Campus CleanAir

TECHNOLOGY DESIGN GUIDE

August 2013

VALIDATED DESIGN

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Preface

Cisco Validated Designs (CVDs) provide the framework for systems design based on common use cases or current engineering system priorities. They incorporate a broad set of technologies, features, and applications to address customer needs. Cisco engineers have comprehensively tested and documented each CVD in order to ensure faster, more reliable, and fully predictable deployment.

CVDs include two guide types that provide tested and validated design and deployment details:

- **Technology design guides** provide deployment details, information about validated products and software, and best practices for specific types of technology.
- **Solution design guides** integrate or reference existing CVDs, but also include product features and functionality across Cisco products and may include information about third-party integration.

Both CVD types provide a tested starting point for Cisco partners or customers to begin designing and deploying systems using their own setup and configuration.

How to Read Commands

Many CVD guides tell you how to use a command-line interface (CLI) to configure network devices. This section describes the conventions used to specify commands that you must enter.

Commands to enter at a CLI appear as follows:

```
configure terminal
```

Commands that specify a value for a variable appear as follows:

```
ntp server 10.10.48.17
```

Commands with variables that you must define appear as follows:

```
class-map [highest class name]
```

Commands at a CLI or script prompt appear as follows:

```
Router# enable
```

Long commands that line wrap are underlined. Enter them as one command:

```
police rate 10000 pps burst 10000 packets conform-action set-discard-class-
transmit 48 exceed-action transmit
```

Noteworthy parts of system output or device configuration files appear highlighted, as follows:

```
interface Vlan64
  ip address 10.5.204.5 255.255.255.0
```

Comments and Questions

If you would like to comment on a guide or ask questions, please use the feedback form.

For the most recent CVD guides, see the following site:

http://www.cisco.com/go/cvd

CVD Navigator

The CVD Navigator helps you determine the applicability of this guide by summarizing its key elements: the use cases, the scope or breadth of the technology covered, the proficiency or experience recommended, and CVDs related to this guide. This section is a quick reference only. For more details, see the Introduction.

Use Cases

This guide addresses the following technology use cases:

- **Proactive Interference Protection by Using Cisco CleanAir**—Continuous Wi-Fi spectrum analysis graphically shows the source and location of interference impacting the Wi-Fi network. Advanced real-time spectrum analysis and diagnostic capabilities are available with Cisco CleanAir-enabled access points.
- **Historical RF Management by Using Cisco CleanAir and Cisco Prime Infrastructure**—Graphical floor-plan heat maps depict the location, type, and impact zone of Wi-Fi interference in a historical context.

For more information, see the "Use Cases" section in this guide.

Scope

This guide covers the following areas of technology and products:

- Cisco CleanAir for onsite, remote-site, and guest wireless LAN controllers
- Network management using Cisco Prime Infrastructure
- Wi-Fi RF spectrum management using Cisco Spectrum Expert and Cisco Prime Infrastructure
- Access to historical CleanAir information by using Cisco Mobility Services Engine (MSE)
- Cisco MSE and Prime Infrastructure virtual appliance

For more information, see the "Design Overview" section in this guide.

Proficiency

This guide is for people with the following technical proficiencies—or equivalent experience:

- **CCNA Wireless**—1 to 3 years installing, operating, and troubleshooting wireless LANs
- **VCP VMware**—At least 6 months installing, deploying, scaling, and managing VMware vSphere environments

Related CVD Guides

Campus Wireless LAN Technology Design Guide

To view the related CVD guides, click the titles or visit the following site: http://www.cisco.com/go/cvd

Technology Use Cases

Wireless technology impacts our lives each and every day. As a result of the explosive growth of wireless products, detection and isolation of interference has become a top concern for Wi-Fi network administrators and managed service providers.

As a society, we continue to expect trouble-free wireless access with a performance profile similar to that of our wired network experience. When wireless performance is impacted due to interference, it is usually transitory in nature. Immediate access to IT engineers specializing in wireless technology is often not possible, and by the time the issue is reported, it usually has cleared.

With Cisco CleanAir, spectrum intelligence that was once restricted to specially built and costly troubleshooting hardware is now available in each Cisco CleanAir access point. In fact, not only can real-time spectrum analysis identify and locate the sources of interference, it is automatically recorded to the Mobility Services Engine for later analysis. Remote access to real-time spectrum analysis is then made available to the Wi-Fi network administrator without regard to the administrator's physical location.

Cisco CleanAir is not only a passive action in Wi-Fi network management; it can also take action to reduce the effects of interference. As a result of interference events, Event-Driven Radio Resource Management (EDRRM) can react in real time to interference issues that are significantly impairing the wireless user experience. At such times, the Cisco CleanAir events can cause the access points affected to change channels in order to side step the interference. This is analogous to stepping off the train track when you detect an oncoming train. Reducing interference events improves the Wi-Fi experience for wireless users, while at the same time ensures that the Wi-Fi network administrator has a better day.

Use Case: Proactive Interference Protection by Using Cisco CleanAir

Without regard to the location of the Wi-Fi network administrator, advanced spectrum analysis information is available in real-time and on an historical basis. With proactive interference protection, Cisco CleanAir can trigger interference avoidance mechanisms, including channel change and transmit power adjustments.

This design guide enables the following Cisco CleanAir capabilities:

- Advanced real-time spectrum analysis–Wi-Fi spectrum analysis allows network administrators to visually see the source and location of interference impacting the Wi-Fi network.
- Detection and classification–Wi-Fi interferences are identified by type (Bluetooth, microwave ovens, video cameras, Digital Enhanced Cordless Telecommunications (DECT) phones and many more) and severity.
- Historical Localization of interference sources–The location of the source of interference is displayed on a scale floor plan or campus map. This is available to the network administrator in both real-time and historical modes of operation.
- Air quality index–Enable constant, proactive monitoring of the RF spectrum and enable the creation of an Air Quality Index for each access point.

Use Case: Historical RF Management by Using Cisco CleanAir and Cisco Prime Infrastructure

Many times interference is transient in nature, affecting us at the most inopportune times. The skilled personnel required to troubleshoot these issues are not always available. The Cisco Mobility Services Engine allows organizations and managed service providers to post event access to RF spectrum information.

This design guide enables the following network capabilities:

- Allowing Wi-Fi network administrators access to historical Cisco CleanAir information for post event troubleshooting
- Configuration and use of the Cisco Mobility Services Engine for CleanAir historical reporting
- Use of Cisco Prime Infrastructure to provide CleanAir reporting information
- Graphical map displaying the location of the interference-generating source by using Cisco Prime Infrastructure
- Display of the size and scope of the area impacted by the interference
- Classification of the interference types for each event

Design Overview

Cisco CleanAir Technology

Cisco CleanAir technology is the integration of Cisco Spectrum Expert Wi-Fi analysis tools with Cisco access points. Before CleanAir technology was released, operators had to walk around with an instrument to detect signals of interest and physically locate the device that generated them. CleanAir helps to automate these tasks within the system management function by adding additional intelligence over Cisco Spectrum Expert, thereby augmenting the overall experience by proactively reclaiming control over the radio spectrum. With the addition of the Cisco Mobility Services Engine virtual appliance (MSE VA), historical CleanAir information is accessible by network operators. This increased off-hours RF-based situational awareness is ideally suited for those environments that require constant RF spectrum management, such as hospitals and manufacturing environments.

The components of a basic Cisco CleanAir solution are the Cisco wireless LAN controller and Cisco Aironet 2600 or 3600 Series access points. To take advantage of the entire set of CleanAir features, Cisco Prime Infrastructure 1.3 can display in real-time the data retrieved from CleanAir.

Cisco Prime Infrastructure 1.3 with Cisco CleanAir technology allows network administrators to visually see how well their network is performing, remotely troubleshoot client connectivity, manage wireless network resources, analyze interference devices from anywhere in the world, and more. The real power of Prime Infrastructure 1.3 with CleanAir combined with Cisco access points is the ability to visually represent the health of the RF environment to the network administrator. This allows the administrator to better manage and troubleshoot issues before they impact the end user. With Cisco MSE included in the solution, the administrator can turn back the clock and look at RF issues that occurred in the past–typically the case encountered due to the delay in reporting such issues and second-level support being engaged.

Cisco Prime Infrastructure 1.3

Cisco Prime Infrastructure enables you to configure and monitor one or more Cisco wireless LAN controllers and associated access points, monitor and troubleshoot radio technology, and visually display Cisco CleanAir data to the network administrator. Cisco Prime Infrastructure 1.3 includes the same configuration, performance monitoring, security, fault management, and accounting options used at the controller level, and it adds a graphical view of multiple controllers and managed access points.

Cisco Prime Infrastructure 1.3 is offered in both a physical and virtual appliance deployment option, providing full product functionality, scalability, ease of installation, and setup tailored to your deployment preference.

Deployment Details

To manage the Cisco wireless LAN controller version 7.4 with Cisco Prime Infrastructure, you must use version 1.3 of Cisco Prime Infrastructure. The procedures for properly installing and configuring Prime Infrastructure 1.3 have been provided. Please complete the following process in order to install Prime Infrastructure 1.3.

PROCESS

Installing and Configuring Cisco Prime Infrastructure 1.3

1. Obtain a license
2. Install software
3. Customize the VMware environment
4. Configure basic settings
5. Configure user authentication
6. Configure users and user groups
7. Add devices and credentials

Procedure 1 Obtain a license

Cisco Prime Infrastructure 1.3 offers a single software installation that can manage up to 10,000 devices. Software licensing allows you to evaluate the software before deciding how you want to proceed: purchasing the license, piloting a small deployment before rolling it out organization-wide, or growing your network management system along with your network. Licensing allows you to first evaluate the software without requiring that you reinstall the software later.

There are two ways to acquire a license. If you are using physical media, complete Option 1. If you are downloading an evaluation version of the software, complete Option 2.

Option 1: Physical media

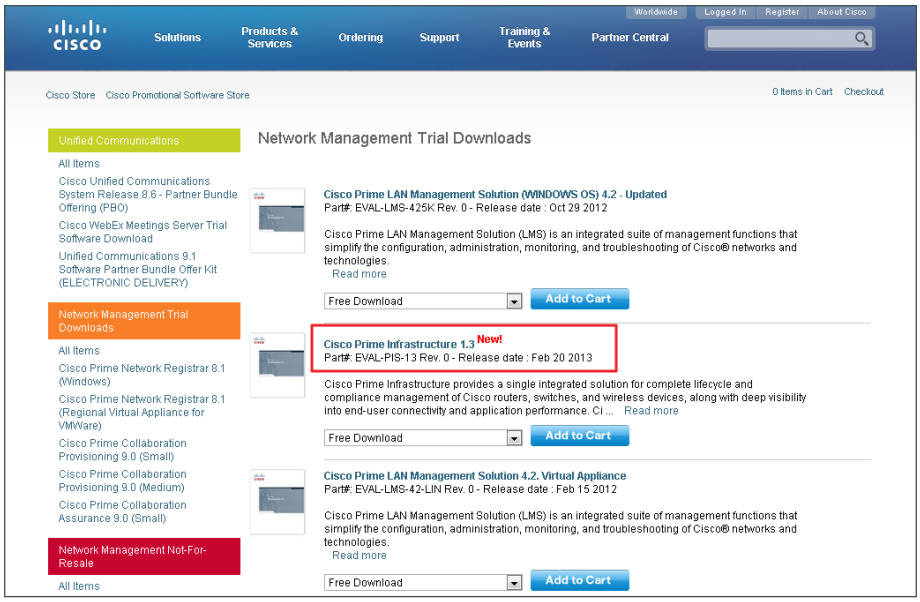
When you purchase a product DVD, it comes with a Product Authorization Key (PAK). The PAK is normally printed on the software claim certificate included with product DVD kit.

Step 1: In a web browser, go the following site:
http://cisco.com/go/license

Step 2: Select the **Click here to continue to Product License Registration** button, and then enter the PAK that you were given.

Option 2: Evaluation software

Step 1: Download an evaluation copy of Prime Infrastructure from the following site: http://cisco.com/go/nmsevals



Via email, you receive a PAK.

Step 2: In a web browser, go the following site: http://cisco.com/go/license

Step 3: Click **Click here to continue to Product License Registration**, and then enter the PAK that you were given.

Procedure 2 Install software

You can install the Cisco Prime Infrastructure 1.3 soft appliance by using the Prime Infrastructure Open Virtualization Archive (OVA) image. Before installing, please note the following:

- Make sure that your system meets the recommended hardware and software specifications listed in the Cisco Prime Infrastructure release notes.
- It takes approximately 30 minutes (deployment in the local system) or 50 minutes (deployment in the network) to install the soft appliance on a virtualized environment.
- Soft appliance OVA software can be installed only in a VMware environment.

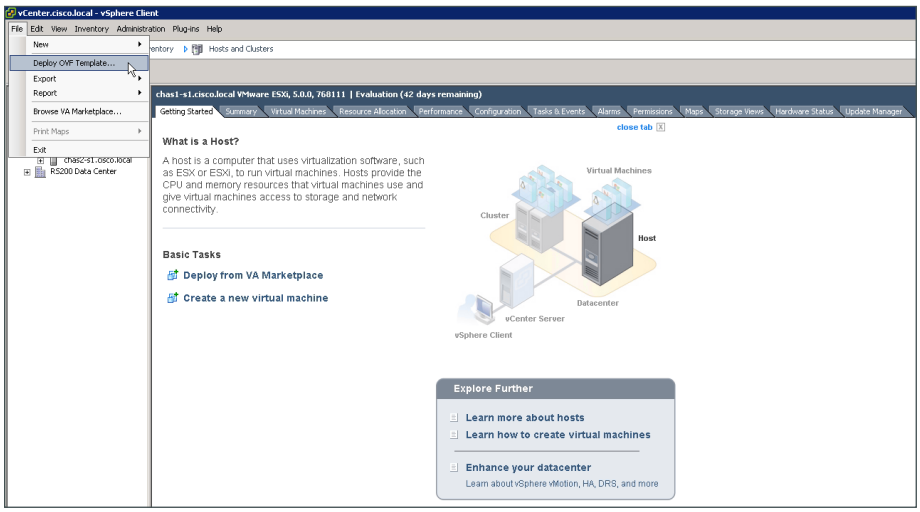
Tech Tip

You do not need to install any soft appliance image on the virtual machine (VM) before installing Cisco Prime Infrastructure, because the Prime Infrastructure OVA image has an embedded RedHat Enterprise soft appliance.

It is recommended you do the following before installing the Cisco Prime Infrastructure 1.3 soft appliance:

- Configure DNS entries for each network device.
- Enable Simple Network Management Protocol (SNMP) and Secure Shell (SSH) Protocol on the devices you are going to import.
- Create an email address that Cisco Prime Infrastructure will use on your internal email server in order to send reports to subscribed users.

Step 1: In the VMware vSphere client, click **File**, and then choose **Deploy OVF Template**.



Step 2: In the Deploy OVF Template wizard, on the Source page, browse to the location of the Cisco Prime Infrastructure OVA file, and then click **Next**.

Step 3: On the OVF Template Details page, review the OVF template details, and then click **Next**.

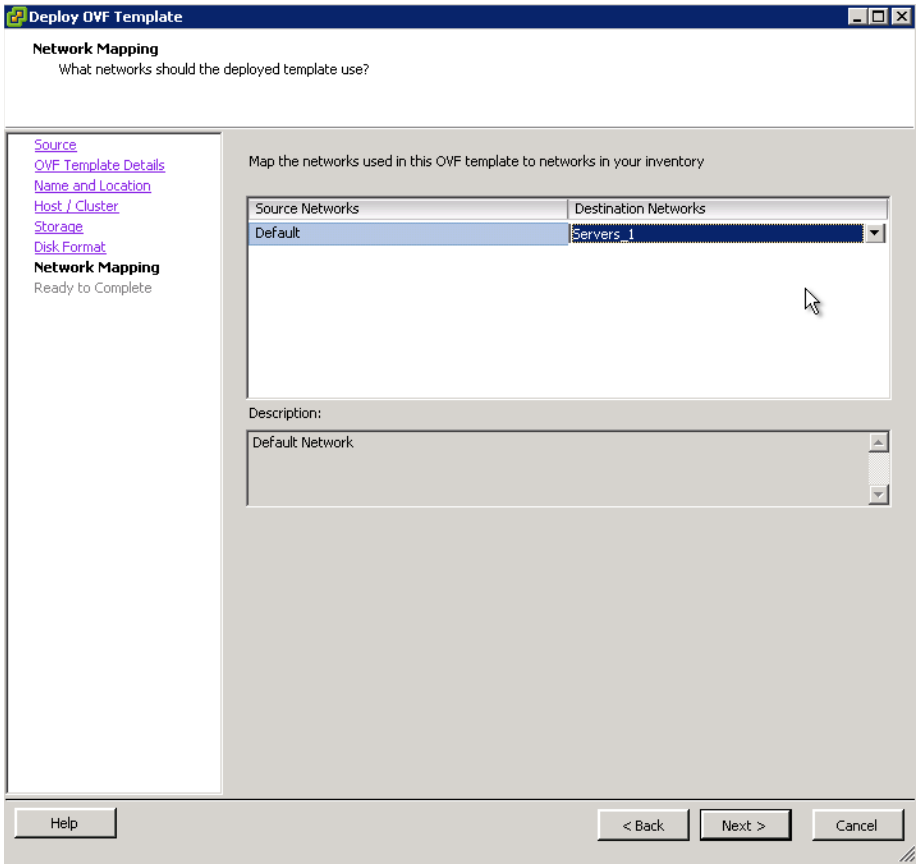
Step 4: On the Name and Location page, enter a unique and descriptive name for the virtual appliance that you are installing (Example: PI-1-3), choose a location to install the virtual appliance, and then click **Next**.

Step 5: On the Host /Cluster page, choose the host or cluster on which to install this virtual machine, and then click **Next**.

Step 6: On the Storage page, choose where you want to store the virtual machine files, and then click **Next**.

Step 7: On the Disk Format page, select **Thick Provision Lazy Zeroed**, and then click **Next**.

Step 8: On the Network Mapping page, in the Destination Networks column, choose the appropriate network mapping group previously defined to the VMware environment (Example: Servers_1), and then click **Next**.



Step 9: On the Ready to Complete page, review the selected options, and then click **Finish**. The OVF installation of Cisco Prime Infrastructure 1.3 begins.

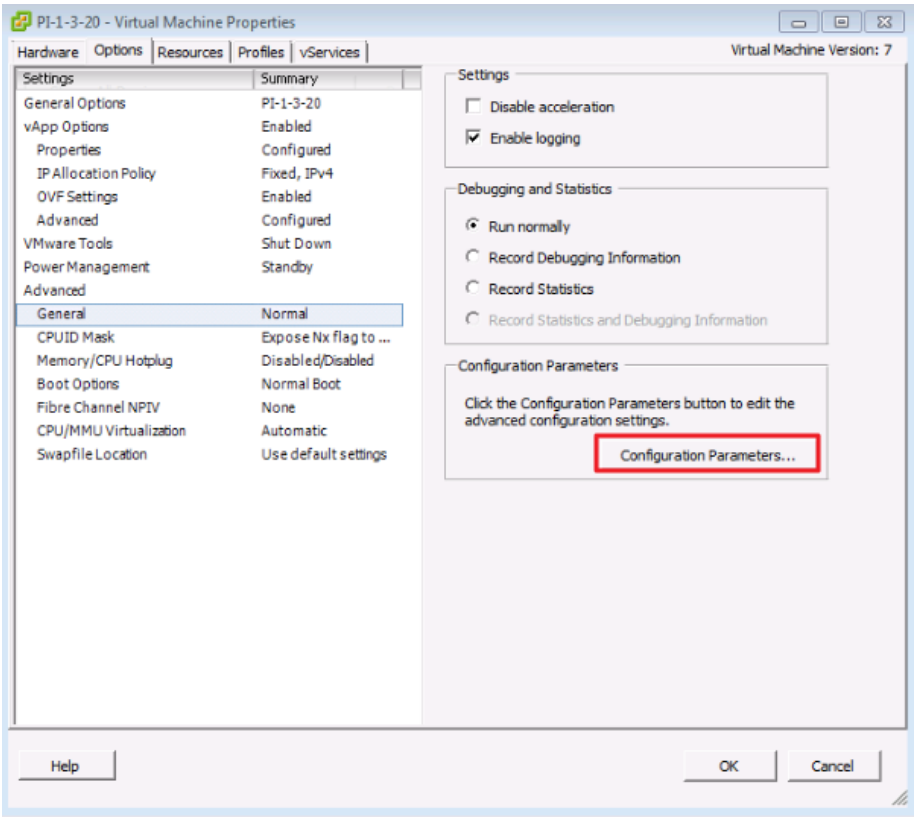
Procedure 3 Customize the VMware environment

(Optional)

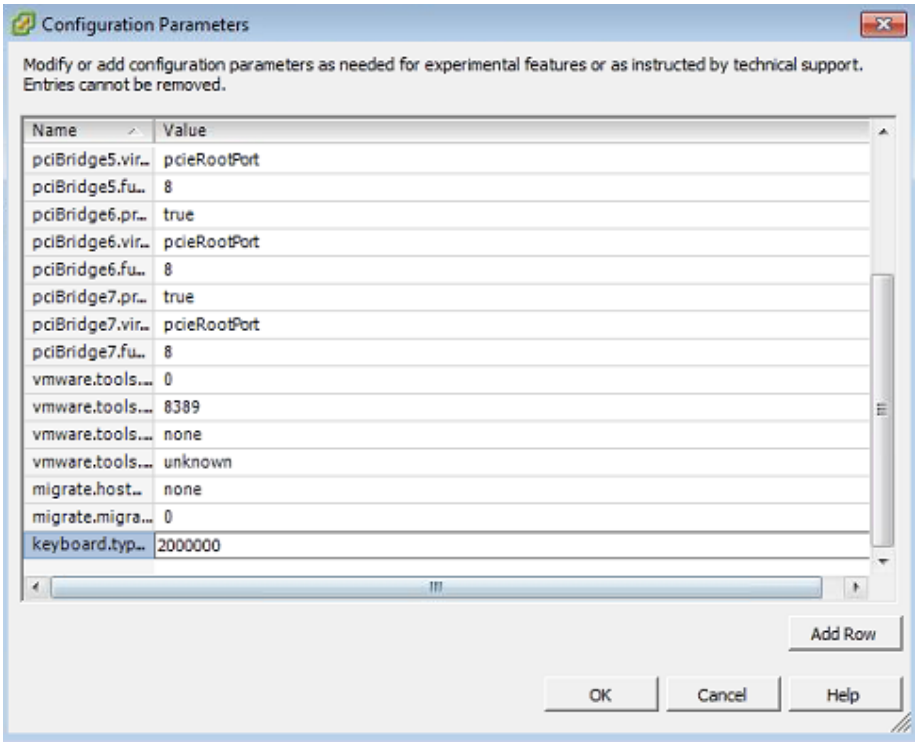
If you find that key strokes are repeating when entering various settings, it may be necessary to configure a keyboard delay value. This procedure is optional but is included here in the event that it is required.

Step 1: Using the VMware vSphere client, access the VMware vCenter environment, highlight the Prime Infrastructure virtual host just installed, and then on the Getting Started tab, click **Edit virtual machine settings**.

Step 2: On the Virtual Machine Properties dialog box, click the **Options** tab, select **General**, and then click **Configuration Parameters**.



