileges. See Permissions Required to Perform Tasks Using the Prime Network Clients, page B-1 for more information.

Note After installing or upgrading Prime Network, we recommend you to clear the browser cache before using CCM.

Workflow for Setting Up CCM

The following table provides the basic workflow for setting up CCM.

	Description	See:
Step 1	Make sure Prime Network is set up correctly: • Verify the CCM port on the gateway, make sure the TFTP directory is set up on the gateway or unit, and so forth. • Check the global settings that can impact the CCM functions that users can perform. If necessary, ask your Administrator to adjust the settings.	 Configuring Prime Network for CCM, page 3-2 Checking Prime Network Global Settings for CCM Operations, page 3-4

	Description	See:
Step 2	Set up your devices so CCM can manage them—for example, make sure devices are reachable and your transfer protocols are set up correctly.	Setting Up Devices to Work With CCM, page 3-4
Step 3	Set up Configuration Management—for example, perform the initial backup of configuration files to the configuration archive, set up the policy for ongoing and event-driven configuration checks, and so forth.	Setting Up Configuration Management, page 3-5
Step 4	Set up Image Management—for example, configure the transport protocol and the staging and storage directories.	Setting Up Image Management, page 3-13
Step 5	Set up device groups for bulk CCM operations.	Setting Up CCM Device Groups, page 3-17

Setting Up Prime Network to Work With CCM

These topics describe how to set up Prime Network to use the CCM features:

- Configuring Prime Network for CCM, page 3-2
- Checking Prime Network Global Settings for CCM Operations, page 3-4

Configuring Prime Network for CCM

Check these settings to ensure Prime Network components are properly configured for CCM operations.

- Verify the gateway port to be used. 8043 is the secure HTTP port enabled by default for CCM, but you can use port 8080 instead using this command:

```
# cd $NCCM_HOME/scripts/
# ./nccmHTTP.csh enable
# dmctl stop
# dmctl start
```

  To disable port 8080, perform the same operation but use the **disable** argument.

- For Image Management, verify that the gateway has sufficient space for the storing and staging directories (see Reference: Image Management Global Settings, page 3-14).
- For file transfers using TFTP, verify that the TFTP directory is set up and available in the Prime Network gateway and/or unit. To modify and verify the TFTP directory, log in as *network-user* and run the following commands from *NETWORKHOME* (the Prime Network installation directory, which is export/home/*network-user* by default). In the following, *IP-address* is the IP address of the unit or gateway.
  - To check the TFTP directory:

```
./runRegTool.sh -gs 127.0.0.1 get IP-address avm83/services/tftp/read-dir

./runRegTool.sh -gs 127.0.0.1 get IP-address avm83/services/tftp/write-dir
```

  - To change the TFTP directory:

```
./runRegTool.sh -gs 127.0.0.1 set IP-address avm83/services/tftp/read-dir tftp dir name

./runRegTool.sh -gs 127.0.0.1 set IP-address avm83/services/tftp/write-dir tftp dir name
```

Supported TFTP Directory Name Format

The TFTP directory name (*tftp-dir-name*) must be a single word and should not include any absolute path from the root directory.

The following example represents the supported TFTP directory formats:

```
./runRegTool.sh -gs 127.0.0.1 set 10.81.87.25 avm83/services/tftp/write-dir
tftpnew1
./runRegTool.sh -gs 127.0.0.1 set 10.81.87.25 avm83/services/tftp/read-dir
tftpnew1
```

TFTP Directory Name Formats that are not Supported

Follow these restrictions while specifying the TFTP directory name (*tftp-dir-name*) in the registry settings:

Do not use the forward slash (/) at the beginning and the end of the TFTP directory name.

Specify the directory name without using the sub directories.

The following example represents that the sub directories *tftpnew/tftpinner* are used and this naming format is not supported:

```
./runRegTool.sh -gs 127.0.0.1 set 10.81.87.25 avm83/services/tftp/write-dir
tftpnew/tftpinner
./runRegTool.sh -gs 127.0.0.1 set 10.81.87.25 avm83/services/tftp/read-dir
tftpnew/tftpinner
```

Specify the same TFTP directory name in the registry settings for both the read directory *avm83/services/tftp/write-dir* and write directory *avm83/services/tftp/read-dir*:

The following example represents that the TFTP directory name *tftpnew1* is used for both the read and the write directories:

```
./runRegTool.sh -gs 127.0.0.1 set 10.81.87.25 avm83/services/tftp/write-dir
tftpnew1
./runRegTool.sh -gs 127.0.0.1 set 10.81.87.25 avm83/services/tftp/read-dir
tftpnew1
```

- Restart AVM 83:

```
networkctl -avm 83 restart
```

Note Do not block the port number 1069. Prime Network uses this port to listen the TFTP traffic flow.

- If the *gateway* is behind a firewall, you must open special ports for CCM. This is not required for units that are located behind firewalls and use Network Address Translation (NAT) because the unit will not require a publicly-available IP address in order for the gateway to contact it.
- For IPv6, CCM functions run smoothly when the network and devices have IPv6 addresses.
- Prime Network's information must be consistent with the device configuration.
  - The SCP port configured on the device VNE (Prime Network's model of the device) must match the SCP port used by the device. If a device is not using the default SCP port, the VNE must also be configured with the non-default port. VNE properties are controlled from the Administration client. See the *Cisco Prime Network 4.2.2 Administration Guide* for more information.

  - The SNMP read-write community configured on the device VNE must match the read-write community configured on the device.

- You can configure timeout for the Command-line interface used for Image distribution jobs. In Prime Network Administration, click **Tools > Registry Controller > Image Management Settings > Image Distribution** to configure timeout for image distribution. The default timeout value is 5400000 ms. You can enter a timeout value between 3600000 ms and 7200000 ms.

Checking Prime Network Global Settings for CCM Operations

The following default CCM behavior is controlled from the Administration client.