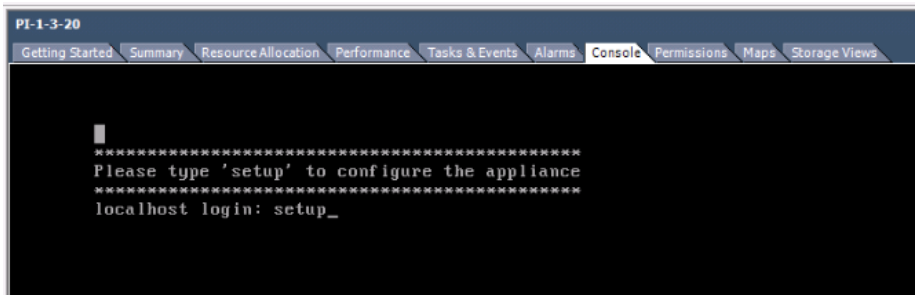
Step 3: On the Configuration Parameters dialog box, click **Add Row**, in the Name column, enter **keyboard.typematicMinDelay**, and in the Value column, enter **2000000** (2 million), and then click **OK**.



Step 4: On the Virtual Machine Properties dialog box, click **OK**.

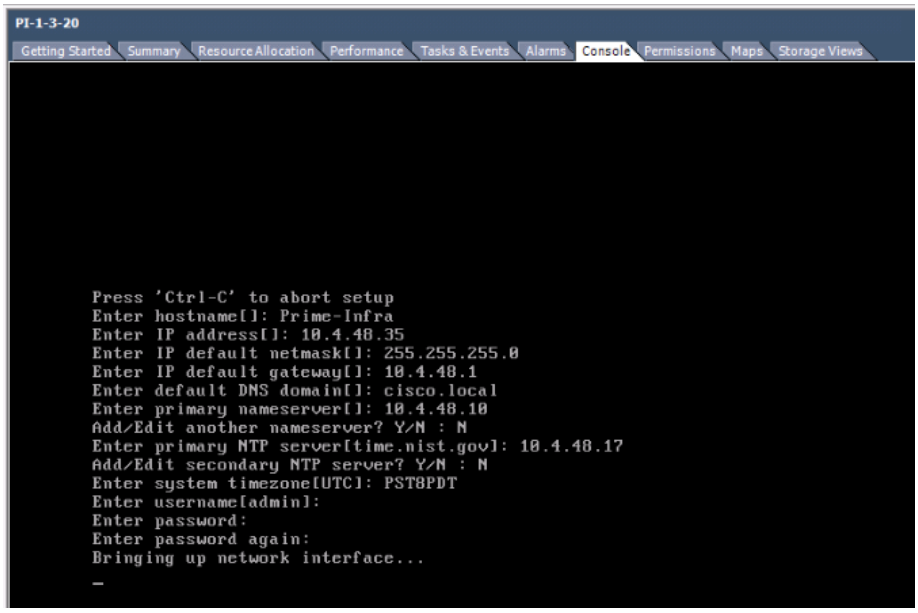
Step 5: On the newly installed virtual machine, click the **Getting Started** tab, and then click **Power on the virtual machine**.

Step 6: Access the **Console** tab, and at the localhost login user ID, enter **setup**. This one-time login automatically starts the setup script.



Step 7: In the startup script, enter the following configuration details for the server :

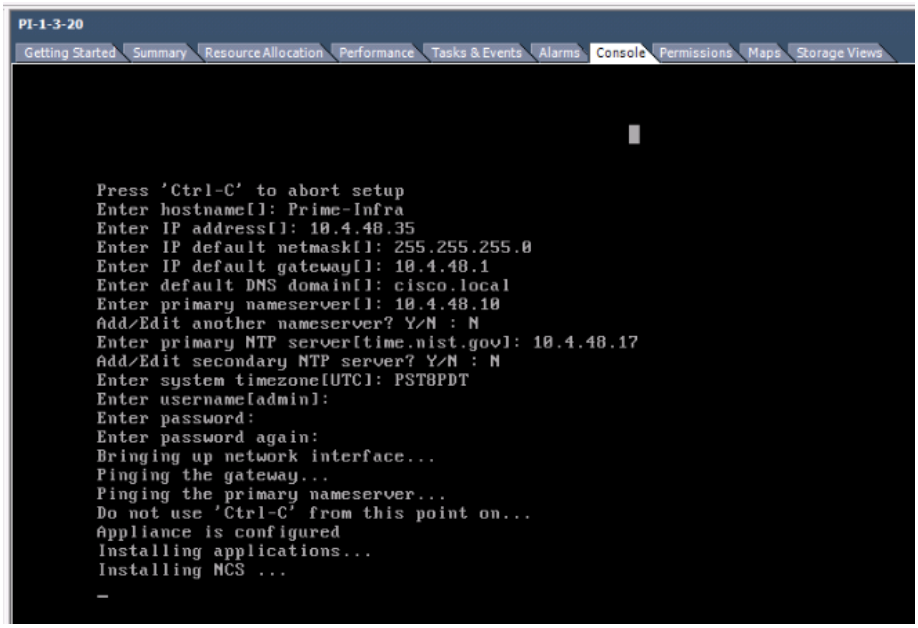
- Hostname–**Prime-Infra**
- IP address–**10.4.48.35**
- IP netmask–**255.255.255.0**
- Default gateway–**10.4.48.1**
- DNS domain name–**cisco.local**
- Primary name server–**10.4.48.10**
- Add/Edit another name server? Y/N–**N**
- Primary NTP server–**10.4.48.17**
- Add/Edit secondary NTP server? Y/N–**N**
- System time zone–**PST8PDT**



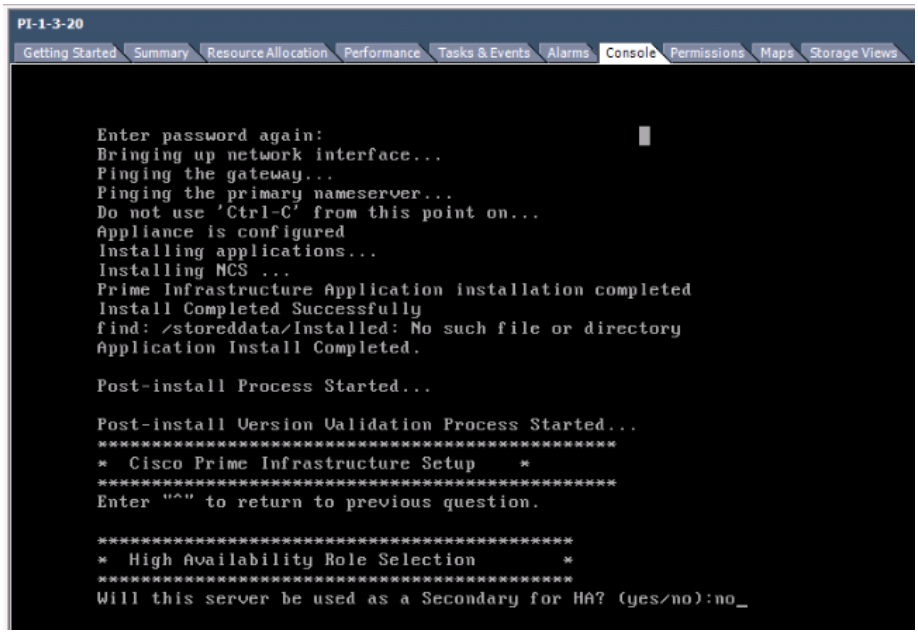
Step 8: Create a username and password for accessing the Cisco Prime Infrastructure appliance console. This user will have the privilege to enable the shell access.

Tech Tip

The default username is **admin**. You cannot use **root** as the username because it is a reserved username. You can use only alphanumeric characters for the username. Enter and confirm the admin password. By default, this password is set as the shell password.

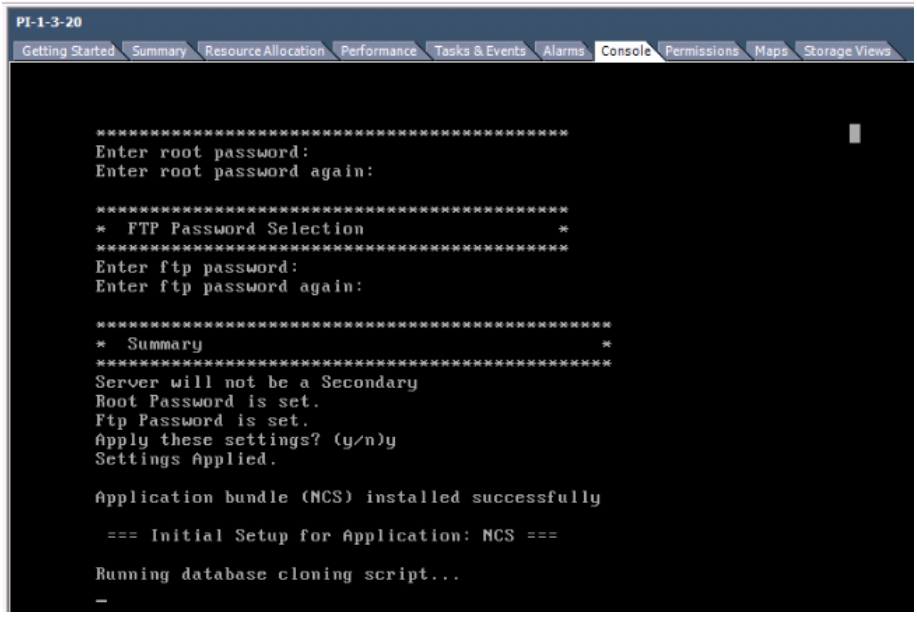


Step 9: If you are planning to use this server as a standalone server or if this is the first or primary server, at the **Will this server be used as a Secondary for HA?** prompt, enter **no**.

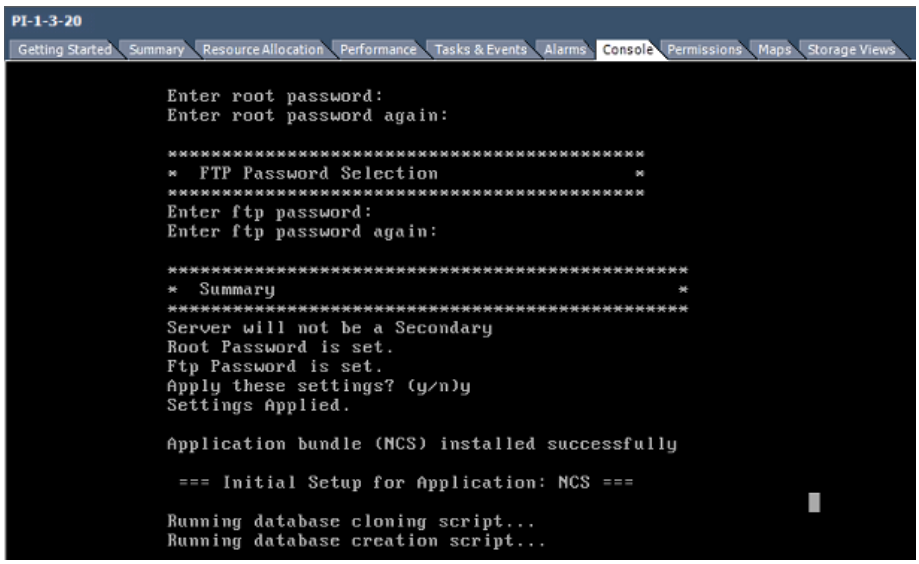


Step 10: Enter and confirm the password for the root account that will be used to access the GUI through a browser. This password must contain a minimum of five characters and is also used for the System Identity account.

Step 11: Enter and confirm an FTP password, review the settings, and then at the **Apply these settings?** prompt, enter **Y**.



It takes 15 to 20 minutes to process the database engine, and then the server automatically reboots.



Procedure 4 Configure basic settings

Tech Tip

Cisco Prime Infrastructure supports the following browsers: Google Chrome (19.0 build), Mozilla Firefox (ESR 10.x, 13.0 and 14.0), and Microsoft Internet Explorer (8.0 or 9.0 with Chrome plug-in).

Native Internet Explorer is not supported. The recommended minimum resolution for each browser is 1280 x 800 pixels.

Step 1: On the client machine, in a web browser, disable any pop-up blockers.

Next, you enable JavaScript.

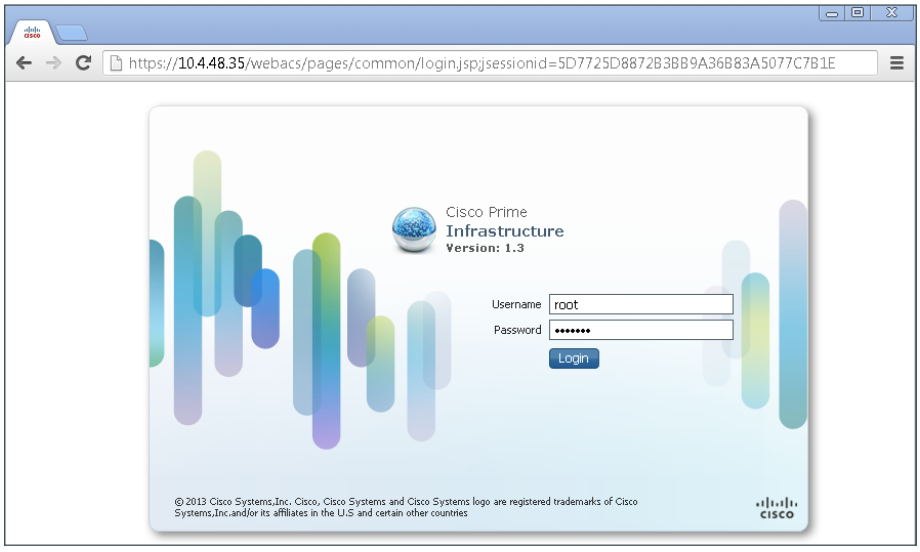
Step 2: If you are using Internet Explorer 8 or later, navigate to **Tools > Internet Options > Security > Custom level > Settings**, and then under **Scripting of Java applets**, select **Enable**.

If you are using Mozilla Firefox 9.x, navigate to **Tools > Option > Content**, and then select **Enable JavaScript**.

If you are using Chrome 19 or later, navigate to **Chrome > Preferences > Privacy**, click **Content Settings**, and then under **JavaScript**, select **Allow all sites to run JavaScript**.

Step 3: In the web browser, open the Cisco Prime Infrastructure portal (Example: https://prime-infra.cisco.local).

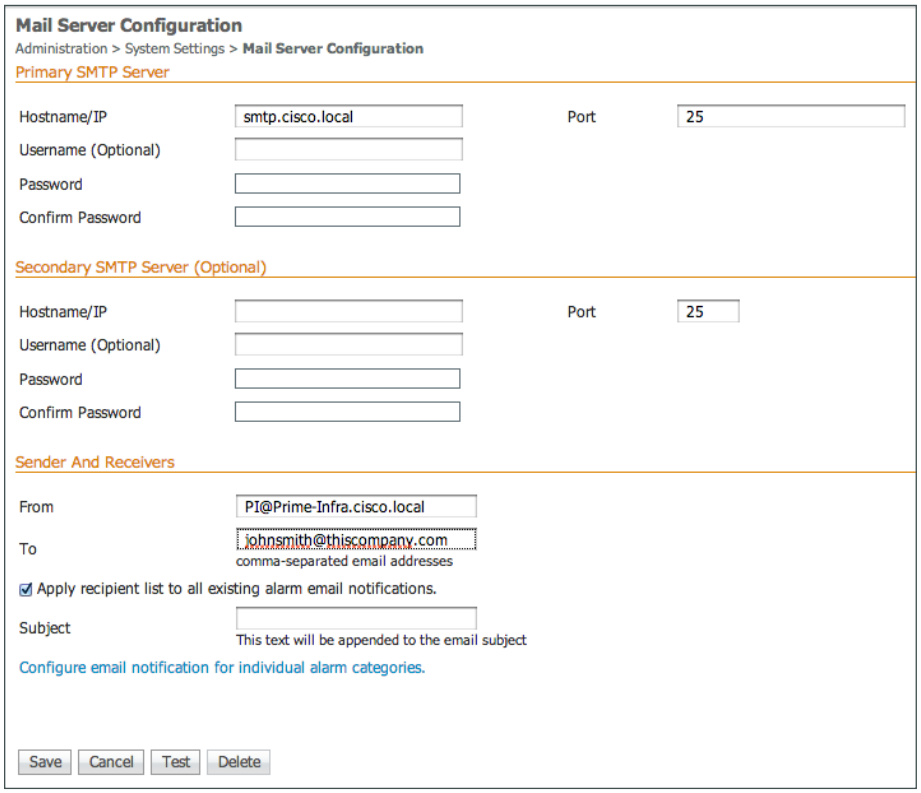
Step 4: Log in by using the username **root** and the password that you provided during installation.



Step 5: Navigate to **Administration > System Settings > Mail Server Configuration**, and then in the Primary SMTP Server section, in the **Hostname/IP** box, enter the host name of the SMTP server (Example: smtp.cisco.local).

Step 6: In the Sender and Receiver section, in the **From** box, enter the email address from which you want to send notifications, and then, in the **To** box, enter the email address to which you want notifications sent.

Step 7: Select **Apply recipient list to all existing alarm email notifications**, and then click **Save**. This enables you to receive email alerts about network issues, job status, report generation, etc.



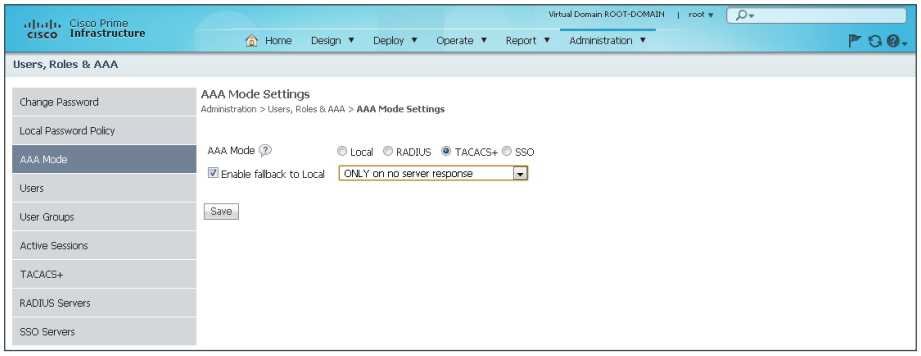
Procedure 5 Configure user authentication

(Optional)

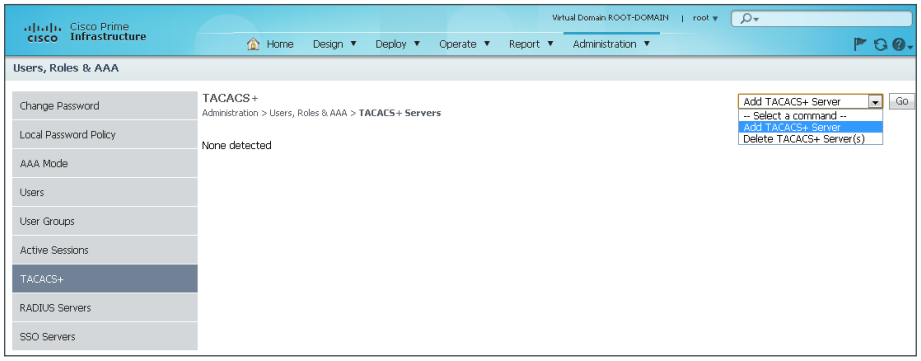
Cisco Prime Infrastructure can use its local database, RADIUS or TACACS+ in order to authenticate user logins. To enable a common authentication experience for network administrators across network devices and the network management system, this guide describes how to configure Cisco Prime Infrastructure to use TACACS+ authentication.

Step 1: Navigate to **Administration > Users, Roles & AAA**, and then in the left column, select **AAA Mode**.

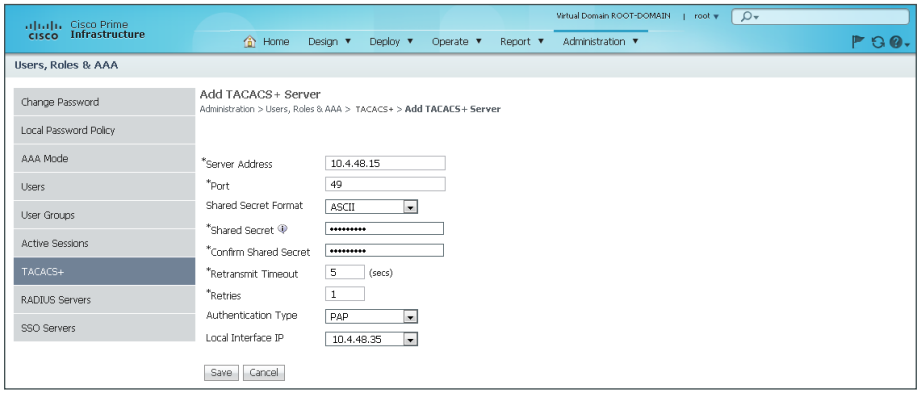
Step 2: Select **TACACS+** and **Enable fallback to Local**, and in the list, choose **ONLY on no server response**, and then click **Save**.



Step 3: In the left column, click **TACACS+**. In the upper right, in the list, choose **Add TACACS+ Server**, and then click **Go**.



Step 4: In the **Server IP Address** box, enter the IP address of the TACACS+ server (Example: 10.4.48.15), and in the **Shared Secret** and **Confirm Shared Secret** boxes, enter the secret key (Example: SecretKey), and then click **Save**.



Procedure 6 Configure users and user groups

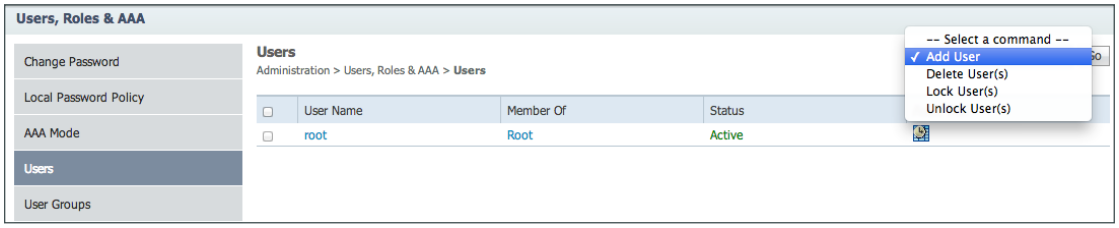
User groups (or *roles*) are collections of privileges that dictate the type of system access the user has. Some predefined roles are:

- **System Monitoring**–These users can access network status information only. They cannot perform any action on a device or schedule a job on a network.
- **Config Managers**–Users can perform all system monitoring tasks and tasks related to network data collection. They cannot perform any task that requires write access on the network.
- **Admin**–Users can monitor and configure operations and perform all system administration tasks.
- **Super Users**–Users can perform all Cisco Prime Infrastructure operations, including administration and approval tasks.

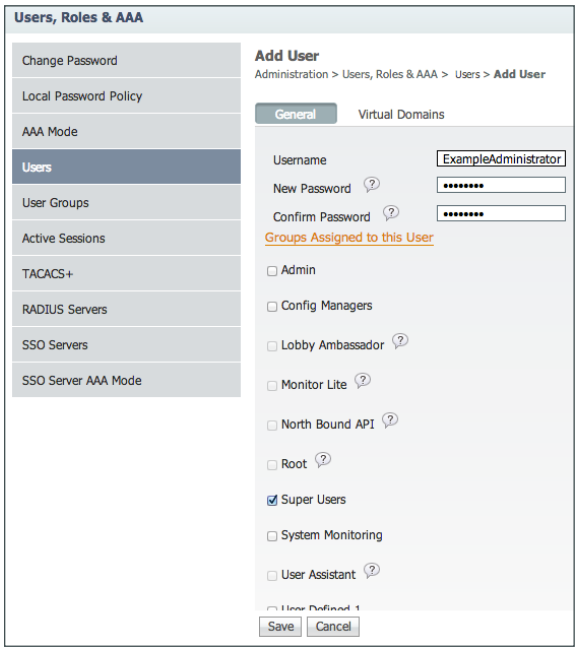
When using an authentication module other than the Cisco Prime Infrastructure local database, Prime Infrastructure authenticates the user against the external module. After the user is successfully authenticated, Prime Infrastructure assigns the configured role to this user.