- The CCM actions that you can perform, and the devices you can view and manage. When a user account is created the administrator assigns a user access level to the user account.
  - The user access level controls what actions the user can perform using CCM.
  - The device scope determines which devices a user has permission to access, and what the user is allowed to do on those devices.

  For a matrix of actions users can perform depending on their user access level and device scope assignments, see Permissions Required to Perform Tasks Using the Prime Network Clients, page B-1.
- Whether users have permission to run CCM jobs. If global per-user authorization is enabled, a user can only run CCM jobs if they have been granted this permission in their user account settings. Global per-user authorization is disabled by default.
- Whether users are required to enter their credentials when they run CCM operations. This is disabled by default.

Note If Prime Network is being used with Prime Central, both, job authorization and credential requirements are enabled.

Users with Administrator privileges can change these settings. They can also configure Prime Network to generate a warning message whenever a user executes a command script. For more information, see the *Cisco Prime Network 4.2.2 Administrator Guide*.

Setting Up Devices to Work With CCM

Check these device settings to ensure your devices can communicate with Prime Network:

- Verify that the device is supported. See *Cisco Prime Network 4.2.2 Supported Cisco VNEs*.
- Make sure you have performed all of the CCM-specific device configuration prerequisites for adding VNEs. These commands are described in the *Cisco Prime Network 4.2.2 Administrator Guide*. For device configuration files, verify that devices are configured to forward configuration change notifications to Prime Network. If you will be using event-triggered archiving, make sure the **logging *gateway-IP*** command is configured on all devices. For CPT devices, the TL1 protocol must be enabled in the VNE Properties, and the default TL1 port is 3082.
- The SNMP read-write community configured on the device must match the SNMP read-write community on the device VNE.
- Verify the reachability between devices and their hosting units.

- Verify the FTP settings. CCM supports FTP for all file and image transfers. Although you can configure a username and password on the device using the **ip ftp** command, this may not be safe if the network is not secure. Before using FTP, do the following:
  - Configure the network device to add the Prime Network *unit user* credentials of the unit that manages the device. (You do not need to add Prime Network *unit server super-user* credentials of the to the device configuration.)
  - Restrict the FTP configuration such that the Prime Network *unit user* has read-write access only to the *NETWORKHOME*/tftp directory and therefore does not have access to unwanted files outside the home directory.
- For IPv6, CCM functions run smoothly when the network and devices have IPv6 addresses.

Setting Up Configuration Management

These topics provide information on how to set up the Configuration Management feature:

- Steps for Setting Up Configuration Management, page 3-5
- Reference: Global Settings for Configuration Management, page 3-7
- Notes on Exclude Commands, page 3-12

Note CCM does not support the following special characters on its Settings pages:

- For Password fields—>, <, ', /, \, !, :, ;, and "
- For all other fields—`, ~, @, #, $, %, ^, &, *, (,), +, =, |, {, }, [,], ', ?, >, <, /, \, !, :, ;, and "

Steps for Setting Up Configuration Management

Many Configuration Management features are disabled by default so that you do not encounter unexpected processing loads on your server—for example, how often CCM checks devices and backs up their configurations to the archive. The following steps explain what you must do to set up Configuration Management. All of these items are configured from the Configuration Management Settings page (**Configurations > Settings**). Many of these settings can be overridden when you create specific jobs.

1. Configure the transport protocol that Prime Network will use between the device and the gateway. These are controlled from the Transport Protocol area. The options are TFTP, SFTP/SCP, and FTP (TFTP is the default). To use FTP as the transfer protocol, you must install FTP on the gateway and the unit servers that manage the VNEs. Note the following:

   Note FTP is not a secure mode of transfer. Use SCP/SFTP instead, for secure config and image transfers.

   - The TFTP source interface on the devices must be able to reach the unit. Otherwise, the configuration management jobs that require TFTP may fail.
   - To use SFTP/SCP for configuration file transfers from a device to a unit, ensure that an SSH server is configured and running on the device (so that during the transfer, the device acts as a server and the unit as a client).

- For Cisco IOS, Cisco IOS XR, and Cisco IOS-XE devices, configure the device with K9-security-enabled images so that the SSH server is up and running on the device.
- To use SCP as the protocol to retrieve configuration files, execute the following command on the device:

```
# ip scp server enable
```

2. Enable the initial synchronization of the archive files with the configurations that are running on the network devices. Whenever the gateway is restarted, CCM will perform this synchronization. By default, synchronization is disabled. To enable it, activate **Enable Initial Config Syncup**.
3. Configure the policies that control how often CCM retrieves information from devices and copies (backs up) configuration files to the archive. By default, all of these settings are disabled. Consider these questions when configuring your settings:
   a. How much disk space is available? Smaller space may require more frequent purging.
   b. Should new configuration files be copied (backed up) to the archive on a periodic basis or on an event-driven basis?

      If configurations are changing frequently and the changes are not of immediate importance, use periodic backups by selecting **Enable Period Config Backup**. This will minimize server workload.

      Note The periodic setting is recommended.

      If every change is considered significant, use event-driven backups (**Enable Event-Triggered Config Archive**).
   c. For event-driven archiving, should information be copied to the archive immediately upon receiving a change (**Sync archive on each configuration change**)? Or should changes be queued and then copied at a certain interval (**Sync archives with changed configurations every ___ hours and ___ minutes**)? If information needs to be copied to the archive immediately, synchronize the archive on each configuration change. Otherwise, you can synchronize the archive at regular intervals (every 1-24 hours).

   While scheduling automatic backup operations, you might be prompted to enter your device access credentials. The device credentials are taken from the Configuration Settings. (See Setting Up Prime Network to Work With CCM, page 3-2.)
4. Configure CCM to perform periodic synchronization of out-of-sync devices by selecting **Enable Periodic Sync for Out of Sync Devices (24Hours)**. The configmgmt-synchronize-sysjob system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page.
5. Configure CCM to export archived configuration to an export server on a periodic basis by selecting **Enable Periodic Config Export** and **Export Settings.** This allows you to free up disk space while keeping a permanent record of historical archives.
6. Configure when files should be purged from the archive using the **Archive Purge Settings**. Consider these questions when configuring the purge settings:
   - How big are the configuration files?
   - How often are changes made to devices?
7. Specify the default mode of restoring configuration files to the devices using **Restore Mode**.
8. Configure the SMTP server and e-mail IDs so that regular configuration management job status e-mails are sent. (You can also specify e-mail settings when you create a job.)