Step 1: Navigate to **Administration > Users, Roles & AAA> Users**.

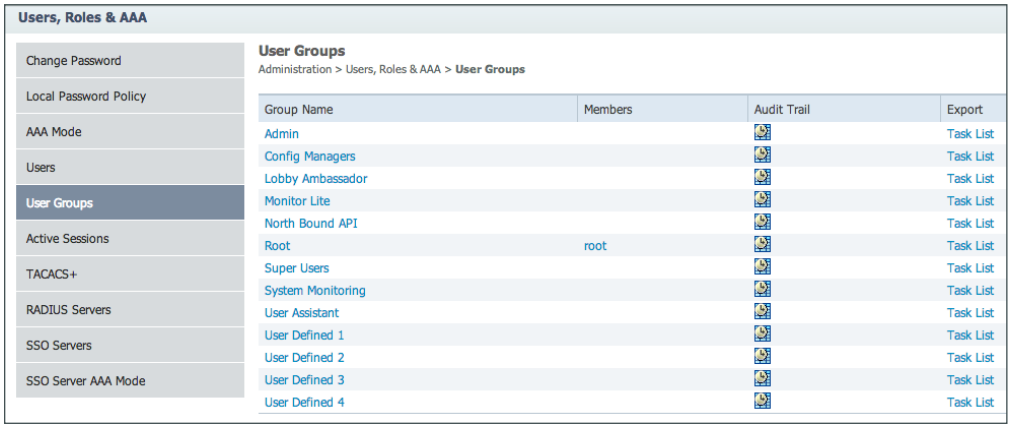
Step 2: In the **Select a command** list, choose **Add User**, and then click **Go**.



Step 3: Enter the username and password, under Groups Assigned to this User, select the role for the user, and then click **Save**.



For any users who require different permissions than those included in Super Users, create user accounts and assign Cisco Prime Infrastructure user groups to each of the user accounts you create.



Procedure 7 Add devices and credentials

Before Cisco Prime Infrastructure 1.3 can manage a device, the device must be in the database. You can add devices to the database in three ways:

- Discover the devices by using a discovery protocol
- Add devices manually
- Import devices in bulk

Cisco Prime Infrastructure supports Layer 2 and Layer 3 protocols for device discovery. Device discovery using Cisco Discovery Protocol is the preferred protocol used by Prime Infrastructure in order to discover network devices in the LAN.

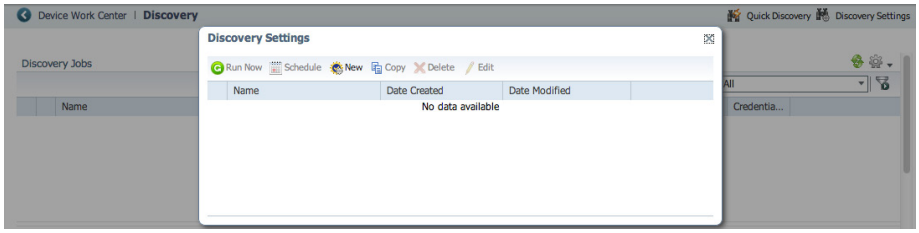
Both Cisco Discovery Protocol and SNMP must be enabled on devices before using this procedure. If you did not deploy your network by using the Campus Wireless LAN Design Guide CVD, which enable both of these protocols, navigate to the following link, and then view the Cisco Prime for IT and Service Providers tab: www.cisco.com/go/prime

The Cisco Prime product page can be located at: http://www.cisco.com/en/US/products/ps12239/index.html

This procedure uses a number of Cisco Prime Infrastructure Discovery features- including Layer-2-based Cisco Discover Protocol (CDP), SNMP v2, and SSH.

Step 1: Navigate to **Operate > Discovery**.

Step 2: In the upper right corner, click **Discovery Settings**, and then click **New**. The values that you enter are the default credentials that Prime Infrastructure uses in order to manage the device inventory, configuration, and software.

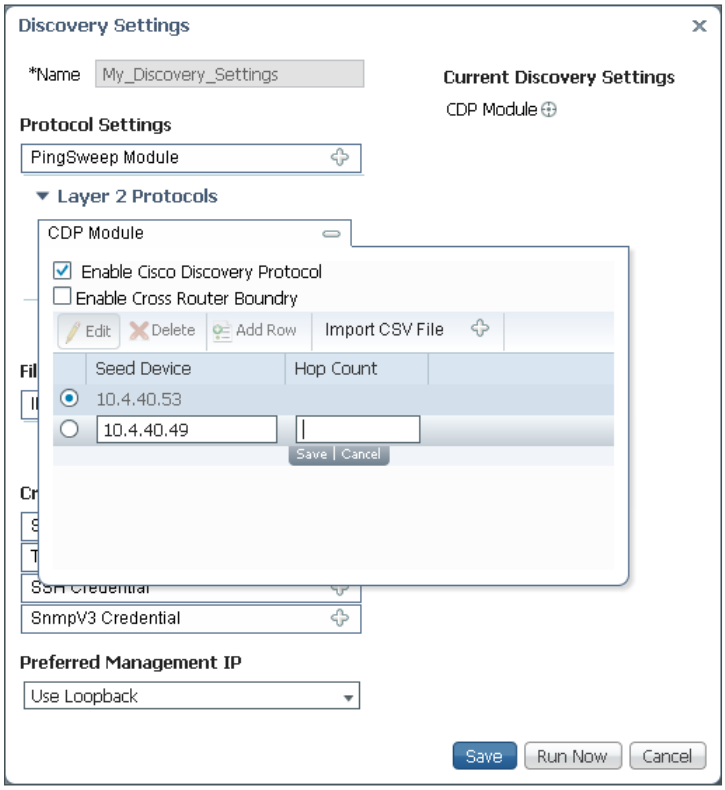


Step 3: In the **Name** box, enter **My_Discovery_Settings**, expand **Layer 2**, and then next to CDP Module, click the **+** icon.

Step 4: In CDP Module, select **Enable Cisco Discovery Protocol**, click **Add Row**, in the **Seed Device** box, enter the cored switch IP address (Example: 10.4.40.49), and then below the Seed Device box, click **Save**.

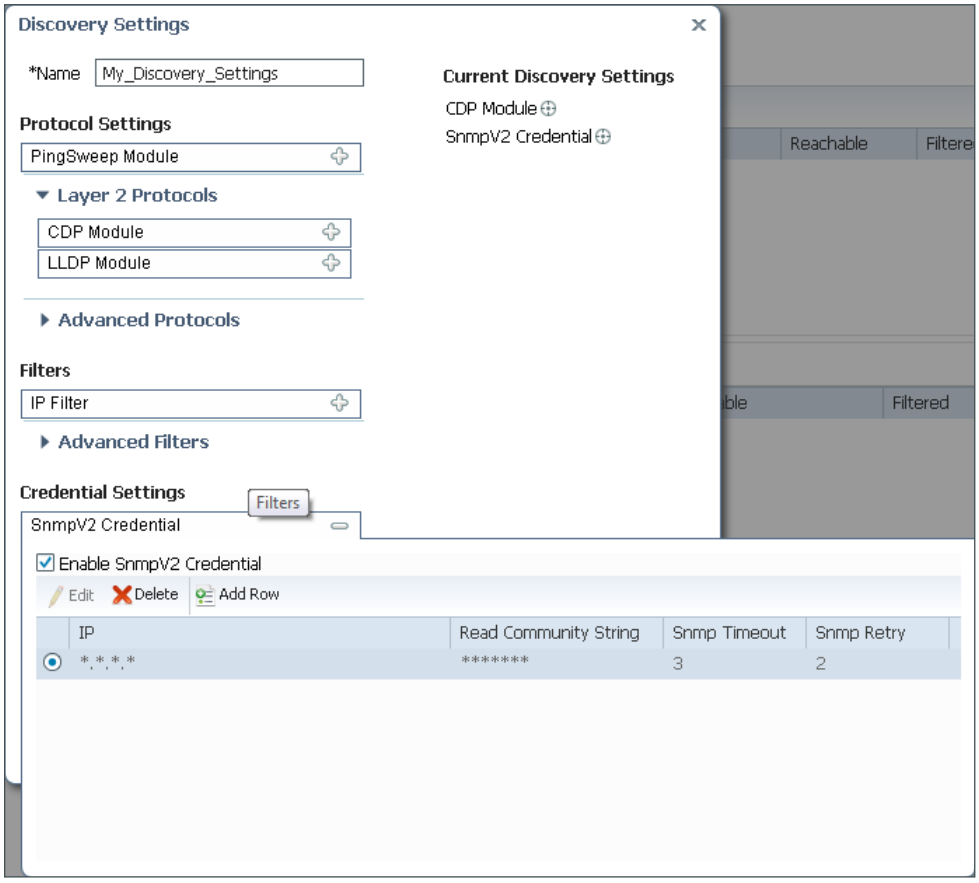
Tech Tip

If you leave the Hop Count column blank, the discovery process continues until the end neighbor is reached. Depending on the network size, this could be a large number of network devices. In large networks, it is recommended that you add a Hop Count value to restrict the size of the discovery.



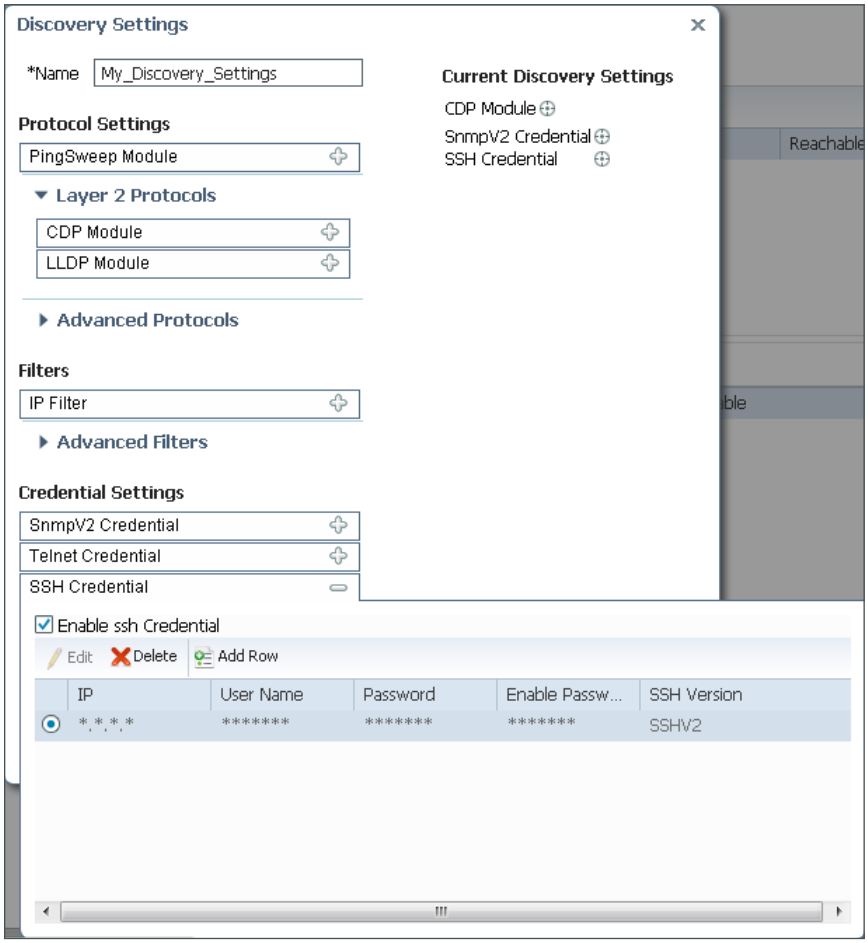
Step 5: Under Credential Settings, next to SnmpV2 Credential, click the **+** icon.

Step 6: Select **Enable SnmpV2 Credential**, click **Add Row**, enter the IP address (Example: *.*.*.*) and read community string (Example: cisco123), and then below the IP box, click **Save**.

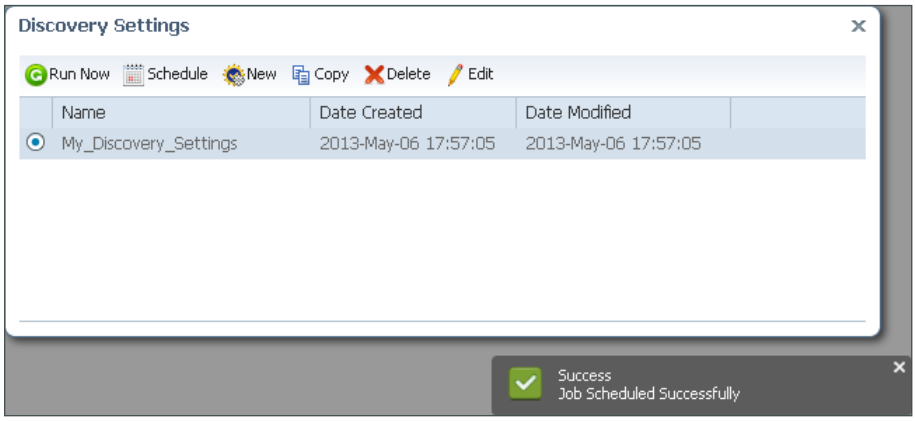


Step 7: Under Credential Settings, next to SSH Credential, click the **+** icon.

Step 8: Select **Enable ssh Credential**, enter the IP address (Example: 0.0.0.0), username, password, and enable password, select **SSHv2**, and then below the User Name box, click **Save**.

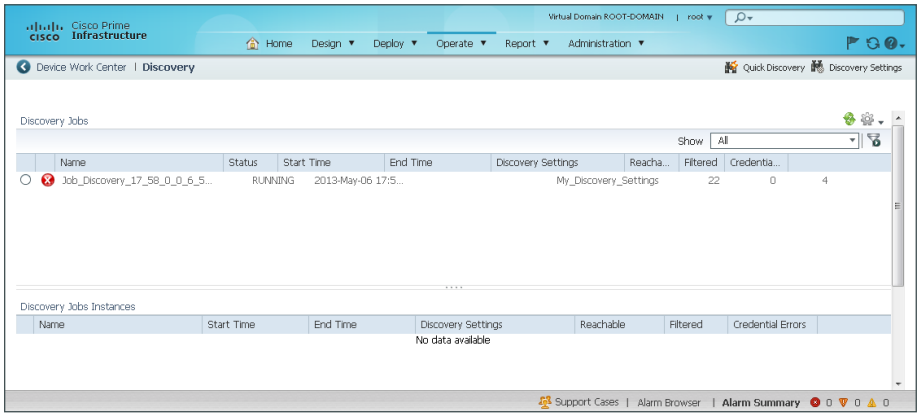


Step 9: On the Discovery Settings dialog box, click **Run Now**. This saves the configuration and begins device discovery.

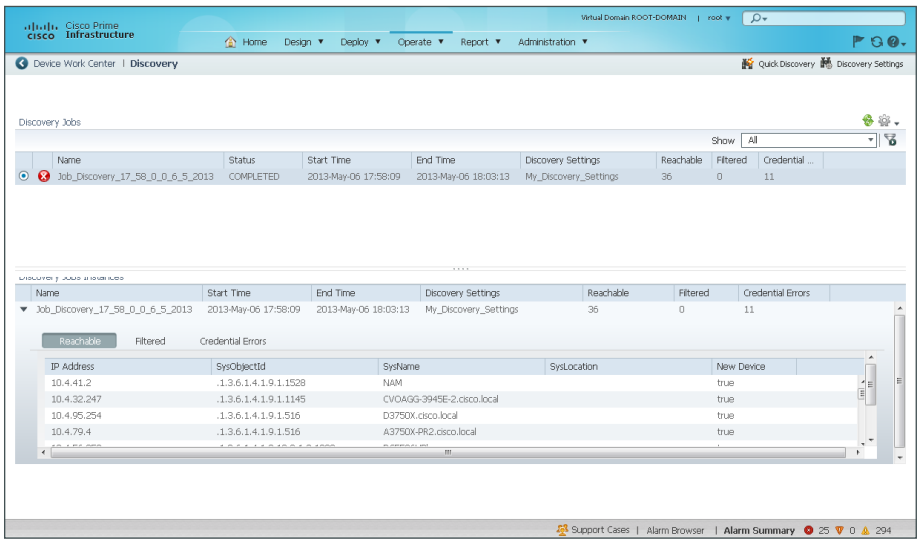


Prime Infrastructure starts discovering the devices on the network. The amount of time this discovery process takes depends on the number of devices on the network.

Step 10: If you want to view the discovery progress, click **Operate > Discovery**. If you want to instantly update the in-progress results, click the green refresh icon in the upper right corner.



After the process is completed, the status changes from running to completed.



Devices on the network have now been discovered and are ready for other management tasks such as asset, configuration, and software-image management.

PROCESS

Adding Buildings and Floor Plans to Cisco Prime Infrastructure 1.3

1. Add the first campus and building
2. Place access points on the map

The real advantage of any management system is that it can present information in a way that helps you make intelligent decisions. Cisco Prime Infrastructure 1.3 brings visibility to the radio spectrum, which allows the administrator to see the coverage that is being provided to users. By including the building and floor maps in Cisco Prime Infrastructure 1.3, visibility of this otherwise unknown or convoluted data that Prime Infrastructure 1.3 derives from the wireless network is enabled. You need to have an image of your floor plan before you begin this procedure. The file can be in JPEG, PNG, or GIF format; and it can also be in CAD DXF or DWG format.

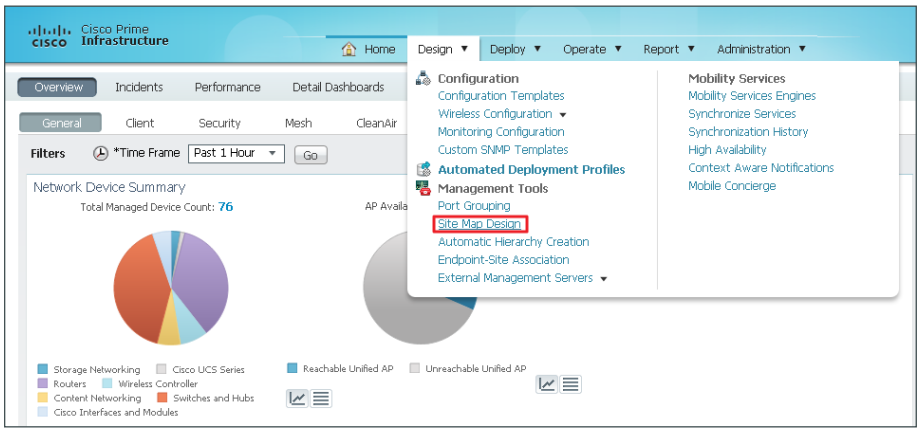
Procedure 1 Add the first campus and building

Even though your organization may have only one building today, it may end up with another building; or perhaps each campus is a single building today, but it could have more buildings in the future. The campus, building, floor approach makes it easy to understand and organize as you dig for more information and peel away the layers to find what you are looking for.

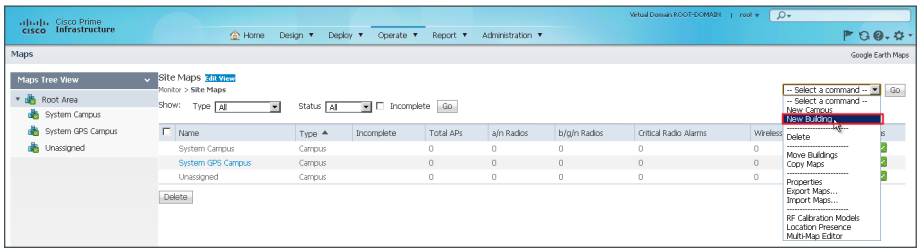
Tech Tip

You need to know the dimensions of the campus buildings that you are bringing into the system so that you can appropriately scale the drawing as each building and floor is added.

Step 1: In Cisco Prime Infrastructure 1.3, navigate to **Design > Management Tools > Site Map Design**.



Step 2: In the **Select a command** list, choose **New Building**, and then click **Go**.

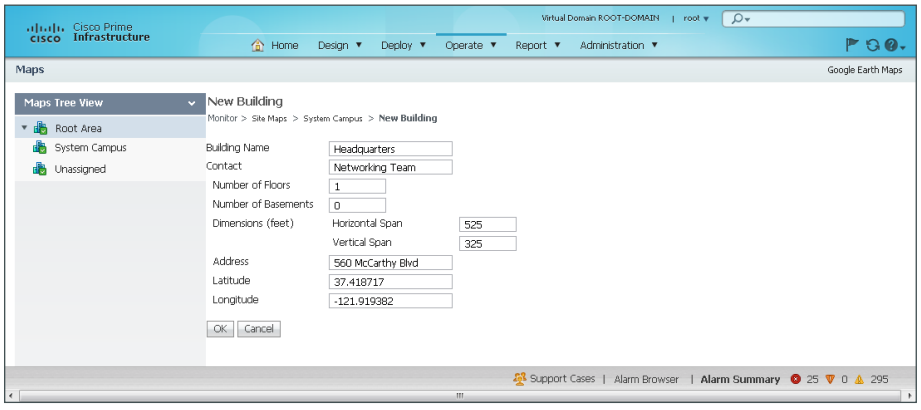


Step 3: Enter the following information about the building:

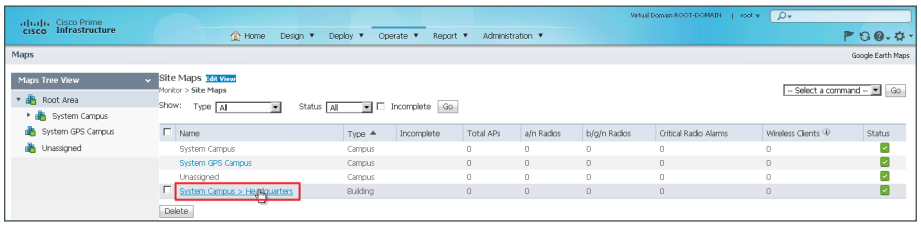
- Building Name–**Headquarters**
- Contact–**Networking Team**
- Number of floors–**1**
- Number of Basements–**0**
- Horizontal Span (feet)–**525**
- Vertical Span (feet)–**325**
- Address–**500 Main Street**
- Latitude and Longitude–As appropriate

Tech Tip

It may be helpful to specify accurate latitude and longitude values for sites that have multiple buildings across a diverse geographic area, such as within a city or in multiple cities. These values can be determined by using Google Maps (http://maps.google.com). Enter the address of the location, right-click the pushpin icon, and then click **What's here?** The coordinates are shown in the search bar.



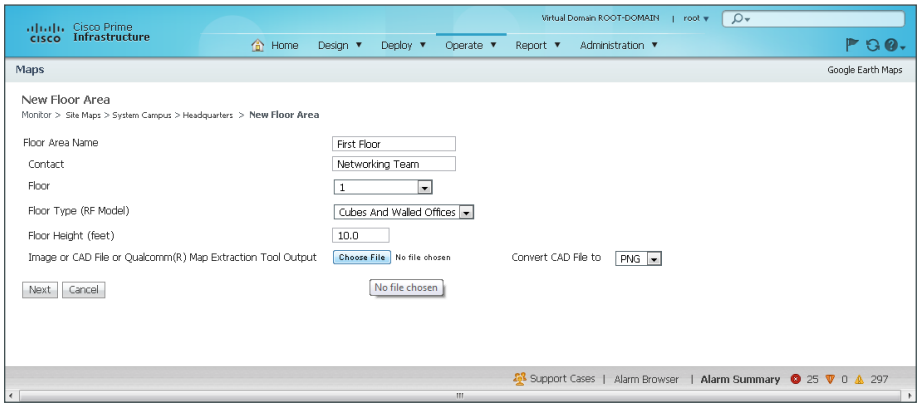
Step 4: Click the name of the newly created building. This selects the building.