9. Specify the commands that should be excluded when CCM compares device configuration files. A set of common exclude commands is provided by default (for example, ntp-clock-period). These are controlled in the **Exclude Commands** area (see Notes on Exclude Commands, page 3-12).

Note Configuring exclude commands is especially important if you are using event-driven archiving. Doing so avoids unnecessary file backups to the archive.

Reference: Global Settings for Configuration Management

Note In the Configuration Management and Image Management Settings pages, CCM does not support the following special characters:

- For Password fields—>, <, ', /, \, !, :, ;, and "
- For all other fields—`, ~, @, #, $, %, ^, &, *, (,), +, =, |, {, }, [,], ', ?, >, <, /, \, !, :, ;, and "

The following table describes all of the settings in the Configurations global settings page. To open the page, choose **Configurations > Settings**.

The backup settings you enter here do not affect the manual backups you can perform by choosing **Configurations > Backup**. The backups you perform from that page and the backups you configure on this Settings page are completely independent of each other.

Table 3-1 Configuration Archive Global Settings

Field	Description
Export Settings	
Server Name	DNS-resolvable server name. **Note** CCM supports export servers with IPv4 or IPv6 address.
Location	The full pathname of the directory to which Prime Network should copy the file on the server specified in the Server Name field.
Username	The login username that Prime Network should use when connecting to the server specified in the Server Name field.
Password	The login password that Prime Network should use when connecting to the server specified in the Server Name field.
Export Protocol	Default export protocol that Prime Network should use when exporting configuration files to another server. The choices are FTP and SFTP. The default is FTP. You can override this protocol while scheduling an export job, if required.
Archive Purge Settings	
When you set the Archive Purge Settings, the configmgmt-archivepurge-sysjob system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page.	
Minimum Versions to Retain	Minimum number of versions of each configuration that should be retained in the archive (default is 2).

Table 3-1 Configuration Archive Global Settings (continued)

Field	Description
Maximum Versions to Retain	Maximum number of versions of each configuration that Prime Network should retain (default is 5). The oldest configuration is purged when the maximum number is reached. Configurations marked **do not purge** are not included when calculating this number. The minimum number of versions to be retained is 5. The maximum number of versions that can be retained is 2147483647.
Minimum Age to Purge	Age (in days) at which configurations should be purged (between 5-360).
Configuration Change Purge Settings	
Purge Change Logs after	Age (in days) at which to purge Change Logs. (Change Logs contain configuration change notifications from devices.) The default is 30 days and the range is 5-360. When you set the Configuration Change Purge Settings, the configmgmt-changeadtprg-sysjob system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page.
Global Settings	
Transport Protocol	Default transport protocol that Prime Network should use when copying configuration files to and from a device. The options are TFTP, SFTP/SCP, and FTP. The default is TFTP. To use FTP as the transfer protocol, you must install FTP on the gateway and the unit servers that manage the VNEs. Note the following: • The TFTP source interface on the devices must be able to reach the unit. Otherwise, the configuration management jobs that require TFTP may fail. • To use SFTP/SCP for config transfers from a device to a unit, you need to ensure that an SSH server is configured and running on the device, such that the device acts as a server and the unit as a client during the transfer. For Cisco IOS, Cisco IOS XR, and Cisco IOS-XE devices, configure the device with K9-security-enabled images so that the SSH server is up and running on the device. For information on the transfer protocol that CCM supports for each device, see the *Cisco Prime Network 4.2.2 Supported VNEs - Addendum*. For its Supported Protocols see the *Support for Change and Configuration Management in 4.2 tables*.
Enable Periodic Config Backup	Detect ongoing configuration changes by performing a periodic collection of device information. Use this method if configurations change frequently but those changes are *not* important to you. CCM compares the timestamp for the last configuration change on the version in the archive with the timestamp on the newer version. If they are different, CCM backs the new file to the archive immediately. By default, this is not enabled. The start time and repeat interval are configurable (4-100 hours). The default start time is 12:00 AM and the default repeat interval is 72 hours. **Note** This CCM collection is independent of the Prime Network inventory collection. When you enable this option, the Configmgmt-backup-sysjob system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page.

Table 3-1 Configuration Archive Global Settings (continued)

Field	Description
Enable Periodic Sync for Out of Sync Devices (72 Hours)	(For Cisco IOS only) Enables automatic synchronization of the out-of-sync devices on a periodic basis. Prime Network adds a device to the list of out-of-sync devices whenever the latest version of the startup configuration is not in sync with the latest version of the running configuration file on the device. The start time and repeat interval are configurable (4-100 hours). The default start time is 12:00 AM and the default repeat interval is 72 hours. When you enable this option, the configmgmt-synchronize-sysjob system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page.
Periodic Export Options	
Enable Periodic Config Export	Allows CCM to periodically export configurations from the archive to the export server. You can set up an interval in the range of 4-100 hours. The default value for export interval is 24 hours. You can also specify the start time for the periodic export operation. Choose one of the following to specify how the export job should be performed when a copy of an archived configuration already exists on the export server: • Export configuration file with all configurations—Overwrite the existing configuration on the export server. • Do not export configuration file—Do nothing. • Export configuration file with reference to previous configuration file— Create a new file that only contains a reference to the previous file. Refer to Copying the Device Files to the Archive (Backups), page 9-32, to learn more about the type of configuration files exported for different devices. When you enable this option, the configmgmt-export-sysjob system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page.
Enable Initial Config Syncup	Allows CCM to fetch the configuration files from the network devices and archive it whenever a new device is added to Prime Network. This populates the Configuration Sync Status dashlet on the dashboard. If this setting is enabled, CCM will *not* perform a syncup when the gateway is restarted (to protect performance), and the Disable Initial Config Syncup on Restart is checked by default. If you *do* want CCM to fetch the configuration files when the gateway restarts, uncheck the Disable Initial Config Syncup on Restart check box. **Note** The "sync up" described here pertains to making sure the archive correctly reflects the network device configurations. This is different from the Synchronize operation, where devices are checked to make sure their running and startup configurations are the same.
Disable Initial Config Syncup on Restart	Do not fetch configuration files when the gateway restarts.