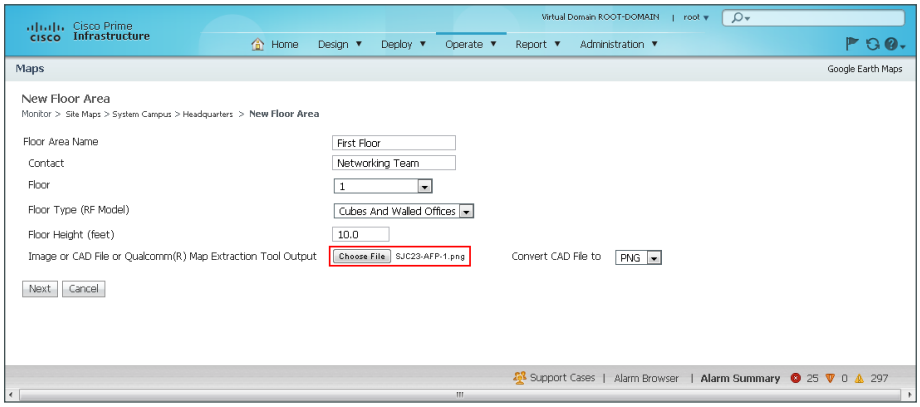
Step 5: In the **Select a command** list, choose **New Floor Area**, and then click **Go**.

Step 6: Enter the following information about the floor area:

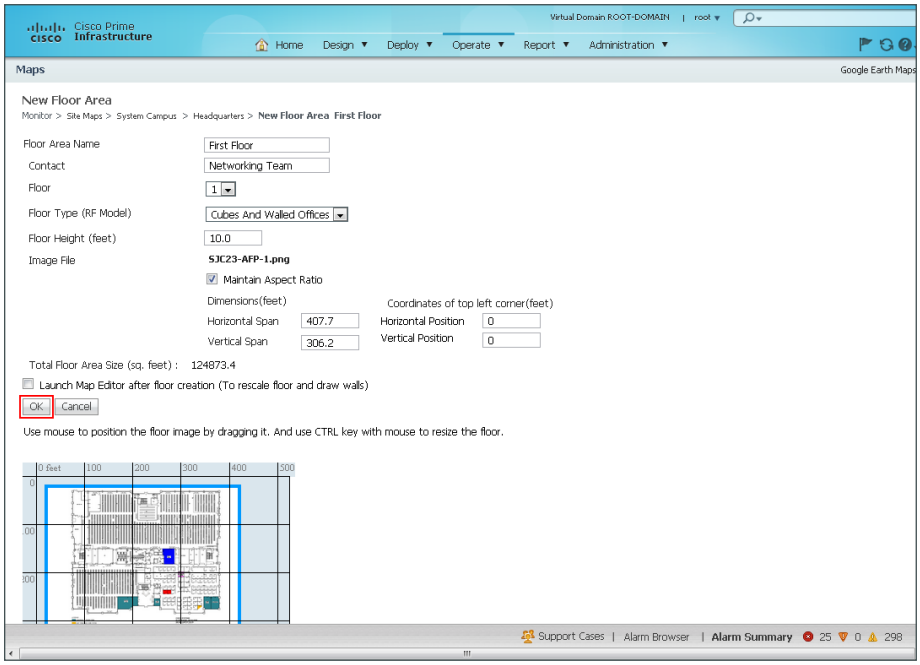
- Floor Area Name–**First Floor**
- Contact–**Networking Team**
- Floor–**1**
- Floor Type (RF Model)–**Cubes And Walled Offices**
- Floor Height (feet)–**10.0**
- Convert CAD File to–**PNG**



Step 7: Click **Choose File**, select the floor plan image filename stored locally on your machine, and then click **Next**.



Step 8: Position the building such that its upper left corner is oriented at the 0/0 feet position on the grid. Some floor plans may have additional whitespace that does not represent the dimensions of your building. Verify proper placement of your new floor area details and image, and then click **OK**.

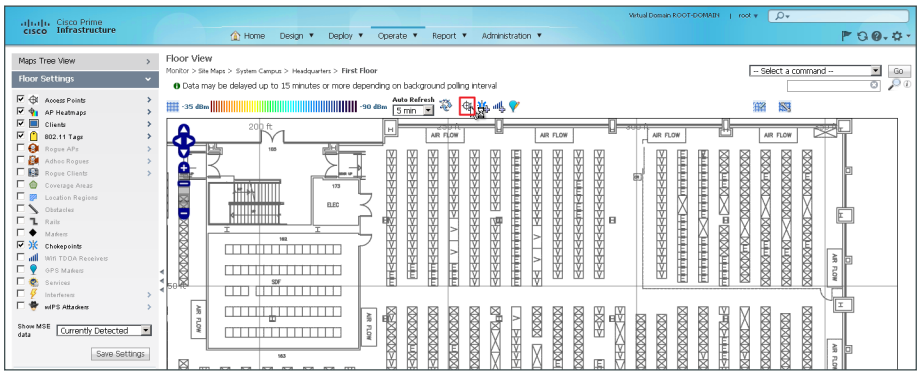


Procedure 2 Place access points on the map

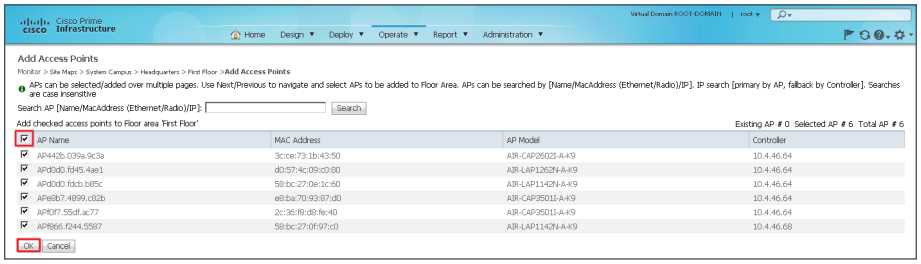
The final piece of the puzzle is to place the access points at the proper locations on your individual floor plans. If you take the time to place your access points where they are actually located, the wireless LAN controllers that work in conjunction with Cisco Prime Infrastructure 1.3 give an accurate view of your network and the devices located in it.

Step 1: Position the floor space so that the zoom and position make it easy to locate the exact position of the access points being added.

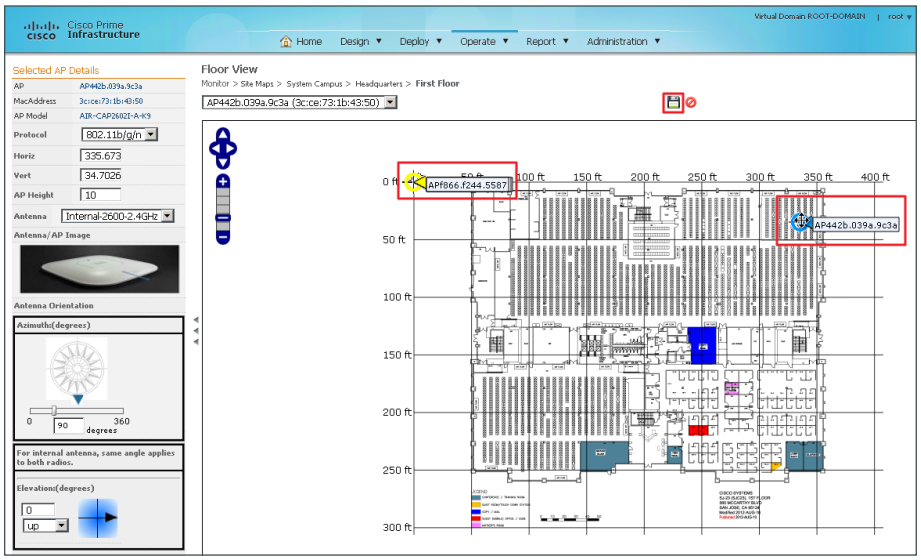
Step 2: Select the Add Access Point crosshairs button.



Step 3: Select access points that are registered with the system but not yet placed for the headquarters building.



Step 4: Carefully place each access point as close to its real position in the building as possible by dragging each one to its proper location, and then click **Save**.



Wait while the system calculates the heat maps from the placement and floor plan area.

PROCESS

Configuring the Wireless Network for Cisco CleanAir

1. Create a Cisco CleanAir AP template
2. Apply the Cisco CleanAir AP template
3. Create a controller EDRRM template
4. Create a Cisco CleanAir controller template

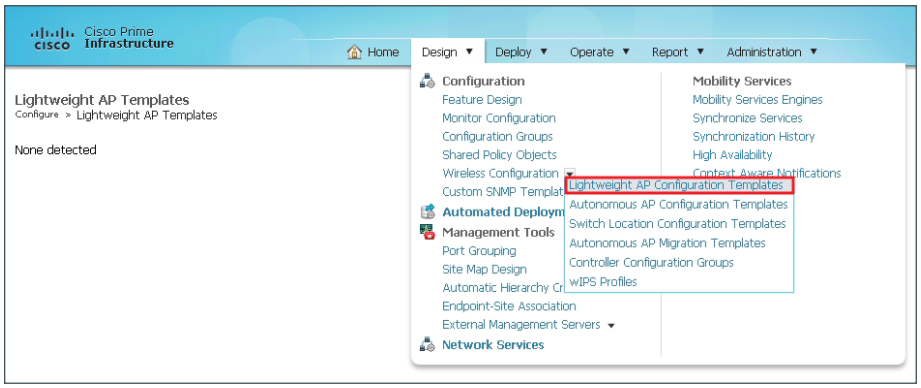
A Cisco wireless LAN controller with connected Cisco Aironet 2600 or 3600 Series access points is immediately Cisco CleanAir-capable. The wireless LAN controllers can give you immediate information about your environment. Where Cisco Prime Infrastructure 1.3 can present a complete network view, the wireless LAN controller displays only data retrieved from the locally connected CleanAir access points.

Cisco Prime Infrastructure 1.3 can handle all management tasks within the network. You can still perform management tasks at each individual controller, but that approach it is not recommended, as it often results in a fragmented configuration. With the Cisco CleanAir access point operating from the wireless LAN controller, you can log in to Cisco Prime Infrastructure 1.3 and configure your controller to support CleanAir.

Procedure 1 Create a Cisco CleanAir AP template

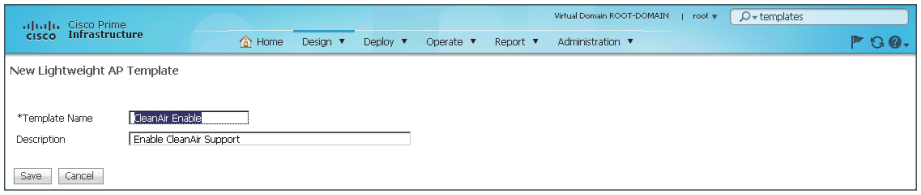
The first step in order to turn on Cisco CleanAir is to ensure that Cisco CleanAir is enabled on each of the access points (APs) for both 2.4 and 5 GHz bands. The following steps outline how to create a template within Cisco Prime Infrastructure 1.3 in order to enable CleanAir on an AP.

Step 1: In Cisco Prime Infrastructure 1.3, navigate to **Design > Configuration > Wireless Configuration > Lightweight AP Configuration Templates**.

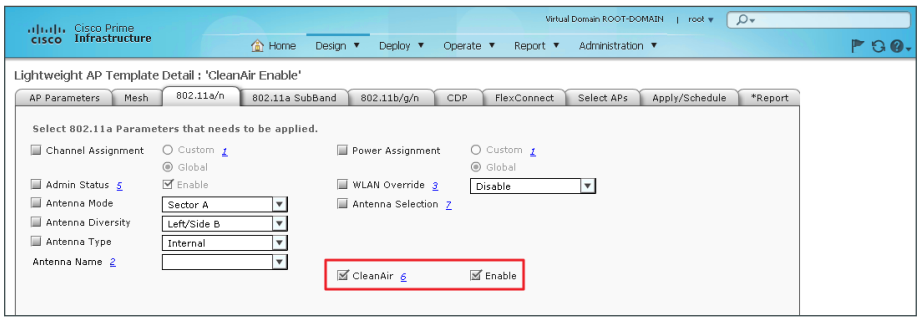


Step 2: In the **Select a command** list, choose **Add Template**, and then click **Go**.

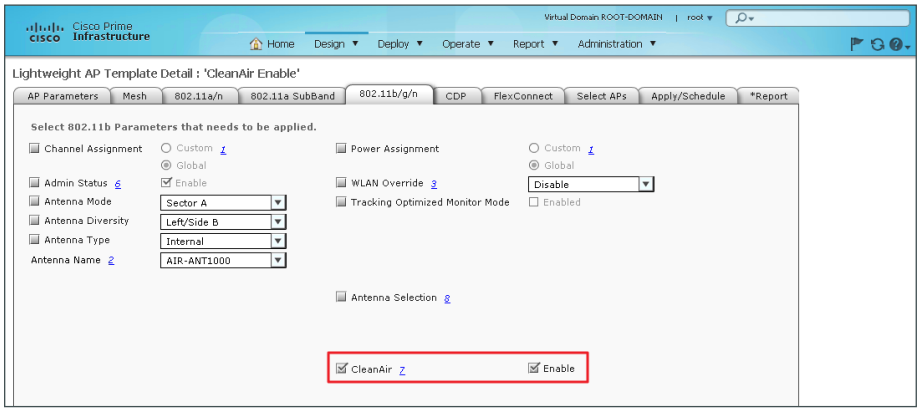
Step 3: In the **Template Name** box, enter a name, in the **Description** box, enter a description, and then click **Save**.



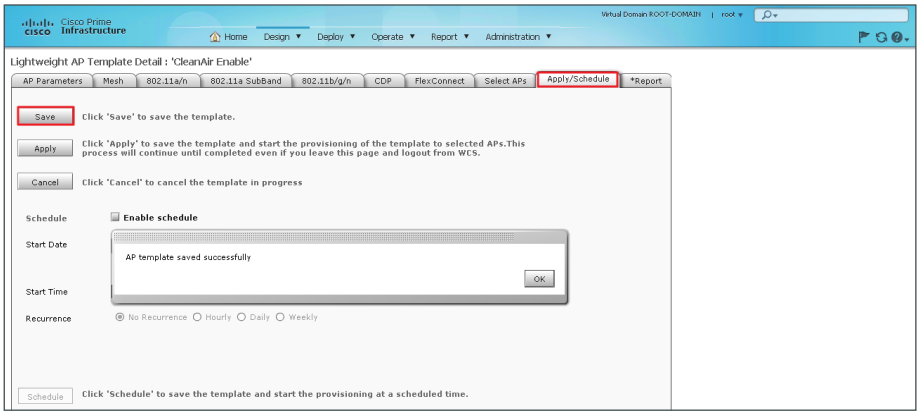
Step 4: On the 802.11a/n tab, ensure that both **CleanAir** and **Enable** are selected.



Step 5: On the 802.11b/g/n tab, ensure that both **CleanAir** and **Enable** are selected.



Step 6: On the Apply/Schedule tab, click **Save**.



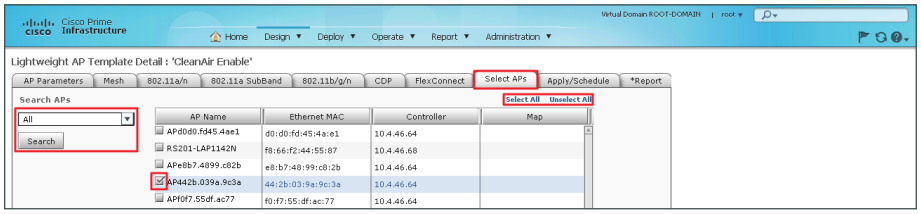
Procedure 2 Apply the Cisco CleanAir AP template

Step 1: Navigate to **Design > Configuration > Wireless Configuration > Lightweight AP Configuration Templates**.

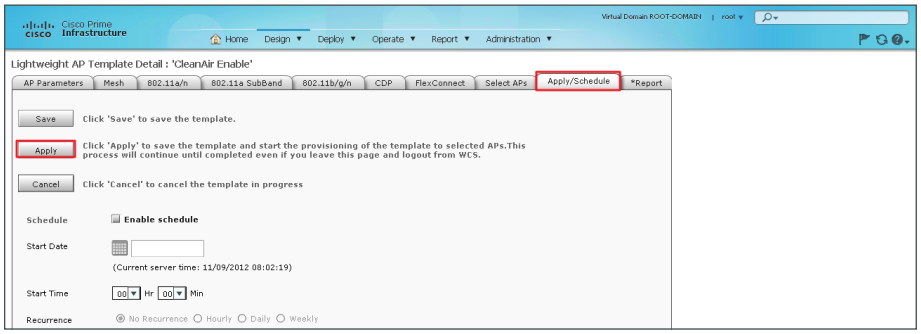
Step 2: From the list of defined templates, choose the template that you created in Step 3 of the previous procedure (Example: CleanAir Enable).

Step 3: On the Select APs tab, in the **Search APs** list, choose **All**, and then click **Search**. By default, all APs are selected.

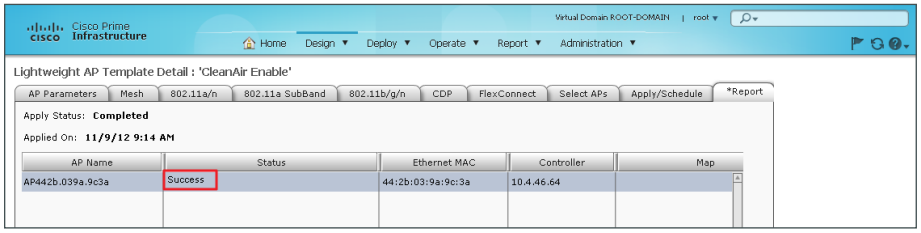
If you want to enable only certain APs, click **Unselect All**, and then individually select the APs you want to enable.



Step 4: On the Apply/Schedule tab, click **Apply**. The CleanAir Enable template is applied to the selected APs.



Step 5: On the Report tab, verify that the Template was successfully applied.



If the CleanAir Enable template is not successfully applied, ensure that:

1. In Cisco Prime Infrastructure 1.3, the SNMP Read/Write Community string for the WLC is correct.
2. In Cisco Prime Infrastructure 1.3, under **Operate> Device Work Center > Device Type > Wireless Controller**, the WLC Audit Status is **Identical** and not **Mismatched**.

Procedure 3 Create a controller EDRRM template

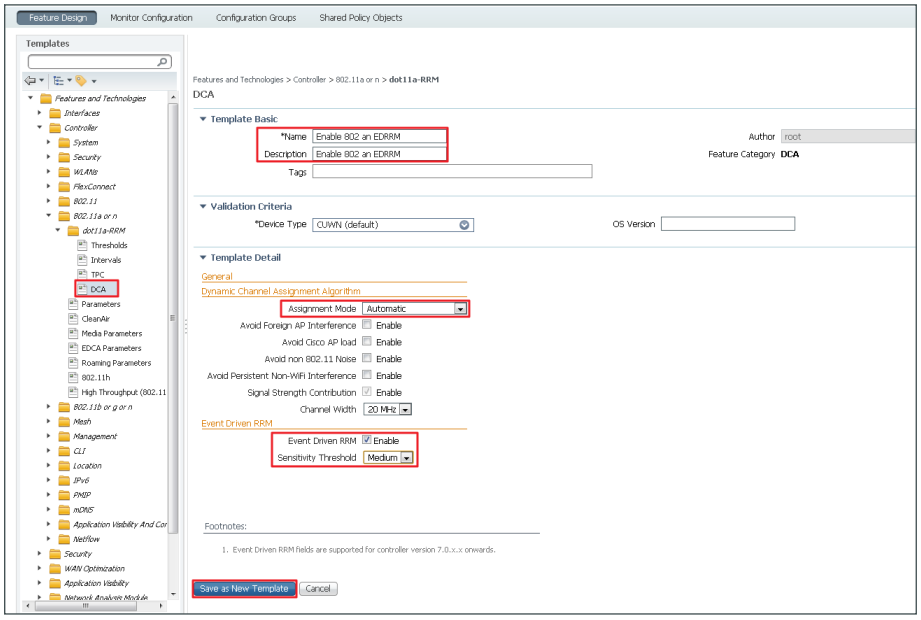
Event-driven radio resource management (EDRRM) is a feature that allows an access point that is in distress to bypass normal RRM intervals and immediately change channels. A Cisco CleanAir access point always monitors Air Quality (AQ) and reports on AQ in 15-second intervals. AQ is a better metric than normal Wi-Fi chip noise measurements because AQ only reports on classified interference devices. That makes AQ a reliable metric in that you know that what is reported is not caused by Wi-Fi energy (and hence is not a transient, normal spike).

The key benefit of EDRRM is very fast action time (30 seconds). If an interferer is operating on an active channel and is causing enough AQ degradation that it triggers EDRRM, clients cannot use that access point or channel. The only thing to do is get the access point off that channel. The EDRRM feature is not enabled by default. You must enable it in two steps: enable Cisco CleanAir and then enable EDRRM.

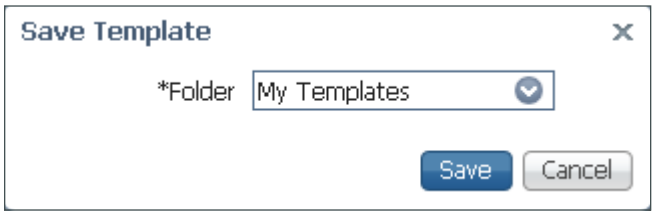
In this procedure, you create a template that is used to enable EDRRM for both the 2.4 and 5Ghz bands.

Step 1: In Cisco Prime Infrastructure 1.3, navigate to **Design > Configuration Templates > Controller**, and then in the tree, navigate to **802.11a or n > dot11a-RRM > DCA**.

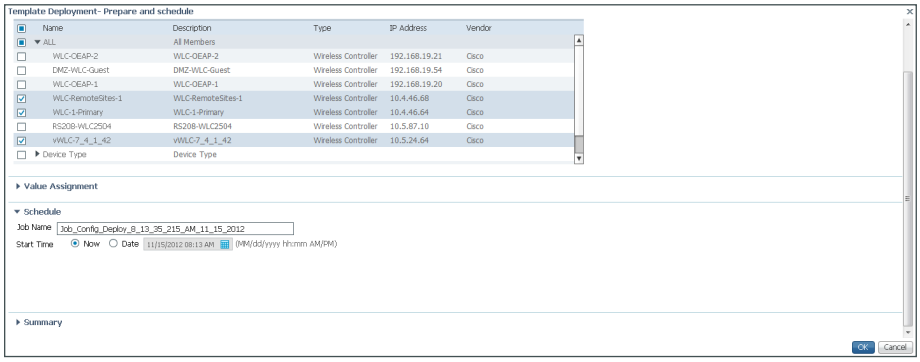
Step 2: Without using illegal characters such as "/" or ".", provide a meaningful name for the template. In the **Assignment Mode** list, choose **Automatic**, for Event Drive RRM, select **Enable**, and then in the **Sensitivity Threshold** list, choose **Medium**.



Step 3: Click **Save as New Template**, and then, on the Save Template dialog box, click **Save**. This saves the template in the My Templates folder.



Step 4: After saving the new template into the My Templates folder, at the bottom of the screen, click **Deploy**, select each of the wireless LAN controllers to apply the template to, and then click **OK**.



Step 5: Repeat Step 2 through Step 4 for 802.11b/g/n.