Table 3-1 Configuration Archive Global Settings (continued)

Field	Description
Enable Event-Triggered Config Archive	Detect ongoing configuration changes by monitoring device configuration change notifications. This setting also controls whether Prime Network populates the Configuration Changes in the Last Week and the Most Recent Configuration Changes dashlets (on the dashboard). When you enable this option, the configmgmt-chngprdcsync-sys job system job is scheduled. You can view the scheduled job in the Configuration Management Jobs (**Configurations > Jobs**) page. Use this method if you consider every configuration file change to be significant. When a notification is received, CCM backs up the new running configuration file to the archive using one of the following methods: • Sync archive on each configuration change—Upon receiving a change notification from a device, immediately backs up the device configuration file to the archive. For each configuration change, a new archive version is created in the Configuration Archives page (Configurations > Archives) and the archive version ID is updated in the Configuration Change Logs page (Configurations > Change Logs). If the archive version is not created in the Configuration Archives page, the Version column in the Configuration Change Logs page displays "N/A". • Sync archives with changed configurations every ___ hours and ___ minutes—Upon receiving a change notification from a device, queue the changes and backs up the device configuration files according to the specified schedule. When a change is queued, the configuration change is updated in the Configuration Change Logs page but the Version column displays "N/A". The backup operation starts to execute and based on the time that the device takes to respond, CCM fetches the running configuration from the device. When the backup operation is successful, a new archive version is created in the Configuration Archives page and the version ID is updated in the Version column in the Configuration Change Logs page. Following are the scenarios when the version ID is not updated in the Configuration Change Logs page: • If you change any configuration using the Exclude Command, CCM ignores the change and will not create any new archive version in the Configuration Archives page. Therefore, version ID is not updated in the Configuration Change Logs page. Make sure you check the Excluded Commands area in the Configuration Management Settings page. • When the backup operation fails and a new archive version is not created in the Configuration Archives page. **Note** Make sure that the configuration change detection schedule does not conflict with purging, since both processes are database-intensive. **Note** If you are using event-triggered archiving, you should also make sure that exclude commands are properly configured. Exclude commands are commands that Prime Network ignores when comparing configurations, and they are controlled from the Settings page. Using this mechanism eliminates unnecessary file backups to the archive. When a configuration change occurs for Cisco ASR 5000, Cisco ASR5500, and Cisco OLT devices, the relevant trap does not include the information about the user who initiated the configuration change. Therefore, the User column in the Configuration Change Logs page displays "N/A".

Table 3-1 Configuration Archive Global Settings (continued)

Field	Description
	Enabling the Enable Event-Triggered Config Archive will start the CCM TFS registration and disabling this option will stop the CCM TFS registration. If you stop the CCM TFS registration in the Event Notification Services page of Prime Network Administration, when the Enable Event-Triggered Config Archive option is enabled, CCM will not receive any change notifications. Similarly, if you start the CCM TFS registration in the Event Notification Services page of Prime Network Administration, when the Enable Event-Triggered Config Archive option is disabled, the count of notifications will increase in the Event Notification Service page, but CCM will not receive any change notifications. Hence, change logs will not be created.
Device Access Credentials	For enhanced security, and to prevent unauthorized access to devices, you might be asked to enter device credentials. This option is enabled if, from the Administration client, **Global Settings > Security Settings > User Account Settings > Execution of Configuration Operations**, you checked the option **Ask for user credentials when running configuration operations**. By default, the device credentials field is populated with the default VNE credentials. You must change the credentials to the device credentials before you save the settings. System jobs will fail, if the credentials entered are incorrect. If you checked the option **Ask for user credentials when running configuration operations** from the Administration client, and did not change the settings from the Settings page after making the change, all system jobs that are scheduled to run will fail. If the option **Ask for user credentials when running configuration operations** (from the Administration client) is not enabled, the default VNE credentials are used. Also, if device credentials are entered in the Settings page, and the option **Ask for user credentials when running configuration operations** is not enabled from the Prime Network Administration client (the Administration client), the device credentials you have entered in the Settings page are ignored and the default VNE credentials are used.
Restore Mode Settings	
Restore Mode	Mode for restoring configuration files to a device: • Overwrite—Prime Network overwrites the existing configuration on the device with the file you selected from the archive. Check the **Use Merge on Failure** check box to restore configuration files in merge mode, if overwrite mode fails. • Merge—Prime Network merges the existing running or startup configuration on the device with the configuration present in the version you selected from the archive.
E-mail Settings	
SMTP Host	SMTP server to use for sending e-mail notifications on the status of configuration management jobs to users. If an SMTP host is configured in the Image Management Settings page, the same value will be displayed here by default. You can modify it, if required.
E-mail Id(s)	E-mail addresses of users to send a notification to after the scheduled job is complete. For two or more users, enter a comma-separated list of e-mail IDs. For example: `xyz@cisco.com,abc@cisco.com` The e-mail IDs configured here will appear by default while scheduling the configuration management jobs. However, you can add or modify the e-mail IDs then.
SMTP Port	SMTP port ID to connect to the host server. The default port is 25.

Table 3-1 Configuration Archive Global Settings (continued)

Field	Description
Email Option	Send an e-mail notification for Configuration Management jobs: • All—To send a notification e-mail irrespective of the job result. • Failure—To send a notification e-mail only when the job has failed. • No Mail—Do not send a notification e-mail on the job status. The selected option will appear by default while scheduling Configuration Management jobs. However, you can modify the option then.
Exclude Commands	
(Device Selector)	Devices to which the exclude commands should be applied (meaning the exclude commands will not be considered when comparing device configuration files). The current selection is highlighted in green. All exclude commands applied to that selection will be listed below the device selector. See Notes on Exclude Commands, page 3-12.
Category Commands	Comma-separated list of commands to be excluded when comparing device configurations for any devices in this category (for example, all Cisco routers)
Series Commands	Comma-separated list of commands to be excluded when comparing device configurations for any devices in this series (for example, all Cisco 7200 series routers)
Device Commands	Comma-separated list of commands to be excluded when comparing device configurations for any devices of this same device type (for example, all Cisco 7201 routers)

Notes on Exclude Commands

Exclude commands are inherited; in other words, if three exclude commands are specified for Cisco routers, all devices is any of the Cisco router families will exclude those three commands when comparing configuration files.

Caution Exclude commands configured for a device family (such as Cisco 7200 Routers) will be applied to all device types in that family (Cisco 7201, Cisco 7204, Cisco 7204VXR, and so forth).

When you are working in the Exclude Commands page, your current selection will be highlighted in green. All exclude commands applied to that selection will be listed below the device selector. When Prime Network compares the router configuration files, it will exclude all of the commands listed in the Device Commands field. If a series is selected (example, Cisco 7200 Series), the commands listed in the Series Commands field will be excluded and so on.

The following procedure describes how to configure exclude commands.

Step 1 Choose **Configurations > Settings**.

Step 2 In the Exclude Commands area, navigate and choose one of the following (your selection is highlighted in green):

- A device category
- A device series
- A device type

Step 3 Enter a comma-separated list of commands you want to exclude when comparing configuration files for that device category, series, or type. You can also edit an existing list of commands.

Your entries change to red until they are saved, and all affected device types, series, or categories are indicated in bold font.

Step 4 If you want a device type to ignore the parent commands (that is, the series and category commands), check the **Ignore Above** check box.

Step 5 Click **Save** to save your changes.

Setting Up Image Management

These topics provide information on how to set up the Configuration Management feature:

- Steps for Setting Up Image Management, page 3-13
- Reference: Image Management Global Settings, page 3-14

Note In the Configuration Management and Image Management Settings pages, Change and Configuration Management does not support the following special characters:

- For Password fields—>, <, ', /, \, !, :, ;, and "
- For all other fields—`, ~, @, #, $, %, ^, &, *, (,), +, =, |, {, }, [,], ', ?, >, <, /, \, !, :, ;, and "

Caution FTP is not a secure mode of transfer. For secure config and image transfers, use SCP/SFTP.

Steps for Setting Up Image Management

The following prerequisites are controlled by the Image Management Settings page (**Images > Settings**). All of the fields in the settings page are described in xxxx.

Many of these settings can be overridden when you create specific jobs.

1. Configure the transport protocol that Prime Network will use between the device and the gateway/unit that manages the device; these are controlled from the **Transport Protocol** area. The options are TFTP, SFTP/SCP, and FTP. The default is TFTP. Note the following:
   - The TFTP source interface on the devices must be able to reach the unit. Otherwise, the configuration management jobs that require TFTP may fail.
   - To use SFTP/SCP for image file transfers from a device to a unit, ensure that an SSH server is configured and running on the device (so that during the transfer, the device acts as a server and the unit as a client). For Cisco IOS, Cisco IOS XR, and Cisco IOS-XE devices, configure the device with K9-security-enabled images so that the SSH server is up and running on the device.
2. Configure the gateway *staging* directory to use when transferring images from Prime Network out to devices in the **File Locations** area. The default is *NETWORKHOME*/NCCMComponents/NEIM/staging/.
3. Configure the gateway *storing* directory to use when transferring images from an outside source into the image repository (from Cisco.com or from another file system). This is controlled from the **File Locations** area. The default is *NETWORKHOME*/NCCMComponents/NEIM/images/.

4. In case of insufficient memory, use the **Clear Flash** option (under **Flash Properties**). This deletes any one file (other than the running image) and recovers the disk space occupied by the file. This procedure is repeated until adequate space is available in the selected flash.
5. Enable the warm upgrade facility to reduce the downtime of a device during planned Cisco IOS software upgrades or downgrades (in the **Warm Upgrade** area).
6. Configure the SMTP server and e-mail IDs so that regular software image management job status e-mails are sent. (You can also specify e-mail settings when you create a job.) This is controlled in the **E-Mail Settings** area.
7. If you plan to download files from Cisco.com, configure the necessary vendor credentials to connect to Cisco.com. These are set in the **Vendor Credentials** area. If you do not have login privileges, follow the procedure in Reference: Image Management Global Settings, page 3-14.
8. Configure the proxy server details to use while importing images to the repository from Cisco.com (in the **Proxy Settings** field).
9. If you plan to download images from an external repository, set up the details of the external server to import images to the Prime Network image repository (in the **External Server Details** area).

Reference: Image Management Global Settings

Note In the Configuration Management and Image Management Settings pages, CCM does not support the following special characters:

- For Password fields—>, <, ', /, \, !, :, ;, and "
- For all other fields—`, ~, @, #, $, %, ^, &, *, (,), +, =, |, {, }, [,], ', ?, >, <, /, \, !, :, ;, and "

The following table describes all of the settings in the Image Management global settings page. To open the page, choose **Images > Settings**.