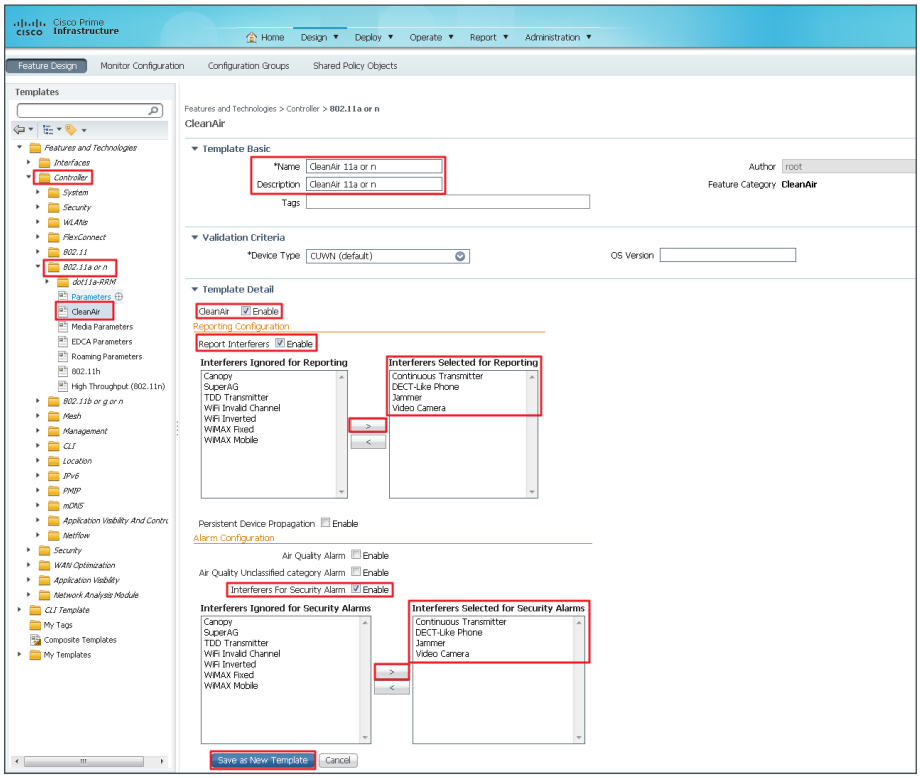
Procedure 4 Create a Cisco CleanAir controller template

The next step is to configure the controller for Cisco CleanAir, and then for each band, you identify which types of interferers are important to report and alarm on.

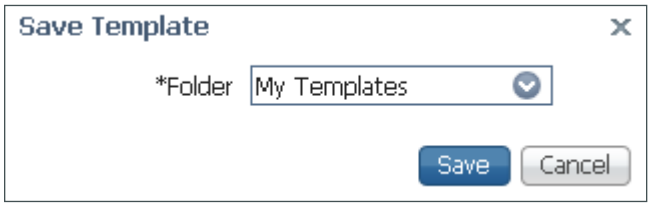
Step 1: In Cisco Prime Infrastructure 1.3, navigate to **Design > Configuration Templates > Controller > 802.11a or n > CleanAir**.

Step 2: On the CleanAir template, do the following:

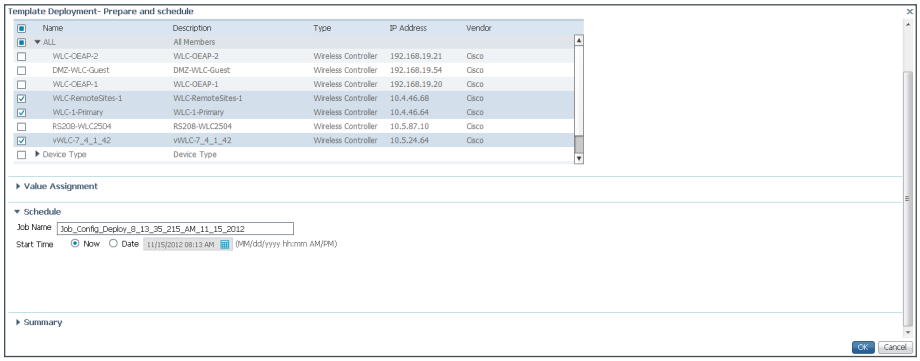
- Provide a meaningful name and description (Example: CleanAir 11a or n).
- Next to CleanAir, select **Enable**.
- Next to Report Interferers, select **Enable**. The interferers selection box for reporting appears.
- Move the following interferer types to the Interferers Selected for Reporting box: **Continuous Transmitter**, **DECT-Like Phone**, **Jammer**, **Video Camera**.
- Next to Interferers For Security Alarm, select **Enable**. The interferers selection box for security alarms appears.
- Move the following interferer types to the Interferers Selected for Security Alarms box: **Continuous Transmitter**, **DECT-Like Phone**, **Jammer**, **Video Camera**.



Step 3: Click **Save as New Template**, on the Save Template dialog box, choose **My Templates**, and then click **Save**.



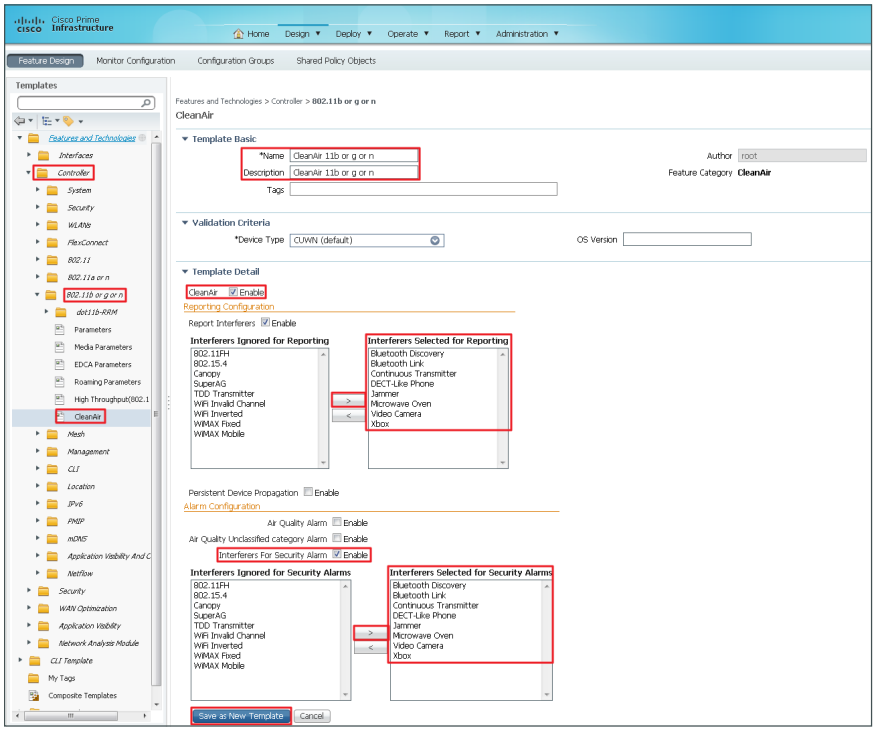
Step 4: After saving, at the bottom of the screen, click **Deploy**, select each of the wireless LAN controllers to apply the template to, and then click **OK**.



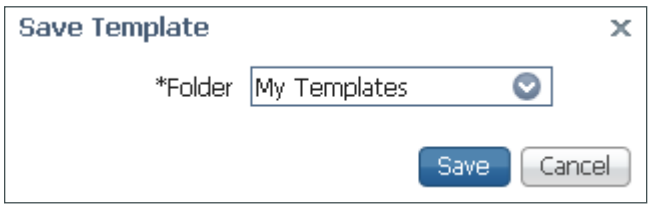
Step 5: In Cisco Prime Infrastructure 1.3, navigate to **Design > Feature Design > Controller > 802.11b or g or n > CleanAir**.

Step 6: On the CleanAir template, do the following:

- Provide a meaningful name (Example: CleanAir 11b or g or n).
- Provide a meaningful description (Example: CleanAir 11b or g or n).
- Next to CleanAir, select **Enable**.
- Next to Report Interferers, select **Enable**. The interferers selection box for reporting appears.
- Move the following interferer types to the Interferers Selected for Reporting box: **Bluetooth Discover**, **Bluetooth Link**, **Continuous Transmitter**, **DECT-Like Phone**, **Jammer**, **Microwave Oven**, **Video Camera**, **Xbox**.
- Next to Interferers For Security Alarm, select **Enable**. The interferers selection box for security alarms appears.
- Move the following interferer types to the Interferers Selected for Security Alarms box: **Bluetooth Discover**, **Bluetooth Link**, **Continuous Transmitter**, **DECT-Like Phone**, **Jammer**, **Microwave Oven**, **Video Camera**, **Xbox**.



Step 7: Click **Save as New Template**, on the Save Template dialog box, choose **My Templates**, and then click **Save**.



Step 8: After saving, at the bottom of the screen, click **Deploy**, select each of the wireless LAN controllers to apply the template to, and then click **OK**.

PROCESS

Installing the Cisco Mobility Services Engine Virtual Appliance

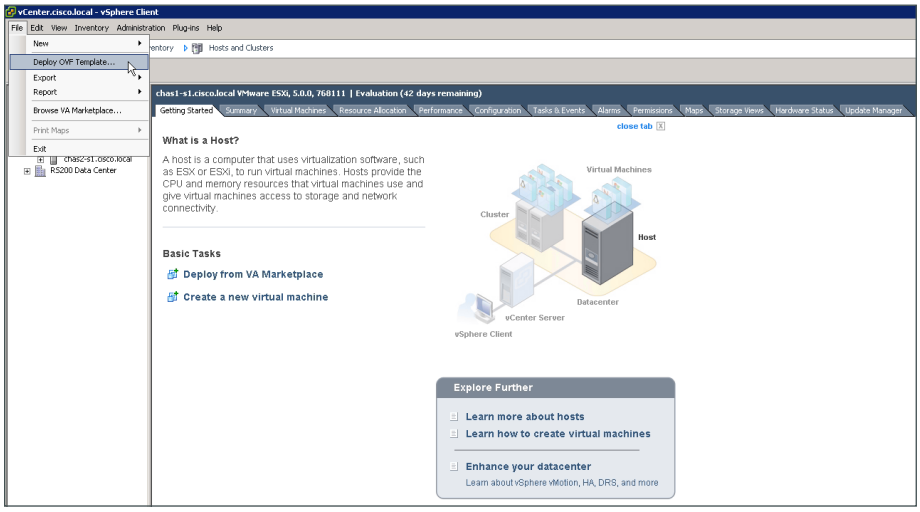
1. Install the Cisco MSE virtual appliance
2. Start the Cisco MSE virtual appliance
3. Configure the Cisco MSE virtual appliance
4. Verify installation of MSE virtual appliance

The Cisco MSE VA is deployed within a VMware environment hosted within the data center or server room. This document assumes that a fully functional VMware environment has been deployed and is operational.

Although capable of much more, the use of the Cisco MSE VA in this design guide is to provide historical Cisco CleanAir reporting. Through the use of the MSE, historical information regarding the location and types of interferers is visible through Cisco Prime Infrastructure 1.3.

Procedure 1 Install the Cisco MSE virtual appliance

Step 1: Using the VMware vSphere client, click **File**, and then choose **Deploy OVF Template**.



Step 2: In the Deploy OVF Template wizard, on the Source page, browse to the location of the Cisco MSE Open Virtual Appliance (OVA) file, and then click **Next**.

Step 3: On the OVF Template Details page, review the OVF template details, and then click **Next**.

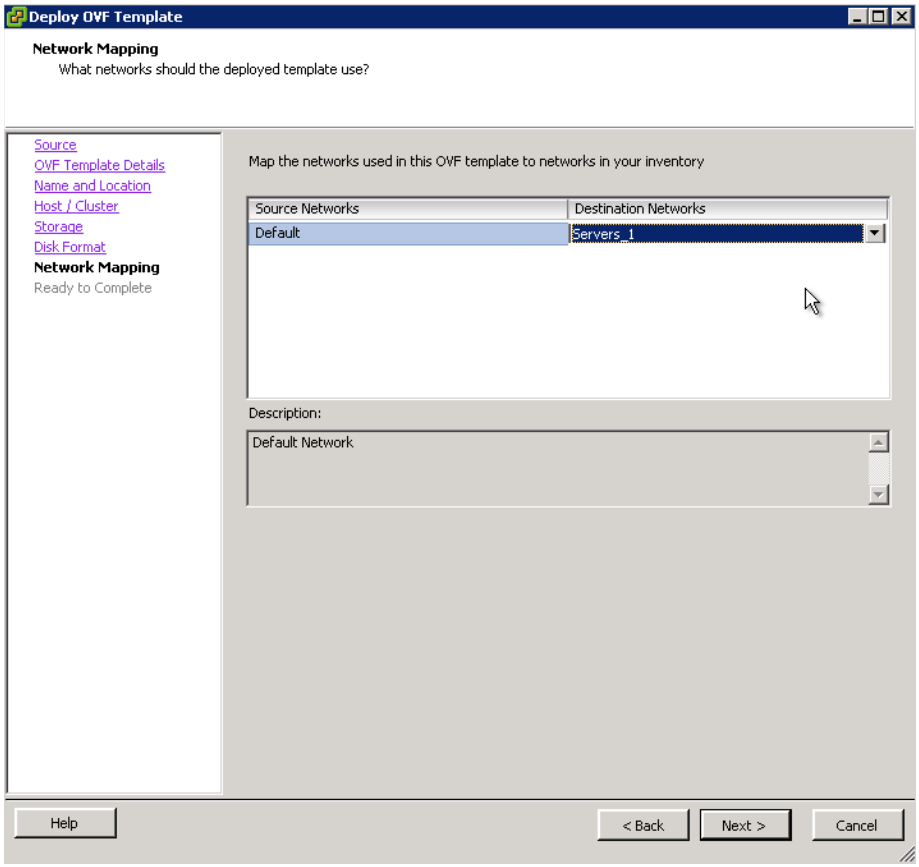
Step 4: On the Name and Location page, enter a unique and descriptive name for the virtual appliance that you are installing (Example: vMSE-VA-7-4-0-31), choose a location to install the virtual appliance, and then click **Next**.

Step 5: On the Host /Cluster page, choose the host or cluster on which to install this virtual machine, and then click **Next**.

Step 6: On the Storage page, choose where you want to store the virtual machine files, and then click **Next**.

Step 7: On the Disk Format page, select **Thick Provision Lazy Zeroed**, and then click **Next**.

Step 8: On the Network Mapping page, in the Destination Networks column, choose the appropriate network mapping group previously defined to the VMware environment (Example: Servers_1), and then click **Next**.



Step 9: On the Ready to Complete page, review the selected options, and then click **Finish**. The OVF installation begins.

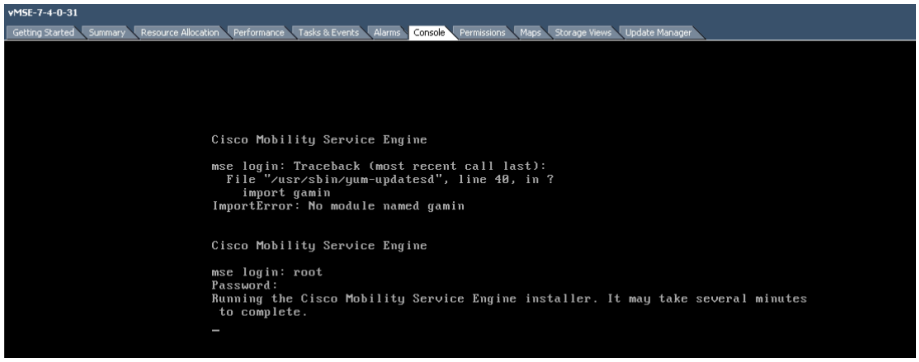
Procedure 2 Start the Cisco MSE virtual appliance

Next, you install the Cisco MSE software on the new virtual machine.

Step 1: In the VMware vSphere client, select the virtual machine just installed (Example: vMSE-7-4-0-31), and then select **Power on the virtual machine**.

Step 2: On the Console tab, after you receive the "Cisco Mobility Services Engine" banner, press **Enter**. The "ImportError: No module named gamin" error appears.

Step 3: At the **mse login** prompt, enter the default username and password: **root/password**. The installation begins and can take up to 45 minutes to complete, depending on the performance of the VM host machine.



Tech Tip

The installation process can take 45 minutes or more to complete. At times during the automated installation process, there may be times where no indication of progress is displayed. Your installation time may vary depending on CPU resources available.

Procedure 3 Configure the Cisco MSE virtual appliance

Step 1: After the virtual machine restarts, in VMware vSphere, navigate to the Console tab.

Step 2: At the **mse login** prompt, enter **root** for the user ID and **password** for the password, and then press <Enter>.

Step 3: At the prompt to setup parameters in the Setup Wizard, enter **YES**, and then press **Enter**.

```
Setup parameters via Setup Wizard (yes/no) [yes]: YES
```

Step 4: Type **Y** for Yes, and then enter the host name of the Cisco MSE virtual appliance.

```
Current hostname=[mse]
Configure hostname? (Y)es/(S)kip/(U)se default [Yes]:
Enter a host name [mse]: vMSE-VA-7-4-0-31
```

Step 5: Type **Y** for Yes, and then configure the domain name. (Example: cisco.local)

```
Current domain=[]
Configure domain name? (Y)es/(S)kip/(U)se default [Yes]:<ENTER>

Enter a domain name for the network domain to which this device belongs.  It must
contain only letters, digits, hyphens [LDH rule] and dots.
It cannot begin and end with a hyphen.

Enter a domain name : cisco.local
```

Step 6: Type **S** for Skip. This skips the high availability configuration.

```
Current role=[Primary]
Configure High Availability? (Y)es/(S)kip/(U)se default [Yes]: Skip <ENTER>
```

Step 7: Type **Y** for Yes, and then configure the eth0 interface parameters.

```
Current IP address=[1.1.1.10]
Current eth0 netmask=[255.255.255.0]
Current gateway address=[1.1.1.1]
Configure eth0 interface parameters? (Y)es/(S)kip/(U)se default [Yes]: Yes
Enter an IP address for first ethernet interface of this machine.
Enter eth0 IP address [1.1.1.10] : 10.4.48.40
Enter the network mask for IP address 10.4.48.40.
Enter network mask [255.255.255.0]: 255.255.255.0
Enter a default gateway address for this machine.
Note that the default gateway must be reachable from the first ethernet interface.
Enter the default gateway address [1.1.1.1]: 10.4.48.1
```

Step 8: Type **S** for Skip. This skips the configuration of a second Ethernet interface.

```
The second ethernet interface is currently disabled for this machine.
Configure eth1 interface parameters? (Y)es/(S)kip/(U)se default [Yes]: Skip <ENTER>
```

Step 9: Type **Y** for Yes, and then configure the DNS (Example: 10.4.48.10).

```
Domain Name Service (DNS) Setup
DNS is currently enabled.
No DNS servers currently defined
Configure DNS related parameters? (Y)es/(S)kip/(U)se default [Yes]: Yes
Enable DNS (yes/no) [yes]: Yes
Enter primary DNS server IP address: 10.4.48.10
Enter backup DNS server IP address (or none) [none] : <ENTER>
```

Step 10: Configure the current time zone (Example: America/Los Angeles).

```
Current timezone=[America/New_York]
Configure timezone? (Y)es/(S)kip/(U)se default [Yes]: Yes <ENTER>
Please identify a location so that time zone rules can be set correctly.
Please select a continent or ocean.
 1) Africa
 2) Americas
 3) Antarctica
 4) Arctic Ocean
 5) Asia
 6) Atlantic Ocean
 7) Australia
 8) Europe
 9) Indian Ocean
10) Pacific Ocean
11) UTC - I want to use Coordinated Universal Time.
12) Return to previous setup step (^).
```

```
#? 2 <ENTER>

 3) Argentina                29) Martinique
 4) Aruba                    30) Mexico
 5) Bahamas                  31) Montserrat
 6) Barbados                 32) Netherlands Antilles
 7) Belize                   33) Nicaragua
 8) Bolivia                  34) Panama
 9) Brazil                   35) Paraguay
10 Canada                    36) Peru
11) Cayman Islands           37) Puerto Rico
12) Chile                    38) St Barthelemy
13) Colombia                 39) St Kitts & Nevis
14) Costa Rica               40) St Lucia
15) Cuba                     41) St Martin (French part)
16) Dominica                 42) St Pierre & Miquelon
17) Dominican Republic       43) St Vincent
18) Ecuador                  44) Suriname
19) El Salvador              45) Trinidad and Tobago
20) French Guiana            46) Turks & Caicos Is
21) Greenland                47) United States
22) Grenada                  48) Uruguay
23) Guadeloupe               49) Venezuela
24) Guatemala                50) Virgin Islands (UK)
25) Guyana                   51) Virgin Islands (US)
26) Haiti
#? 47 <ENTER>

Select your time zone from the country specific time zone menu.

<SNIP>
20) Mountain Standard Time - Arizona
21) Pacific Time
22) Alaska Time

#? 21 <ENTER>
The following information has been given:
United States
Pacific Time

Therefore TZ='America/Los_Angeles' will be used.
Local time is now:      Fri Oct   5  07:54:52 PDT 2012.
Universal Time is now: Fri Oct   5  14:54:52 UTC 2012.
Is the above information OK?
1) Yes
2) No
#? 1 <ENTER>
```

Step 11: Choose the default option as to when Cisco MSE automatically restarts.

```
Enter whether you would like to specify the day and time when you want the MSE to
be restarted.  If you don't specify anything, then Saturday 1 AM will be taken as
the default.
Configure future restart day and time ? (Y)es/(S)kip [Skip]: <ENTER>
```

Step 12: Specify the remote syslog server used to publish the Cisco MSE logs (Example: 10.4.48.15).

Tech Tip

Selecting a priority level of 2 generates both warning and information-level messages. The facility value is a way of determining which process created the message. LOCAL0 through LOCAL7 are typically used for networking equipment.

```
Configure Remote Syslog Server to publish/MSE logs MSE logs.

A Remote Syslog Server has not been configured for this machine.
Configure Remote Syslog Server Configuration parameters? (Y)es/(S)kip/(U)se
default [Yes]: Yes
Configure Remote Syslog Server IP address : 10.4.48.15

Configure Remote Syslog Server Priority parameter.
select a priority level
1) ERROR (ERR)
2) WARNING
3) INFO
Enter a priority level (1-3) : 2 <ENTER>

Configure Remote Syslog Server's Facility parameter.
Select a logging facility
0) LOCAL0 (16)
1) LOCAL1 (17)
2) LOCAL2 (18)
3) LOCAL3 (19)
4) LOCAL4 (20)
5) LOCAL5 (21)
6) LOCAL6 (22)
7) LOCAL7 (23)
Enter a facility(0-7) :4 <ENTER>
```

Step 13: Type **S** for Skip. This skips the next step, which is used for modifying the iptables for Cisco MSE.

```
Enter whether or not you would like to change the iptables for this machine
(giving access to certain host).

Configure Host access control settings ?(Y)es/(S)kip [Skip]: <ENTER>
```

Step 14: Configure Network Time Protocol (NTP), as shown below.

```
Network Time Protocol (NTP) Setup.
If you choose to enable NTP, the system time will be configured from NTP servers
that you select. Otherwise, you will be prompted to enter the current date and
time.
NTP is currently disabled.
Configure NTP related parameters? (Y)es/(S)kip/(U)se default [Yes] Yes
Enter whether or not you would like to set up the Network Time Protocol(NTP) for
this machine.
If you choose to enable NTP, the system time will be configured from NTP servers
that you select. Otherwise, you will be prompted to enter the correct date and
time.
Enable NTP (yes/no) [no]: Yes
Enter NTP server name or address: 10.4.48.17
Enter another NTP server IP address (or none) [none]: <ENTER>
Configure NTP Authentication ? (Y)es/(S)kip/(U)se default [Yes]: Skip
```

Step 15: Type **S** for Skip. This skips the configuration of the Cisco MSE audit rules, login banner, and console access.

```
Audit rules Setup.
Configure audit rules and enable Audit daemon? (Y)es/(S)kip/(U)se default [Yes]:
Skip <ENTER>
Current Login Banner = [Cisco Mobility Service Engine]
Configure login banner (Y)es/(S)kip/(U)se default [yes]: Skip <ENTER>
System console is not restricted.
Configure system console restrictions (Y)es/(S)kip(U)se default value [Yes] :
Skip <ENTER>
```

Step 16: Type **Yes**. This enables SSH root access.

```
SSH root access is currently enabled.
Configure ssh access for root (Y)es/(S)kip(U)se default [Yes]: <ENTER>
Enter whether or not you would like to enable ssh root login.  If you disable
this option, only console root login will be possible.
Enable ssh root access (yes/no): Yes <ENTER>
Single user mode password check is currently disabled.
Configure single user mode password check (Y)es/(S)kip/(U)se default [Yes]: Skip
<ENTER>
Configure root password (Y)es/(S)kip/(U)se default [Yes]: <ENTER>
You can now choose the new password.
A valid password should be a mix of upper and lower case letters, digits, and
other characters.  You can use a 14 character long password with characters from
all of these classes.  An upper case letter that begins the password and a digit
that ends it do not count towards the number of character classes used.
Enter new password: Hgt50N3181.5n2B <ENTER>
```

Tech Tip

Cisco MSE requires the use of strong passwords, which must be a minimum of 14 characters long with rigid requirements on the use of various character classes. Choose a strong password and document it according to your internal InfoSec policies.