Table 3-2 Image Management Global Settings

Field	Description
Transfer Protocol	Default transfer protocol to use when copying images to and from a device. This setting can be overridden when creating a distribution job (for example, if you know a device does not support the default protocol). FTP and TFTP are unsecured. The TFTP source interface on the devices must be able to reach the unit. Otherwise, the image management jobs that require TFTP may fail. To use SFTP/SCP for image transfers from a device to a unit, you need to ensure that an SSH server is configured and running on the device, such that the device acts as a server and the unit as a client during the transfer. For Cisco IOS, Cisco IOS XR, and Cisco IOS-XE devices, configure the device with K9-security-enabled images so that the SSH server is up and running on the device.
Flash Properties	In case of insufficient memory, use the **Clear Flash** option (under **Flash Properties**). This deletes any one file (other than the running image) and recovers the disk space occupied by the file. This procedure is repeated until adequate space is available in the selected flash.

Table 3-2 Image Management Global Settings (continued)

Field	Description	
Warm Upgrade	If checked, a Cisco IOS image can read in and decompress another Cisco IOS image and transfer control to this new image. This functionality reduces the downtime of a device during planned Cisco IOS software upgrades or downgrades. This can be overridden when creating the job. **Note** You can perform a warm upgrade only on Cisco IOS devices 12.3(2)T or later, such as 12.4T, 15.0, 15.1T, and for ISR 800/1800/2800/3800 series and 1900/2900/3900 series.	
File Locations	Full pathname of directories where images are stored when they are being imported into the Prime Network image repository, or when they are being transferred out of the repository to devices. New directories must be empty and have the proper permissions (read, write, and execute permissions for users). The entries must be full pathnames. In the following default locations, *NETWORKHOME* is the Prime Network installation directory.	
	Staging Directory	Location where images from the Prime Network image repository are placed before transferring them out to devices. The default is *NETWORKHOME*/NCCMComponents/NEIM/staging/.
	Storing Directory	Location where images from an outside source are placed before importing them into the Prime Network image repository (from Cisco.com, from existing devices, or from file system). The default is *NETWORKHOME*/NCCMComponents/NEIM/images/.
External Server Details	Details about external server from which images can be imported into repository.	
	Server Name	IP address of the external server (IPv4 or IPv6 addresses supported).
	Image Location	Path where the image is located on the server.
	User Name	Username to access the external server. **Note** Username is not displayed for Cisco OLT devices.
	Password	Password to access the external server.
	SSH Port	SSH port ID to connect to the server.

Table 3-2 Image Management Global Settings (continued)

Field	Description	
E-mail Settings	Settings for automatic e-mail notifications about the status of jobs.	
	SMTP Host	SMTP server to use for sending e-mail notifications on the status of image management jobs to users. If an SMTP host is configured in the Configuration Management Settings page, the same value will be displayed here by default. You can modify it, if required.
	E-mail Id(s)	E-mail address of the user to send a notification to after the scheduled job is complete. For two or more users, enter a comma-separated list of e-mail addresses. For example: `xyz@cisco.com,abc@cisco.com` The e-mail IDs configured here will appear by default while scheduling the image management jobs. However, you can add/modify the e-mail IDs then.
	SMTP Port	SMTP port ID to connect to the host server. The default port is 25.
	Email Option	Controls when e-mail notifications for Imange Management jobs are sent (can be overridden when creating the job): • All—Send a notification irrespective of the job result. • Failure—Send a notification e-mail only when the job has failed. • No Mail—Do not send a notification e-mail on the job status.
Proxy Settings	Details about proxy server to use when importing images from Cisco.com	
	HTTP Proxy	HTTP proxy server to use for downloading images from Cisco.com.
	Port	Port address to use for downloading images from Cisco.com.
Vendor Credentials	Usernames and passwords that can be used to download images from Cisco.com. (See the procedure described in Reference: Image Management Global Settings, page 3-14.)	

Obtaining Cisco.com Login Privileges for Image Management

Login privileges are required for all images operations that access Cisco.com. To get access, you must have a Cisco.com account. If you do not have a user account and password on Cisco.com, contact your channel partner or enter a request on the main Cisco website.

You can register by going to the following URL:

http://tools.cisco.com/RPF/register/register.do

To download cryptographic images from Cisco.com, you must have a Cisco.com account with cryptographic access.

To obtain the eligibility for downloading strong encryption software images:

Step 1 Go to the following URL:

http://tools.cisco.com/legal/k9/controller/do/k9Check.x?eind=Y&return_url=http://www.cisco.com

Step 2 Enter your Cisco.com username and password, and click **Log In**.

Step 3 Follow the instructions provided on the page and update the user details.

Step 4 Click **Accept** to submit the form.

Step 5 To verify whether you have obtained the eligibility to download encrypted software:

a. Go to the following URL:

http://tools.cisco.com/legal/k9/controller/do/k9Check.x?eind=Y&return_url=http://www.cisco.com

b. Enter your username and password, and click **Log In**.

The following confirmation message is displayed:

```
You have been registered for download of Encrypted Software.
```

Setting Up CCM Device Groups

User-defined device groups allow you to apply changes to devices in bulk. You can choose specific devices as you perform CCM operations, but having predefined device groups can save you time. There are two types of device groups:

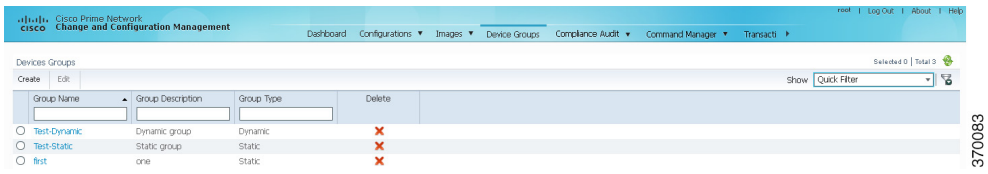
Group Type	Description
Static	Devices are never automatically added to these groups; new devices must be added manually.
Dynamic	Devices are automatically added to a group if they match membership rules.

If a device group's members changes during a CCM operation, the CCM operation is applied to the devices that belong to the group *at the time of execution*.

To view the existing device groups and create new user-defined device groups:

Step 1 Click the **Device Groups** tab. The Device Groups page appears as shown in Figure 3-1.