Step 17: Accept the default log-in parameters and GRand Unified Bootloader (GRUB) settings.

```
Login and password strength related parameter setup
Maximum number of days a password may be used : 99999
Minimum number of days allowed between password changes : 0
Minimum acceptable password length : disabled
Login delay after failed login : 5
Checking for strong passwords is currently enabled
Configure login/password related parameters? (Y)es/(S)kip/(U)se default [Yes]:
Skip <ENTER>
GRUB password is not currently configured.
Configure GRUB password (Y)es/(S)kip/(U)se default [Yes]: Skip <ENTER>
```

Tech Tip

GRUB is used to password-protect the boot loader in Linux systems. If you specify a GRUB password, each time the virtual appliance is booted up, the GRUB password must be entered. If the password is lost or forgotten, the virtual appliance cannot be booted up. Configuring a GRUB password should be done with consideration and documented accordingly in your organization's operations manual.

Step 18: Select **Yes**, and configure the Cisco Prime Network Control System (NCS) communications username.

```
Configure NCS communications username? (Y)es/(S)kip/(U)se default [Yes]: Yes
<ENTER>
Enter an admin username.
This user is used by the NCS and other northbound systems to authenticate their
SOAP/XML session with the server.
Enter a username : vMSEuser
Configure NCS communication password? (Y)es/(S)kip/(U)se default [Yes]: Yes
<ENTER>
Enter a password for the admin user.
The admin user is used by the NCS and other northbound systems to authenticate
their SOAP/XML session with the server. Once the password is updates, it must
correspondingly be updated on the NCS page for MSE General Parameters so that the
NCS can communicate with the MSE.
Enter NCS communication password:  C1scO!349@
Confirm NCS communication password :  C1scO!349@
```

Step 19: Confirm and approve the settings obtained through the Setup Wizard.

```
-------BEGIN-------
   Host name=vMSE-VA-7-4-0-31
   Domain=cisco.local
   Eth0 IP address=10.4.48.40, Eth0 network mask=255.255.255.0
   Default gateway=10.4.48.1
   Enable DNS=yes, DNS servers=10.4.48.10
   Time zone=America/Los_Angeles
   Enable NTP=yes, NTP Servers=10.4.48.17
   Enable SSH root access=yes
   Root password is changed.
   NCS username is changed.
   NCS password is changed.
     Remote Systemlog Server IPAddress=10.4.48.15, Remote Syslog Server
Facility=Local0
     Remote Syslog Server Priority=WARNING
-------END-------
You may enter "yes" to proceed with configuration, "no" to make more changes, or
"^" to go back to the previous setup.
Configuration Changed
Is the above information correct (yes, no, or ^): Yes <ENTER>
```

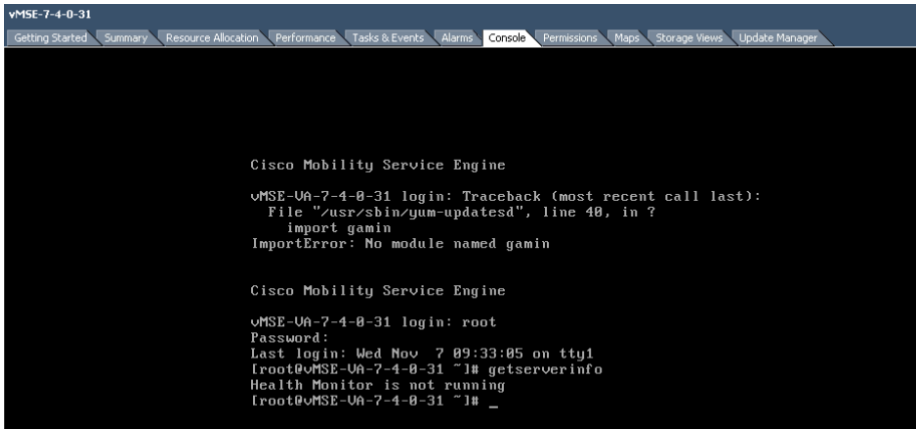
Procedure 4 Verify installation of MSE virtual appliance

Manually restart the Cisco MSE server and using the following steps, confirm that the MSE processes have indeed started.

Step 1: In VMware vSphere, shutdown and restart the Cisco MSE VA host.

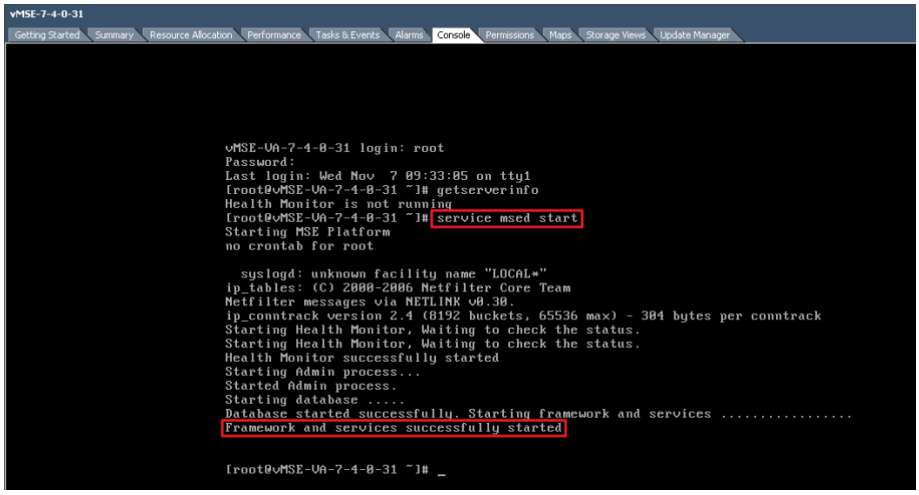
Step 2: On the Console tab, log in to the Cisco MSE by entering **root** for the user ID and the password configured in Step 16 (Example: Hgt50N3181.5n2B).

Step 3: When logged in, enter the **getserverinfo** command, and then note the status of the Health Monitor.



Step 4: If the Cisco MSE Health Monitor is running, skip to the next procedure.

If the Cisco MSE Health Monitor is not running, enter the **service msed start** command. The MSE platform processes start.



Step 5: Repeat Step 3 and verify that the MSE Health Monitor is running.

PROCESS

Configuring Cisco Prime Infrastructure 1.3 for the Cisco MSE VA

1. Log in to Cisco Prime Infrastructure 1.3
2. Add a user ID for the Cisco MSE VA
3. Add the Cisco MSE VA
4. Confirm Cisco MSE VA addition and license
5. Synchronize the WLCs to use Cisco MSE
6. Enable NMSP between MSE and WLCs

Cisco Prime Infrastructure 1.3 must be configured with the relevant Cisco MSE VA information. This configuration allows Prime Infrastructure 1.3 to communicate with the MSE VA server.

Tech Tip

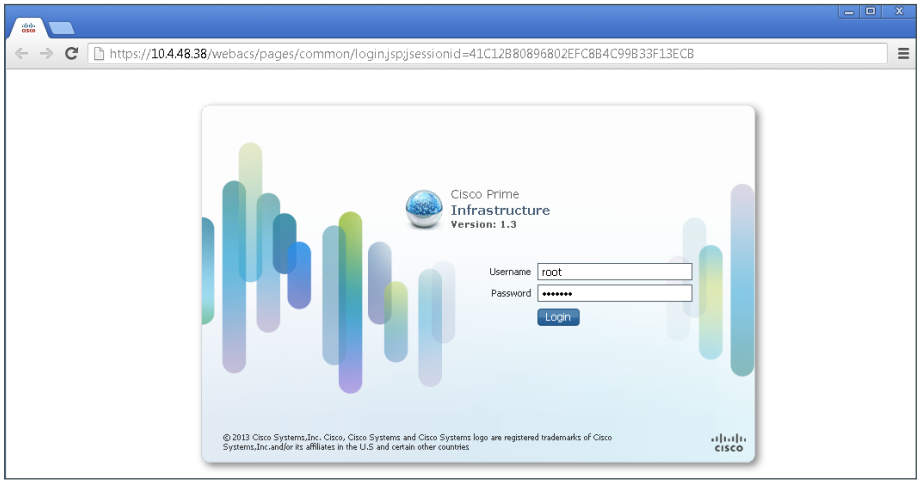
Cisco Prime Infrastructure supports the following browsers: Google Chrome (19.0 build), Mozilla Firefox (ESR 10.x, 13.0 and 14.0), and Microsoft Internet Explorer (8.0 or 9.0 with Chrome plug-in).

Native Internet Explorer is not supported. The recommended minimum resolution for each browser is 1280 x 800 pixels.

Procedure 1 Log in to Cisco Prime Infrastructure 1.3

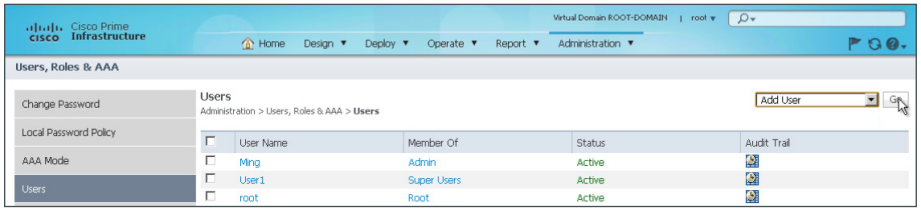
Step 1: Using a supported browser, access the Cisco Prime Infrastructure 1.3 management interface (Example: https://10.4.48.38).

Step 2: Log on using the configured Cisco Prime Infrastructure 1.3 user ID and password (Example: root/Prime13).



Procedure 2 Add a user ID for the Cisco MSE VA

Step 1: In Cisco Prime Infrastructure 1.3, navigate to **Administration > Users**, in the list, choose **Add User**, and then click **Go**.

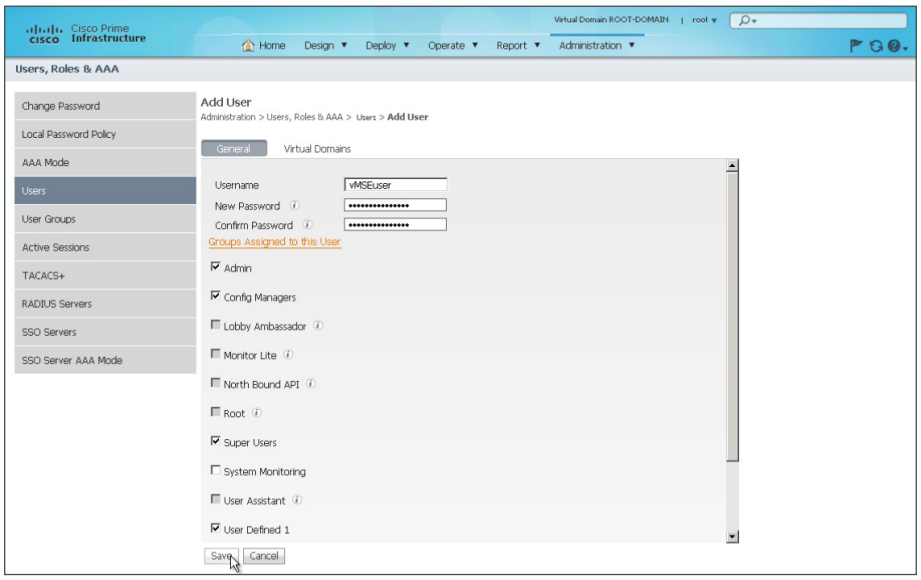


Step 2: Enter the username (Example: vMSEuser) and password (Example: C1scO!349@) that you configured in Step 18 of Procedure 3, “Configure the Cisco MSE virtual appliance.”

Step 3: Select **Admin**, **Config Managers**, **Super Users**, and **System Monitoring**, and then click **Save**.

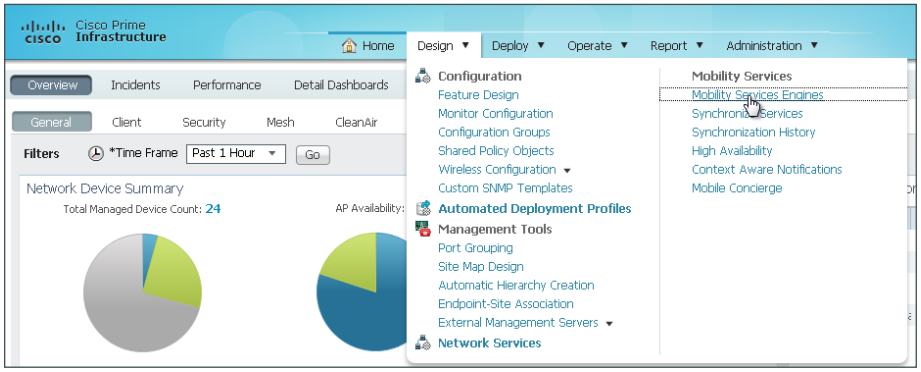
Tech Tip

It may be necessary to modify the password policy in Cisco Prime Infrastructure 1.3 in order to accept passwords that contain variations of the word Cisco as used above. To do this, navigate to **Administration > Users, Roles & AAA > Local Password Policy**, and modify the necessary policy settings in order to match your security policy.



Procedure 3 Add the Cisco MSE VA

Step 1: Navigate to **Design > Mobility Services Engines**.



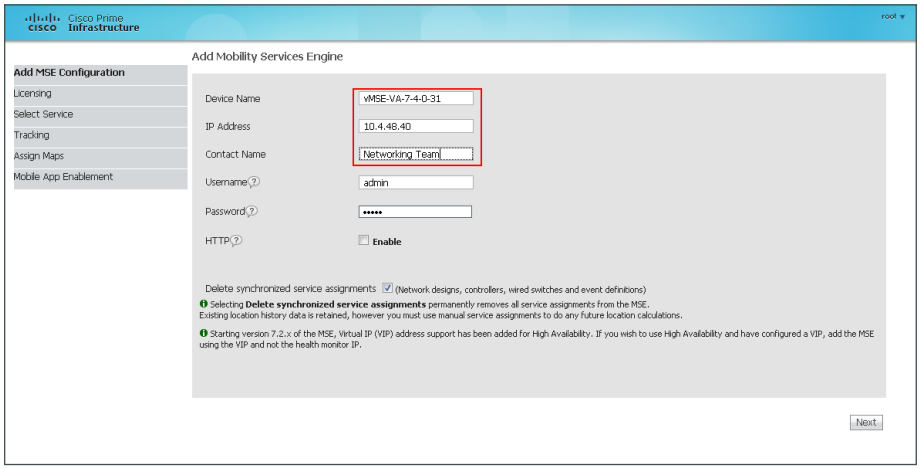
Step 2: In the list, choose **Add Mobility Services Engine**, and then click **Go**.

Step 3: On the Add Mobility Services Engine page, enter the following parameters:

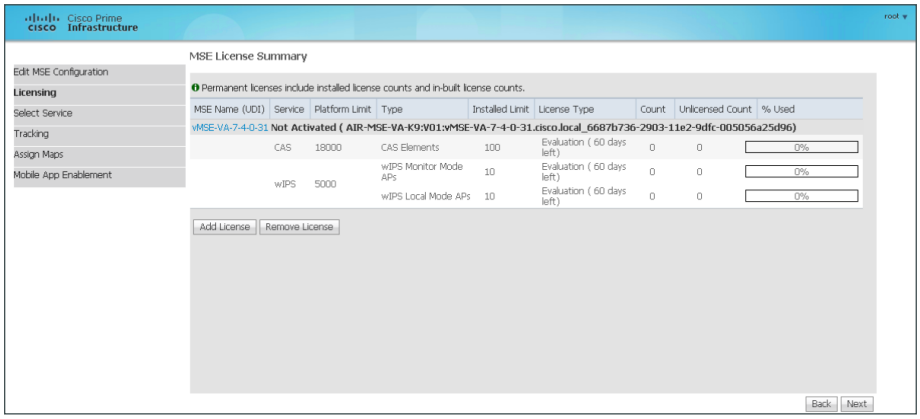
- Device Name–**vMSE-VA-7-4-0-31**
- IP Address–**10.4.48.40**
- Contact Name–**Networking Team**
- Username–**admin** (do not change this)
- Password–(do not change the auto-filled value)
- HTTP Enable–**No**

Tech Tip

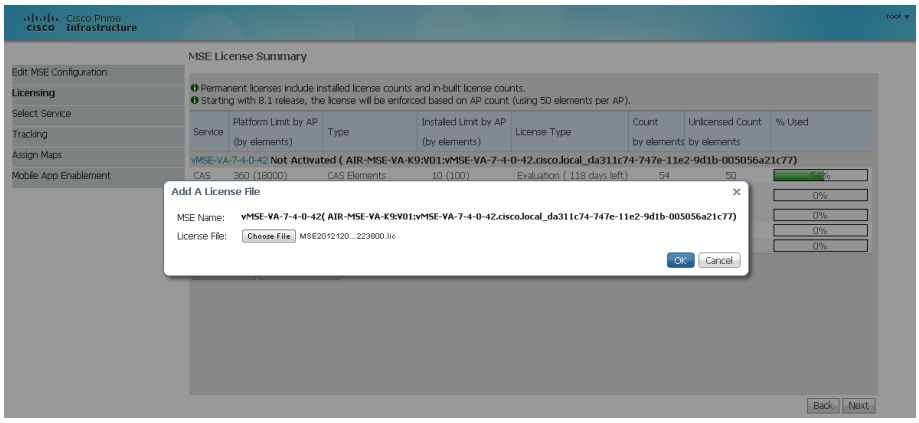
Note that enabling HTTP changes the default from HTTPS. It is recommended that you leave HTTP disabled for added security. It is not necessary to change the password.



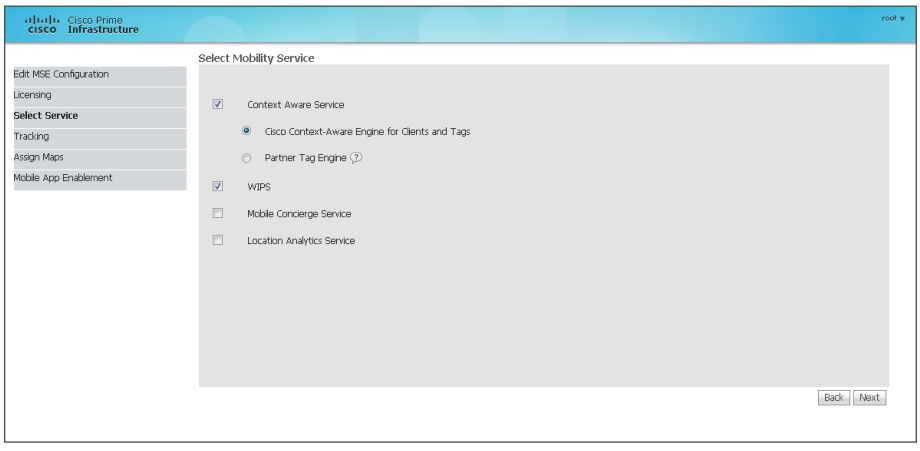
Step 4: On the MSE License Summary page, review the Cisco Prime licensing for the Cisco MSE VA. If you do not have additional licenses to add, click **Next**.



If you have additional licenses for the MSE, click **Add License**. On the Add A License File dialog box, click **Choose File**, select the Cisco MSE license file that you received as part of the fulfillment process, and then click **OK**. On the MSE License Summary page, click **Next**.



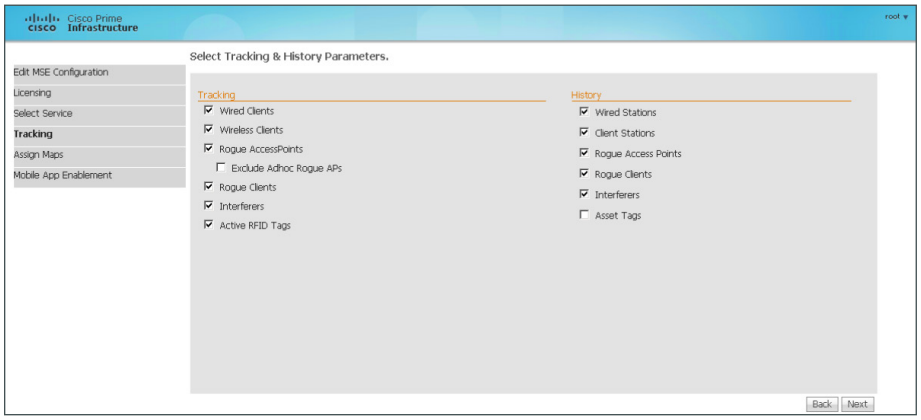
Step 5: On the Select Mobility Service page, select **Context Aware Service**, Wireless Intrusion Protection Service (**WIPS**) and then click **Next**.



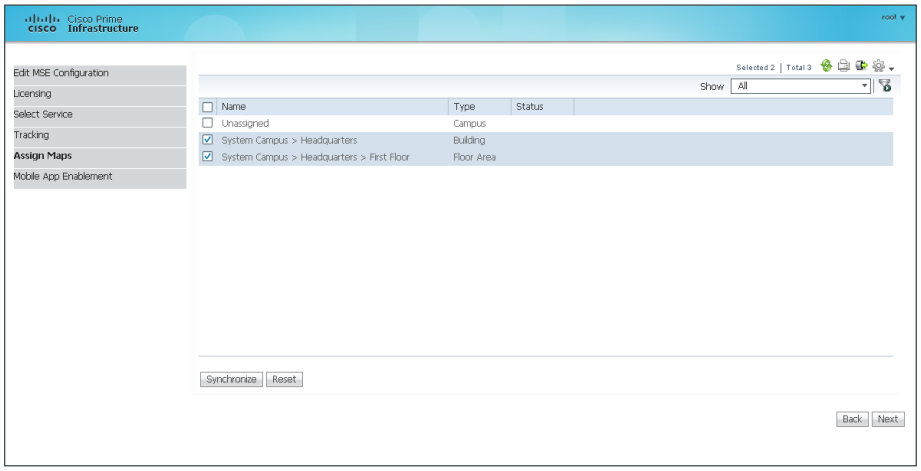
Step 6: On the Tracking page, enable the following real-time and historical tracking services as shown in the following table, and then click **Next**.