Figure 3-1 Device Groups Page



The Device Groups page displays the name, description, and whether the membership is static or dynamic. To delete a group, click the red X next to the group name.

To view the devices in a group, click the hyperlinked group name. The Group Members page displays the device status, IP address, and element type. To display additional device properties, click the Device Name hyperlink. The status icons are illustrated in the following.

Symbol	Description
	Device is in operational state.
	Device is not in operational state (the device is most likely in the Maintenance or Unreachable state). Click the device hyperlink and open the device properties popup to see details about the device.

Step 2 To create a new group, click **Create** and enter the required information. Names must be unique. Do not use the reserved names **adminGroup** and **ROOT-DOMAIN.**

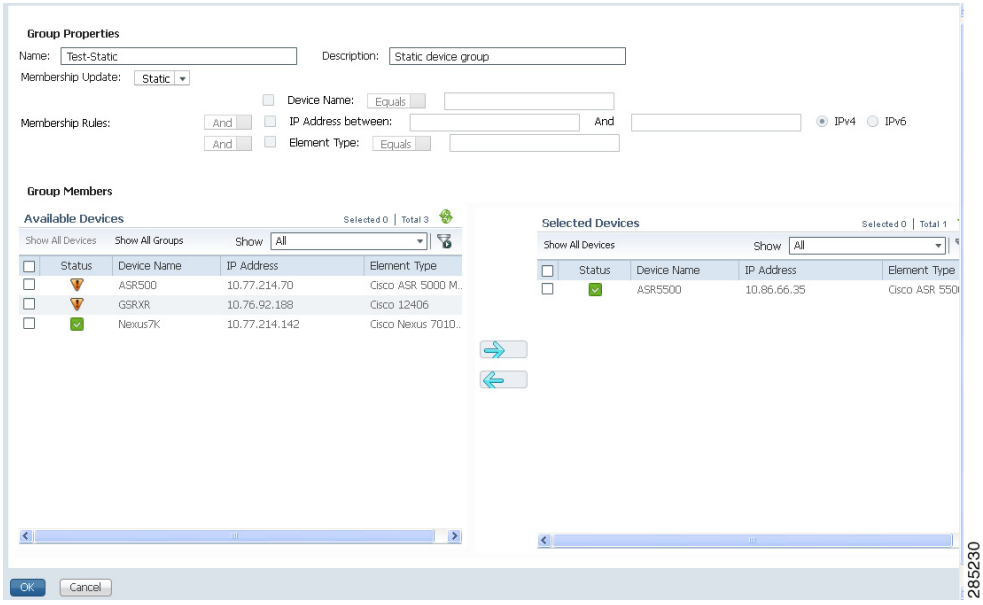
Step 3 In the Membership Update drop-down list box, choose Static or Dynamic.

- Dynamic device group—If you choose Dyamic, set up a membership rule to control which devices are added to the group. You can use rules with parameters such as device name, range of device IP addresses, and device element type. For example:

```
Device Name    equals    1800
IP Address between    10.77.214.107    And    10.77.214.171    IPv4
Element Type    equals    Cisco 1801
```

Note You can choose a combination of parameters by using the And/Or operator. You can also use a comma-separated list to provide multiple values for the Device Name and Element Type parameters.

- Static device group—If you choose static, select the devices from the Group Members list.



Step 4 Click **OK** to save the group.

Setting Up Image Distribution Servers

Cisco Prime Network provides solution for distributing software images in a network based on the network architecture that contains CCM GUI, gateways, units, and direct network elements with distribution servers placed between the units and network elements. Using the distribution servers for storing software images facilitates efficient bandwidth utilization within a network. The distribution server works with the secure protocol, for example, SCP or SFTP.

In the distribution server, you can copy the software image to the network element.

Note Using Distribution servers you can perform only the Distribution operation. Install Add operation must be performed as a separate operation.

Prerequisites for Using Distribution Server

- Distribution server is a Linux server with minimal installation of RHEL with expect, PERL, and OpenSSL packages (to provide SSH, SCP, SFTP, and rsync functionalities). The Prime Network software must not be installed on it.
- Distribution server should be ready with a user account created to be used as a part of this solution.
- Distribution server credential configuration file should be created, at the time of solution installation, using a script provided as a part of the solution.
- Location of the directory where the images are stored on the distribution server should be identified and added to the mapping file.
- Initial configuration of tool or solution after installation includes executing the script to fetch distribution server username, SSH keys of the unit, and creating or saving it to a configuration file. You can test connectivity to distribution server at this time using a utility which is a part of the solution.

Required Settings for Using Distribution Server

- VNE device to distribution servers mapping in Units—External file, for example file in CSV format must be available in the units. The CSV file contains information that describes about the mapping between the VNE devices and corresponding distribution servers, for example, distro_scp.csv and distro_sftp.csv. This file is maintained as a part of the new device add process to ensure that it is in sync with the Prime Network inventory.
- Certified Software Image on the Gateway—A certified image is made available in a predefined directory on the gateway. The image is imported into the Prime Network repository. Then, the image is copied to the distribution servers using rsync mechanism.
- SSH connection between unit and distribution server—Login as a Prime Network user and execute the following commands to setup SSH keys between the unit server and distribution server:

```
ssh-keygen -t rsa
ssh-copy-id -i /export/home/pn422/.ssh/id_rsa.pub root@10.76.82.171
```

- Execute image distribution configuration script—Execute the image distribution configuration script (imagedistributionconfig.pl) on units to provide the distribution server access credentials username and SSH keys. After which, a configuration file (.distroCreds.conf) is created.

- Copy the software image to the distribution server—Copy the image to be copied to distribution server and configure the image directory and distribution mappings in the CSV file on unit.
- Test the connectivity to distribution server—Execute the script (testDistroSSHaccess.pl) to test the connectivity. The script is available in the following location: $ANAHOME/Main/scripts/configuration/cisco/NEIM

Note The required PERL modules should be installed.