Table 1 - Tracking and history parameters

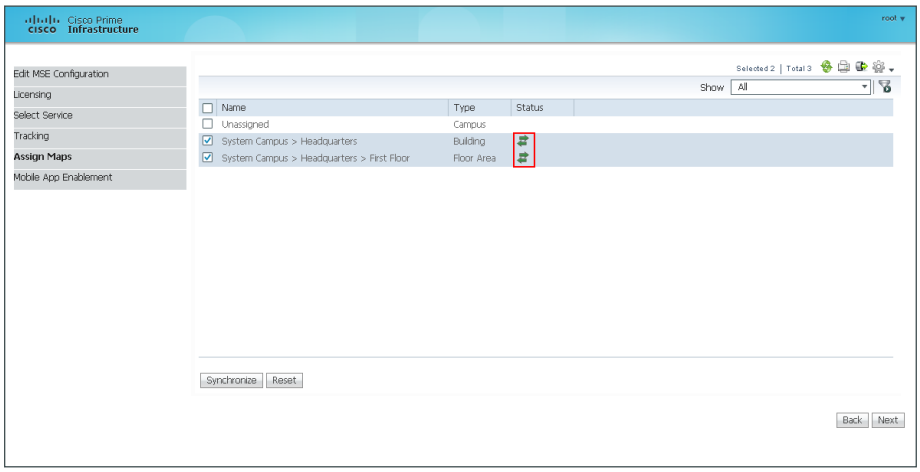
Tracking	History
Wired Client	Wired Stations
Wireless Clients	Client Stations
Rogue Access Points	Rogue Access Points
Rogue Clients	Interferers
Active RFID Tags	–



Step 7: On the Assign Maps page, select the building and floor plan created and click **Synchronize**.

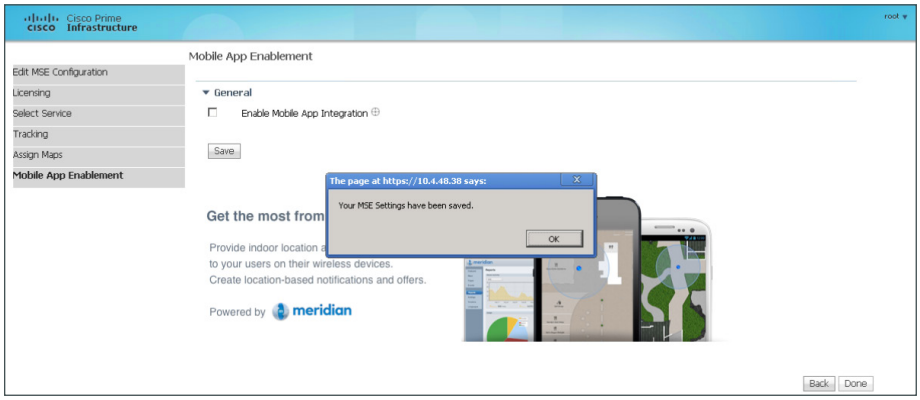


The Status changes to bi-directional as shown by the green arrows in the status column.



Step 8: Click **Next** to continue.

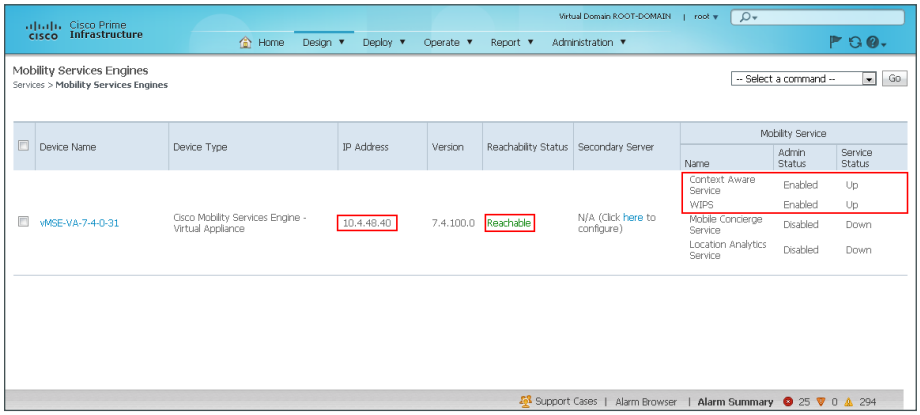
Step 9: On the Mobile App Enablement page, do not enable Mobile App Integration, click **Done**, and then on the "Your MSE Settings have been saved" message, click **OK**.



Procedure 4 Confirm Cisco MSE VA addition and license

It may be necessary to limit the number of elements that are being tracked, according to the license. If you are using the evaluation license, which allows 100 items to be tracked and expires in 180 days, you may have to limit what those license elements are being used for. This procedure provides guidance for manually configuring which items to track.

Step 1: Navigate to **Design > Mobility Services Engines**, and then verify that the configured IP address of the Cisco MSE VA is reachable and that each of the mobility services are available.

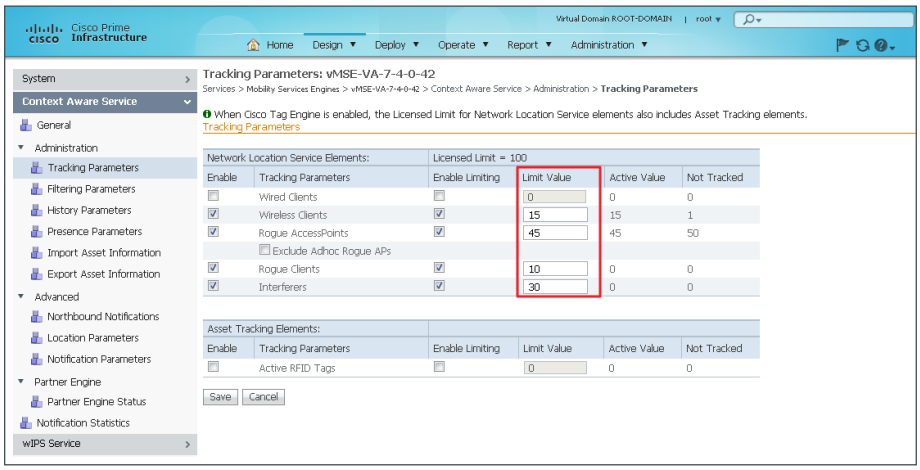


Step 2: If you do not want to manually configure which devices are tracked, skip to the next procedure.

If you want to manually configure tracking, navigate to **Design > Mobility Services Engines**, and then select the Cisco MSE.

Step 3: In the tree, navigate to **Context Aware Services > Administration > Tracking Parameters**.

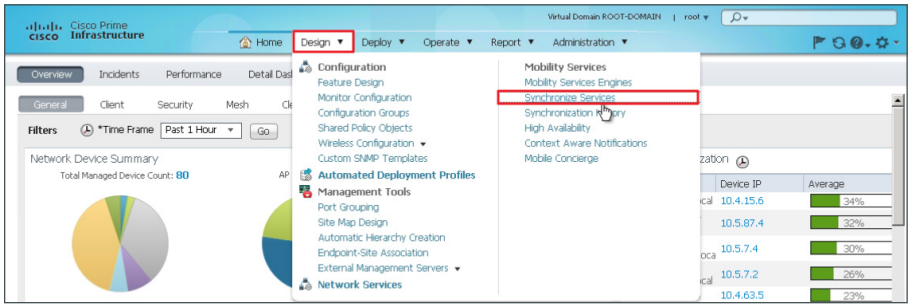
Step 4: Enable only the Network Location Service elements necessary, and then enter a limit value that conforms to your Licensed Limit (Example: **15** Wireless Clients + **45** Rogue Access Points + **10** Rogue Clients + **30** Interferers = 100 Licensed Elements). When appropriately valued, click **Save**.



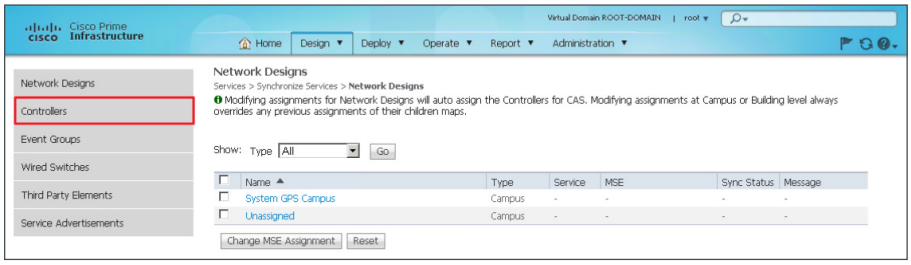
Procedure 5 Synchronize the WLCs to use Cisco MSE

In order to establish and assign Cisco MSE to each of the wireless LAN controllers, it is first necessary to synchronize them. In the following steps, you assign the MSE VA to each of the wireless LAN controllers in Cisco Prime Infrastructure 1.3.

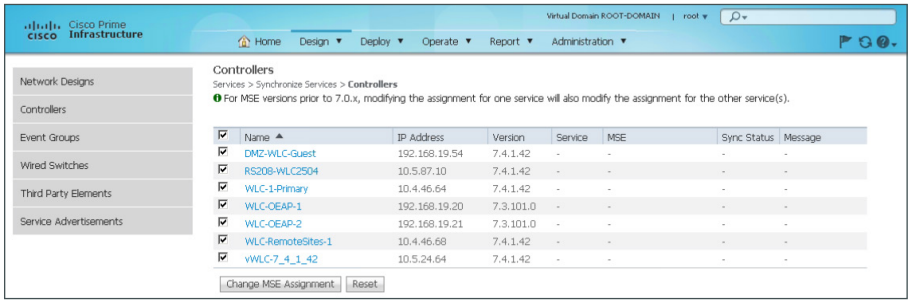
Step 1: Navigate to **Design > Mobility Services > Synchronize Services**.



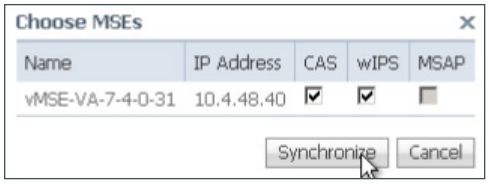
Step 2: On the left side of the page, in the list, click **Controllers**.



Step 3: Select each of the wireless LAN controllers that you want to assign to the Cisco MSE, and then click **Change MSE Assignment**.



Step 4: On the Choose MSEs dialog box, select **CAS** (Context Aware Service) and **wIPS**, and then click **Synchronize**.



Procedure 6 Enable NMSP between MSE and WLCs

The Cisco Network Mobility Service Protocol (NMSP) is a Transport Layer Security (TLS) based protocol that manages the communication between the Cisco MSE and the wireless infrastructure inclusive of controllers and Cisco Catalyst switches. Information collected at chokepoints, along with various telemetry and emergency information, is communicated by using this protocol.

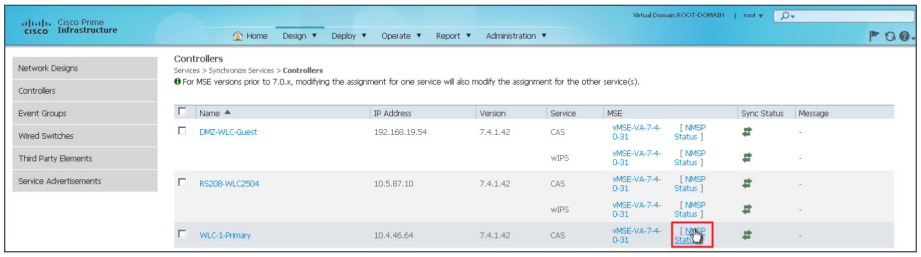
If the wireless LAN controller was discovered in Cisco Prime Infrastructure by using the Read/Write SNMP community string, then Cisco NMSP should be established automatically between the Cisco MSE and the WLC. If however the WLC was discovered using the Read Only community string, NMSP is likely in the inactive state, as shown in Step 3 below.

Tech Tip

In order for Cisco MSE to communicate with the wireless infrastructure by using NMSP, the clocks of all devices must be synchronized. It is therefore recommend that all infrastructure components utilize NTP for consistent clock synchronization.

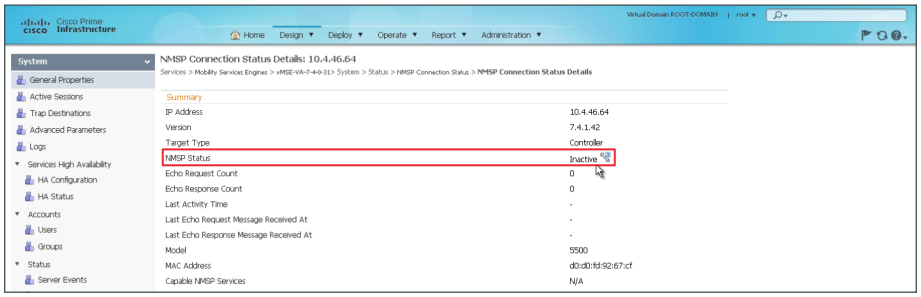
Step 1: Navigate to **Design > Mobility Services > Synchronize Services**, and then in the left column, click **Controllers**.

Step 2: On the Controllers page, for each of the wireless LAN controllers that provide Cisco CleanAir information, click the **[NMSP status]** link.



Step 3: If any of the WLCs has an NMSP status of **Inactive**, note which WLCs are not in an active state. Perform the steps below for each of the inactive WLCs.

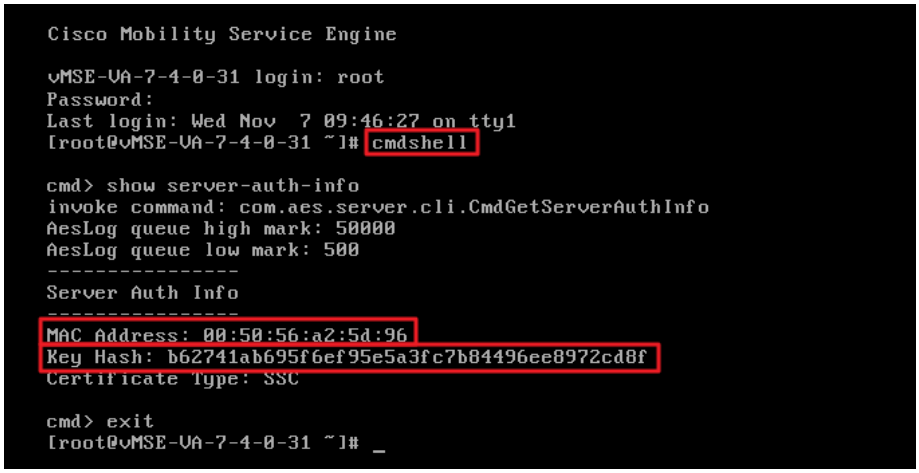
If all of the WLCs have an NMSP status of **Active**, skip to the next procedure.



Step 4: On the Cisco MSE VA, in the CLI, issue the **cmdshell** command. The response is the **cmd>** prompt.

Step 5: At the **cmd>** prompt, issue the **show server-auth-info** command.

Step 6: Copy down the key hash value and MAC address as shown on the Cisco MSE VA. Be careful not to transpose any digits in the hash string or MAC address obtained.



Next, you determine if the Cisco MSE is authorized in the WLC.

Step 7: From the console port, navigate to the CLI interface of a wireless LAN controller that displayed as Inactive in Step 3, and then enter the **show auth-list** command. In the example below, there are no MSEs currently authorized to establish an NMSP session with the wireless LAN controller.

```
(Cisco Controller) >show auth-list
Authorize MIC APs against AAA ..................... disabled
Authorize LSC APs against Auth-List ............... disabled
APs Allowed to Join
  AP with Manufacturing Installed Certificate.... yes
  AP with Self-Signed Certificate................ no
  AP with Locally Significant Certificate........ no
```

Step 8: Authorize the Cisco MSE on the wireless LAN controller by using the information obtained from the MSE VA in Step 6.

```
(Cisco Controller) >conf
(Cisco Controller) config>auth-list add ssc 00:50:56:a2:5d:96
b62741ab695f6ef95e5a3fc7b84496ee8972cd8f
(Cisco Controller) config>
```

Step 9: Verify that the Cisco MSE has been authorized on the wireless LAN controller.

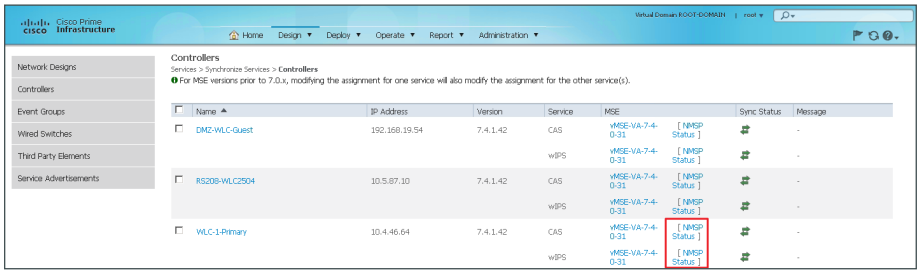
```
(Cisco Controller) >show auth-list
Authorize MIC APs against Auth-list or AAA ..... disabled
Authorize LSC APs against Auth-List ..... disabled
APs Allowed to Join
  AP with Manufacturing Installed Certificate.... yes
  AP with Self-Signed Certificate..... no
  AP with Locally Significant Certificate..... no

Mac Addr          Cert Type Key Hash
----------------- --------- ----------------------------------------
00:50:56:a2:5d:96 SSC       b62741ab695f6ef95e5a3fc7b84496ee8972cd8f
(Cisco Controller) >
```

Step 10: Repeat Step 7 through Step 9 for each of the wireless LAN controllers that do not have an established NMSP connection.

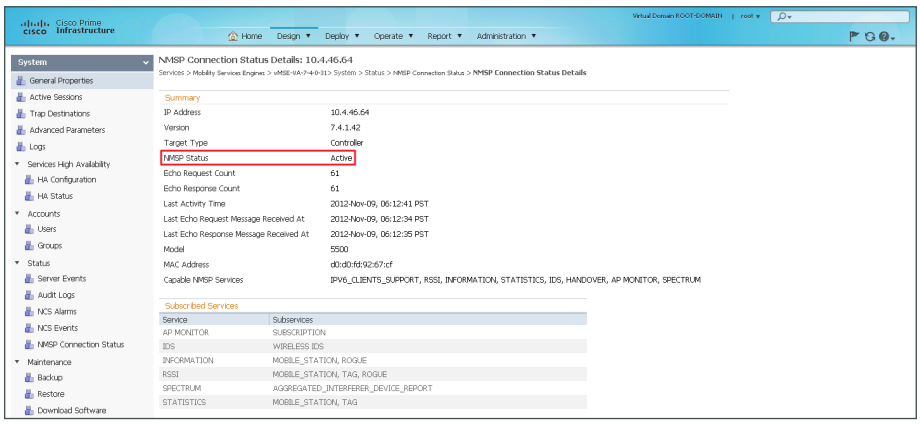
After manually adding the Cisco MSE key hash value and MAC address to the WLCs, you must verify that the NMSP status is now active.

Step 11: Within Cisco Prime Infrastructure 1.3, navigate to **Design > Mobility Services > Synchronize Services > Controllers**, and then for every WLC connected to Cisco MSE and used for CAS or wIPS, click the **[NMSP Status]** link.



The NMSP status should now be **Active** for each of the WLCs, as shown below.

Step 12: If the status does not change to an active state, verify that the authorization list on the WLC has the proper MAC address and SSC key hash of the Cisco MSE VA. Also, ensure IP connectivity exists between the WLC, MSE, and Cisco Prime Infrastructure 1.3.



Troubleshooting with Cisco CleanAir

With the addition of the Cisco MSE VA, historical Cisco CleanAir information is readably accessible through Cisco Prime Infrastructure 1.3. The ability to determine the quality of the RF spectrum combined with the ability to retrieve baseline historical information is key in most RF spectrum troubleshooting.

The real power of Cisco CleanAir is that network administrators, without leaving their own desks, can analyze the Wi-Fi spectrum in any location to which they have connectivity.

The Cisco Aironet 2600 and 3600 Series access points can be put in Spectrum Expert-Connect mode and used as a virtual remote interface for the knowledgeable engineer, no matter where this valuable human resource is located. By changing the role of your CleanAir access point and connecting the Cisco Spectrum Expert Wi-Fi 4.0 (or later) software, the Wi-Fi network administrator can view the environment directly. Your organization no longer needs to fly expensive personnel onsite in order to troubleshoot physical-layer issues that are challenging and, too often, intermittent.

PROCESS

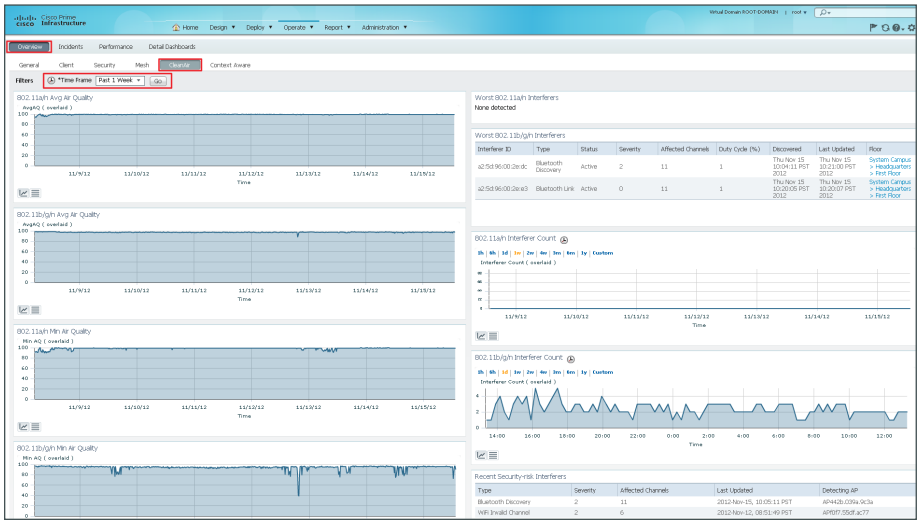
Viewing and Analyzing Cisco CleanAir

1. View historical Cisco CleanAir information
2. Access Cisco CleanAir APs using Spectrum Expert

Procedure 1 View historical Cisco CleanAir information

Oftentimes it's imperative that a historical baseline for RF spectrum management is available. Using Cisco Prime Infrastructure 1.3 combined with the Cisco MSE VA, you can easily view historical information.

Step 1: In Cisco Prime Infrastructure 1.3, navigate to **Home > Overview > CleanAir**, in the **Filters** list, choose the desired time frame, and then click **Go**.