- You can use distribution server in the IPv4 environment only.

Setting Up Distribution Servers

To set up distribution servers:

Step 1 Choose **Tools > Registry Controller > Image Management Settings > Image Distribution**.

Step 2 In the **Image Distribution** window, select the **True** option to use distribution server.

Note You can also copy the software image without using the distribution server. Choose the **False** option in the **Image Distribution** window. The **False** option is the default value in the **Image Distribution** window.

Enabling SSH Resync on VNE and CCM

SSH key is the common way to securely connect to remote machines. It is used to identify trusted computers, without using passwords. SSH enables connecting to a virtual private server in a highly secured manner than using a password.

In Cisco Prime Network, the SSH key synchronization is created to handle device disconnections due to SSH key mismatch. Prime network uses SSH keys to communicate with the devices.

Synchronization of SSH Key with VNE

Based on user configuration, when the device reboots, a new SSH key is generated to serve the internal security purposes. Prime Network tries to connect to a device with the key which was used at the first communication. In case of any key mismatch, the VNE synchronizes with the device automatically, fetches the new SSH key from the device, updates in Prime Network, and re-connects to the device using the updated key. The new SSH key synchronization happens only if the server authentication is enabled as 'save-first-auth' and automatic key synchronization feature is enabled via the registry controller.

Synchronization of SSH Key in CCM

When communicating with the device, Cisco Prime Network CCM operations use the SSH keys that are stored in the **known_hosts** file. This file is available in the ***<Prime Network HOME>/.ssh/known_hosts*** directory. If there is a mismatch in the SSH key and if the automatic key synchronization feature is enabled, then the Cisco Prime Network CCM script synchronizes with the device automatically. After which, the CCM script connects without server-side authentication, learns the new SSH keys, and updates the new keys in the **known_hosts** file for further communication. If there is a mismatch, then the automatic key synchronization feature should be enabled to synchronize with the SSH keys.

Common Settings for Key Resync for SSH-VNE and CCM

Follow the prerequisites to enable key resync for SSH VNE and CCM:

- Enabling Server Authentication Settings, page 3-21
- Enabling SSH key synchronization, page 3-21

Enabling Server Authentication Settings

To enable SSH settings, follow the steps provided below:

Step 1 Log on to the **Administration** client.

Step 2 Click **New** to open the **New VNE** window.

Step 3 Click the **Telnet/SSH** tab and check the **Enable** check box.

In the **Telnet/SSH** window, once the **Enable** option is checked, the other options such as **Protocol**, **Port**, **Prompt**, and **Mask** are also enabled.

Step 4 From the **Protocol** drop-down list, choose the **SSHv2** option to open the **SSHv2** pane.

Step 5 In the **Server Authentication** drop-down list of the **SSHv2** pane, choose **save-first-auth mode**.

The server authentication is set.

Enabling SSH key synchronization

SSH key synchronization is defined in device protocol reachable settings.

To enable the SSH key synchronization, follow the steps provided below:

Step 1 Log on to the **Administration** client.

Step 2 From the **Tools** menu, choose **Registry Controller** to open the **Registry Controller** window.

Step 3 In the **Registry Controller** window, expand the **Device Protocol Reachability** node.

Step 4 Click **Telnet** to open the **Telnet** pane.

Step 5 Choose **True** from the **Enable Re-Sync SSH Keys** drop-down list. The SSH key synchronization is enabled.

By default, the **Enable Re-Sync SSH Keys** option is set to **False**.

Verifying SSH key Resync on VNE

To verify SSH key resync on VNE, follow the steps provided below:

Step 1 Model the VNE using SSHv2. Refer Enabling Server Authentication Settings, page 3-21.

Step 2 Enable resync on the device. Refer Enabling SSH key synchronization, page 3-21.

Step 3 Log into the device, and change the key in the device.

Note For **VNE**, a **DSA key** change is to be performed by using the **crypto key generate dsa** command. Refer the Configuring SSH topic (Steps 5 and 6 under the Detailed Steps section) of the Cisco ASR 9000 Series Aggregation Services Router System Security Configuration Guide.

Step 4 In the PN Admin/Vision client, right-click the VNE and restart by selecting **Stop VNE** followed by **Start VNE** options to reflect the actual state of the VNE.

Important Guidelines to ensure the key resync on VNE

- If the device key is changed and the resync is set to **true**, after restart-In the **VNE status** tab, the **Investigation State** would be **Operational** and the **CLI state** under **Telnet/SSH Connectivity** also would be **Operational**.
- If the key is changed and resync is set to the default value of **false**, after restart-The **VNE status** tab would update the **Investigation State** to **Currently Unsychronized,** and the **Telnet/SSH Connectivity CLI State** to **Down** and **Description** as '**Protocol failed to connect to host**'.

Verifying SSH key Resync on CCM

To verify SSH key resync on CCM, follow the steps provided below:

Step 1 Model the VNE using SSHv2. Refer Enabling Server Authentication Settings, page 3-21.

Step 2 Enable resync on the device. Refer Enabling SSH key synchronization, page 3-21.

Step 3 Login to the device, and change the key in the device.

Note For **CCM**, an **RSA key** change is to be performed using the **crypto key generate rsa** command. On setting the resync value to true, the **RSA key entries** sync with the device and are updated in the **known_host** file so that the CCM operations become successful. On setting the resync value to false, the CCM operations would fail.

Step 4 Login to the CCM Dashboard, navigate to the **CCM** page, and choose any CCM operation such as Backup/Restore.

Step 5 From the VNEs listed, select the required VNE on which the operation needs to be performed.

Important Guidelines to ensure the key resync on CCM

- If the resync value is set to false, then any CCM operation performed would fail.
- If the resync value is set to true, then any CCM operation performed would succeed.

Known Limitation for CCM

On performing a **DSA key change**, the **DSA key entries** are not updated in the **known_host** files. However, this does not impact any CCM operation. In other words, irrespective of the resync value (true or false), the CCM operations are always successful.