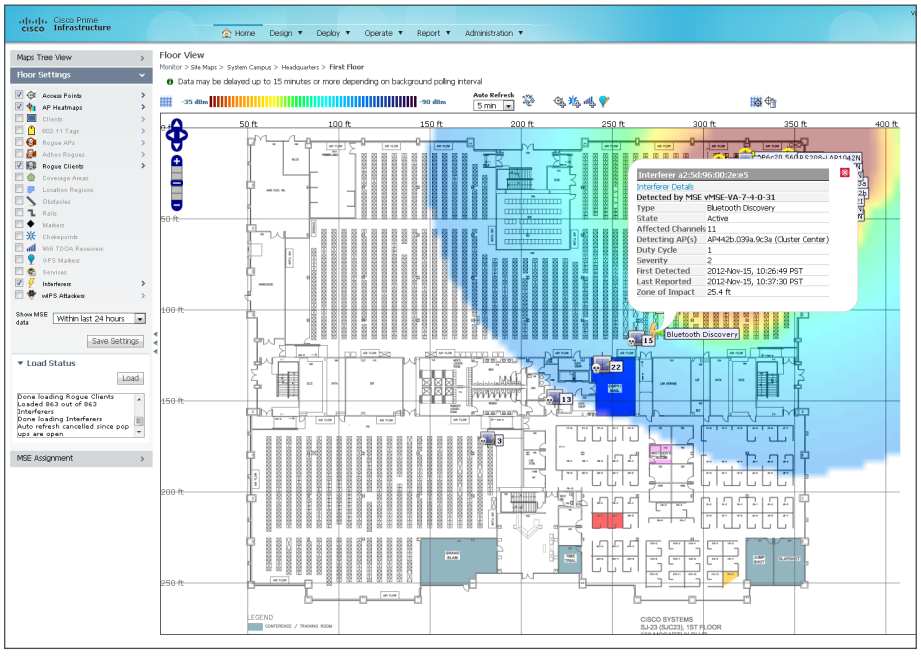
Tech Tip

If you find that Cisco CleanAir Air Quality graphs are not being displayed as shown above, you may need to perform one or more of the following troubleshooting steps:

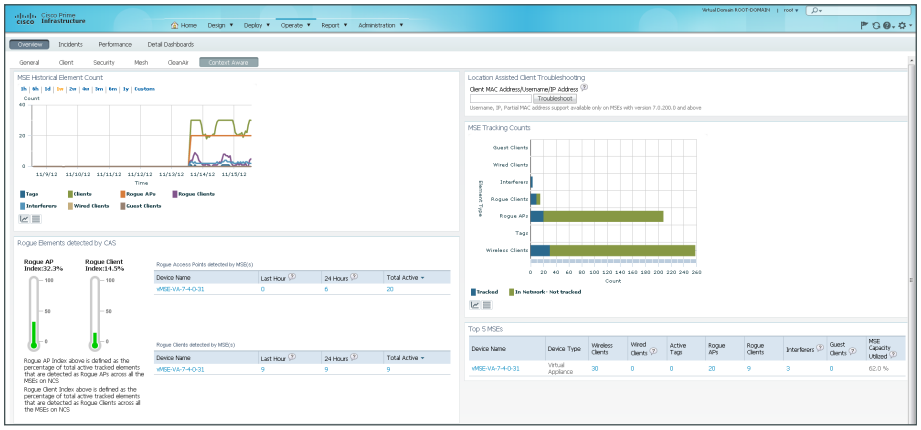
1. Ensure that CleanAir-capable APs have been configured on the floor plan or map and that their radios are enabled.
2. Ensure that all CleanAir settings have been successfully applied to the APs and wireless LAN controller via the templates described in this document.
3. Repeat Step 4 in Procedure 5 above by first clearing **CAS** (Context Aware Services) and **wIPS** and then synchronizing. Then go back again, select **CAS** and **wIPS**, and re-synchronize.
4. Ensure that NMSP between the Cisco MSE and WLCs is established within Prime Infrastructure as defined in Procedure 6, "Enable NMSP between MSE and WLCs."
5. Ensure that the Cisco MSE services are running as described in Procedure 4, "Confirm Cisco MSE VA addition and license."

Step 2: Click **Worst Interferers**. The corresponding floor plan is displayed.

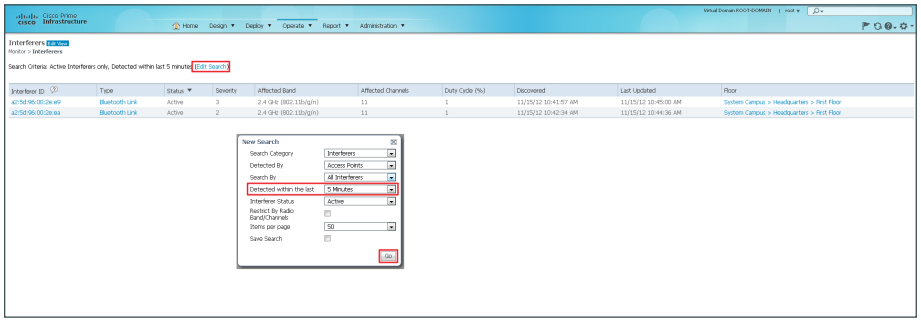
Step 3: In the left pane, under Floor Settings, select **Interferers**. The list of interferers is graphically displayed.



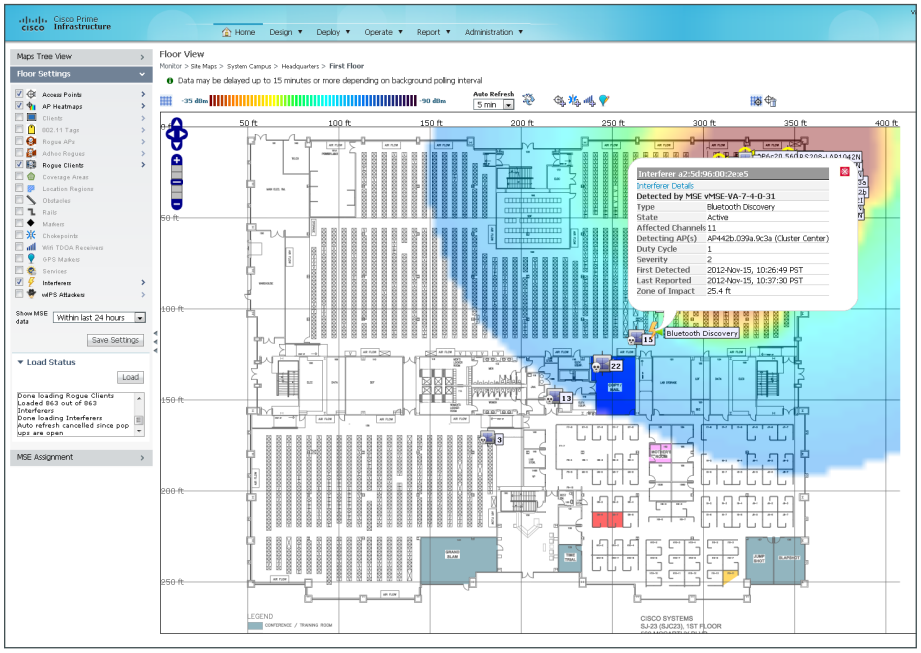
Step 4: Navigate to **Overview > Context Aware**. This displays the historical information on the number of rogues, wireless clients, and other context-aware information obtained from the Cisco MSE VA.



Step 5: Within Cisco Prime Infrastructure 1.3, navigate to **Operate > Operational Tools > Wireless > Interferers**. A list of active interferers discovered within the last 5 minutes is shown. If you click **Edit Search**, you can alter the timeframe.

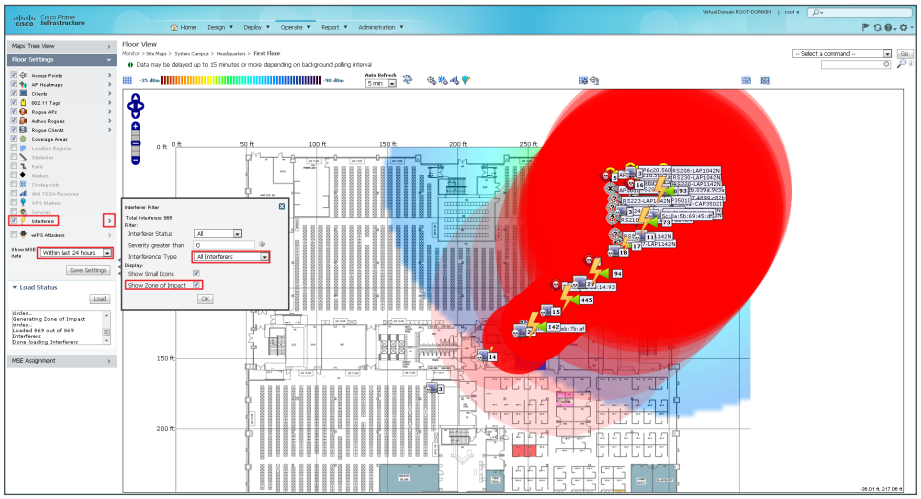


Step 6: Click the floor for any of the alarm conditions shown above. The floor plan is displayed for the affected area.



Step 7: In the **Show MSE data** list, choose **Within the last 24 hours**, and then to the right of Interferers, click the arrow.

Step 8: In the Interferer Filter pane, in the **Interference Type** list, choose **All Interferers**, select **Show Zone of Impact**, and then click **OK**. Note the zone of impact caused by all sources of interference.



Procedure 2 Access Cisco CleanAir APs using Spectrum Expert

When the call for assistance arrives, it almost certainly will originate from a location that does not have the knowledgeable human resources to troubleshoot, identify, and fix the issue. Wi-Fi devices are designed to send and receive Wi-Fi signals, but they do not have the capability to identify non–Wi-Fi radio interferers, such as microwave ovens, Digital Enhanced Cordless Telecommunications (DECT) phones, analog wireless cameras, or even radio jammers. The specialized radios in the Cisco CleanAir radio environment can identify these devices and, with triangulation, can find where these devices are located.

When the call comes in, you need to identify as many facts about the issue as possible in order to make informed decisions. The information can include the location of the problem (for example, the street side of the building does not have connectivity) and time of day (for example, the issue is pronounced at lunch time). With as much information from the end user as possible, you can now look at the radio environment because the system shows that clients are connecting and Cisco Prime Infrastructure 1.3 indicates that AQ has dropped.

The Cisco CleanAir-capable access point must be changed from either Monitor Mode or Local Mode of operation to Spectrum Expert Connect Mode (SE-Connect). This change is disruptive to the wireless users that are associated to the access point.

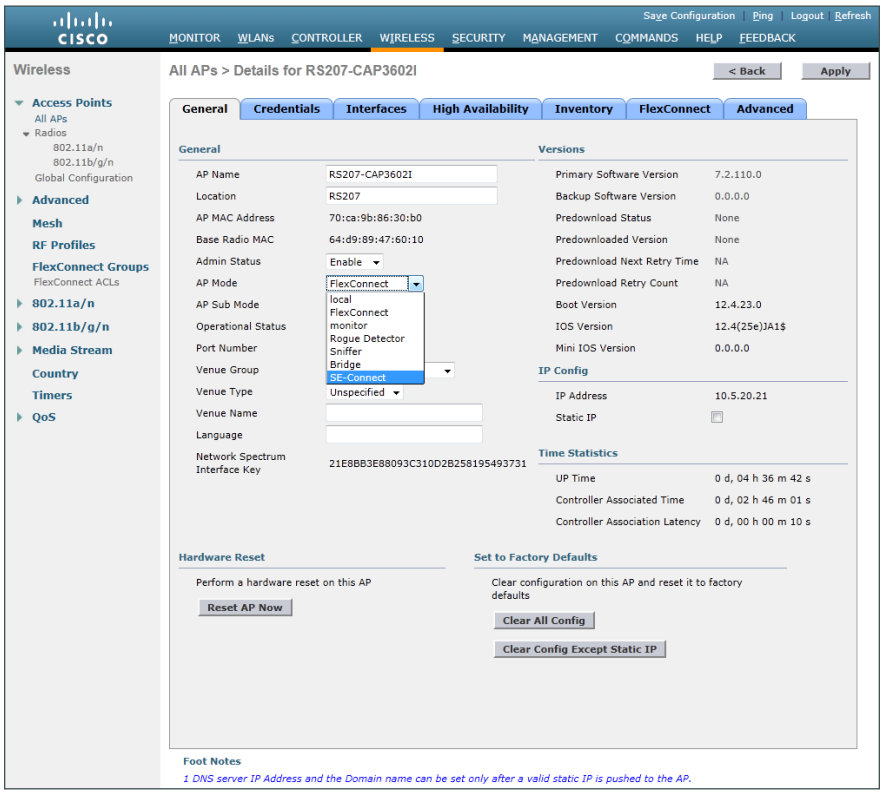
Step 1: Log in to the wireless LAN controller.

Step 2: Navigate to **WIRELESS**.

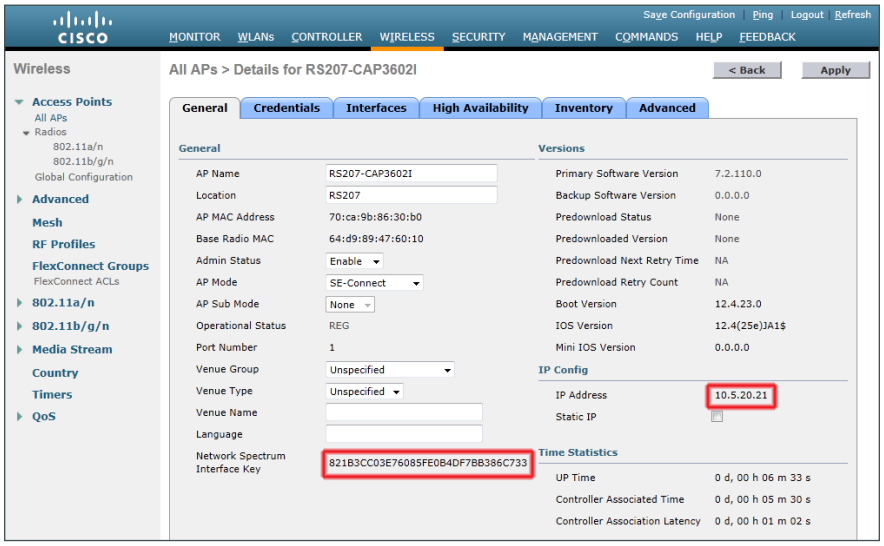
Step 3: Select the Cisco CleanAir access point that is closest to the suspected source of interference.

Step 4: In the **AP Mode** list, choose **SE-Connect**, and then click **Apply**.

Step 5: Wait for the access point to reboot and reconnect to the wireless LAN controller.



Step 6: Copy the Network Spectrum Interface Key and the IP address.



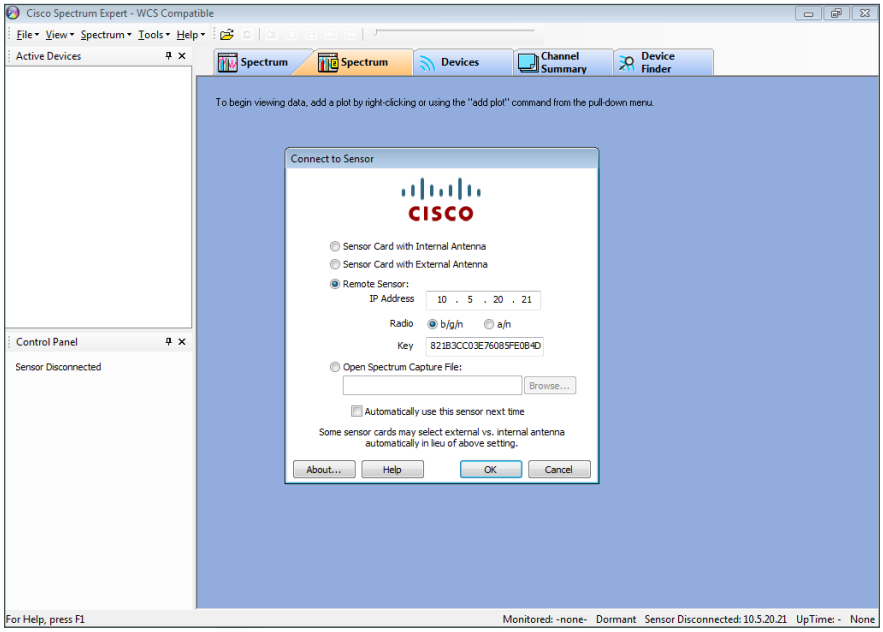
Step 7: On a Supported Windows platform with Cisco Spectrum Expert Wi-Fi (4.0 or later) installed, launch Cisco Spectrum Expert.

Step 8: Select **Remote Sensor**.

Step 9: Enter the IP address and the Network Spectrum Interface Key of the Cisco CleanAir access point that you copied in Step 6.

Step 10: If the access point is on the 2.4 GHz band, select **b/g/n**, and then click **OK**.

If the access point is on the 5 GHz band, select **a/n**, and then click **OK**.

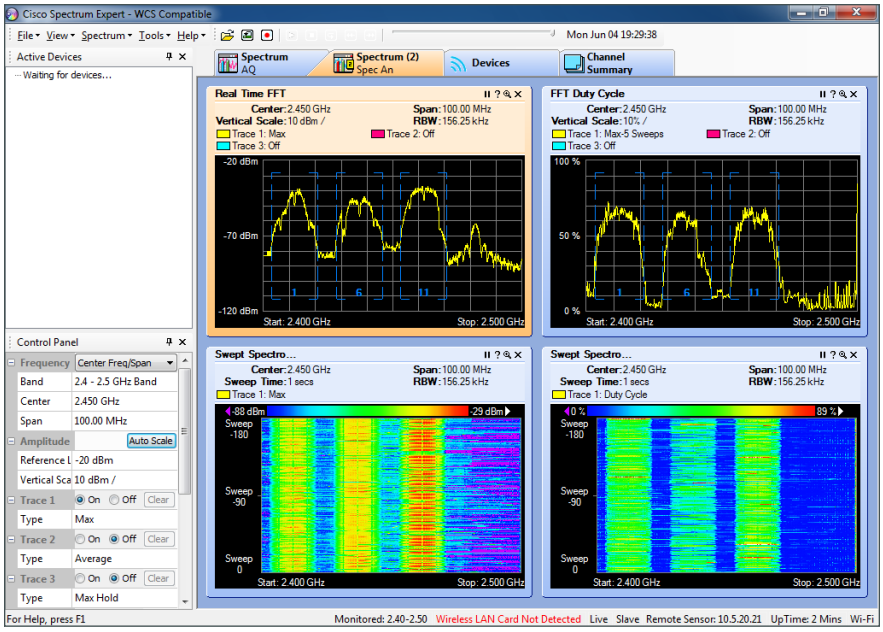


The connected Windows machine now connects to the remote Cisco CleanAir access point on UDP port 37540 (if you selected **b/g/n** in Step 10) or on UDP port 37550 (if you selected **a/n** in Step 10). If connection problems occur, verify that you can ping the Cisco CleanAir access point and that no network devices are blocking the necessary UDP port information.

Remote Spectrum Analysis

The remote sensor capability in Cisco Spectrum Expert gives you the ability to get real-time, physical-layer spectrum data without having to drive or fly onsite. The following figure illustrates this capability in a Wi-Fi-only environment and gives you an understanding of how it can show you what is really happening in your remote environment.

Figure 1 - Cisco Spectrum Expert spectrum analysis



Tech Tip

Note that in the figure above, Cisco Spectrum Expert does not detect a wireless LAN card and that the remote sensor is at 10.5.20.21.

Appendix A: Product List

Wireless LAN Controllers

Functional Area	Product Description	Part Numbers	Software
Remote Site Controller	Cisco 7500 Series Wireless Controller for up to 6000 Cisco access points	AIR-CT7510-6K-K9	7.4.100.0
	Cisco 7500 Series Wireless Controller for up to 3000 Cisco access points	AIR-CT7510-3K-K9	
	Cisco 7500 Series Wireless Controller for up to 2000 Cisco access points	AIR-CT7510-2K-K9	
	Cisco Flex 7500 Series Wireless Controller for up to 1000 access points	AIR-CT7510-1K-K9	
	Cisco 7500 Series Wireless Controller for up to 500 Cisco access points	AIR-CT7510-500-K9	
	Cisco 7500 Series Wireless Controller for up to 300 Cisco access points	AIR-CT7510-300-K9	
	Cisco 7500 Series High Availability Wireless Controller	AIR-CT7510-HA-K9	
	Cisco Virtual Wireless Controller for up to 5 Cisco access points	L-AIR-CTVM-5-K9	
	Cisco Virutal Wireless Controller 25 Access Point Adder License	L-LIC-CTVM-25A	
	Cisco Virtual Wireless Controller 5 Access Point Adder License	L-LIC-CTVM-5A	
	Cisco Virtual Wireless Controller 1 Access Point Adder License	L-LIC-CTVM-1A	
On Site, Remote Site, or Guest Controller	Cisco 5500 Series Wireless Controller for up to 500 Cisco access points	AIR-CT5508-500-K9	7.4.100.0
	Cisco 5500 Series Wireless Controller for up to 250 Cisco access points	AIR-CT5508-250-K9	
	Cisco 5500 Series Wireless Controller for up to 100 Cisco access points	AIR-CT5508-100-K9	
	Cisco 5500 Series Wireless Controller for up to 50 Cisco access points	AIR-CT5508-50-K9	
	Cisco 5500 Series Wireless Controller for up to 25 Cisco access points	AIR-CT5508-25-K9	
	Cisco 5500 Series Wireless Controller for up to 12 Cisco access points	AIR-CT5508-12-K9	
	Cisco 5500 Series Wireless Controller for High Availability	AIR-CT5508-HA-K9	
On Site Controller, Guest Controller	Cisco 2500 Series Wireless Controller for up to 50 Cisco access points	AIR-CT2504-50-K9	7.4.100.0
	Cisco 2500 Series Wireless Controller for up to 25 Cisco access points	AIR-CT2504-25-K9	
	Cisco 2500 Series Wireless Controller for up to 15 Cisco access points	AIR-CT2504-15-K9	
	Cisco 2500 Series Wireless Controller for up to 5 Cisco access points	AIR-CT2504-5-K9	

Wireless LAN Access Points

Functional Area	Product Description	Part Numbers	Software
Wireless Access Points	Cisco 3600 Series Access Point Dual Band 802.11a/g/n and CleanAir with Internal Antennas	AIR-CAP3602I-x-K9	7.4.100.0
	Cisco 3600 Series Access Point Dual Band 802.11a/g/n and CleanAir with External Antennas	AIR-CAP3602E-x-K9	
	Cisco 2600 Series Access Point Dual Band 802.11a/g/n and CleanAir with Internal Antennas	AIR-CAP2602I-x-K9	
	Cisco 2600 Series Access Point Dual Band 802.11a/g/n and CleanAir with External Antennas	AIR-CAP2602E-x-K9	

Wireless LAN

Functional Area	Product Description	Part Numbers	Software
Wireless LAN	Cisco Mobility Services Engine (Virtual Appliance)	L-MSE-7.0-K9	7.4.100.0
	MSE License PAK (E Delivery)	L-MSE-PAK	
	1000 AP WIPS Monitor Mode licenses	L-WIPS-MM-1000AP	
	100 AP WIPS Monitor Mode licenses	L-WIPS-MM-100AP	
	1 AP WIPS Monitor Mode license	L-WIPS-MM-1AP	

Network Management

Functional Area	Product Description	Part Numbers	Software
Network Management	Cisco Prime Infrastructure 1.2	R-PI12-K9[1]	1.3.0.20[1]
	Cisco Prime Infrastructure 1.2 Base License and Software	R-PI12-BASE-K9[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 10,000 Device License	L-PI12-LF-10K[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 5000 Device License	L-PI12-LF-5K[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 2500 Device License	L-PI12-LF-2.5K[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 1000 Device License	L-PI12-LF-1K[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 500 Device License	L-PI12-LF-500[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 100 Device License	L-PI12-LF-100[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 50 Device License	L-PI12-LF-50[1]	
	Cisco Prime Infrastructure 1.2 - Lifecycle - 25 Device License	L-PI12-LF-25[1]	
	Cisco Spectrum Expert Wi-Fi (CardBus)	AIR-CSCO-SE-WIFI-C	4.1.11

[1] To obtain Cisco Prime Infrastructure 1.3, order Prime Infrastructure 1.2 with a service contract and download Prime Infrastructure 1.3 from Cisco.com. Existing customers with a valid service contract can also download Cisco Prime Infrastructure 1.3. Customers without a valid service contract must purchase a service contract to gain access to the Prime Infrastructure 1.3 download on Cisco.com.

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